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International dimension of illicit trafficking in nuclear and other radioactive material

Lyudmila Zaitseva*, Friedrich Steinhäusler** and George Bunn***

**Center for International Security and Cooperation,*
Institute for International Studies, Stanford University
*** Institute of Physics and Biophysics, University of Salzburg*
**** Center for International Security and Cooperation,*
Institute for International Studies, Stanford University

ABSTRACT

Illicit trafficking in nuclear and other radioactive material is primarily associated with Russia and other former Soviet republics. Indeed, with the collapse of the former Soviet Union (FSU) in 1991, hundreds of tons of weapons-usable nuclear material and thousands of radiation sources were left without adequate control and protection, thus posing a risk for sabotage, theft and diversion. Out of 700 illicit trafficking incidents recorded in the Stanford's Database on Nuclear Smuggling, Theft and Orphan Radiation Sources (DSTO), over 450 either took place in the former Soviet Union or involved material that had reportedly originated from the FSU. In the period 1992-1994, Western and Eastern Europe were heavily affected by the inflow of nuclear material smuggled from the FSU. Since then, various measures were taken by the European countries and former Soviet republics to prevent the trafficking of radioactive substances ranging from the improvement of physical security at nuclear facilities to the installation of detection equipment at international borders. However, although the number of illicit trafficking incidents in Western Europe has decreased dramatically since 1994 and the overall annual number of such cases has been lower than in 1994, evidence suggests that diverted nuclear material is still being smuggled out of the FSU. An increased number of interceptions of nuclear and other radioactive material in the Caucasus, Turkey and Central Asia, well-known for their drugs and arms smuggling routes, over the past three years demonstrates that the material may now be moving south rather than west. This is particularly alarming considering the proximity of these countries to the potential end-users of nuclear and other radioactive material, such as Al Qaida terrorist network and aspiring nuclear weapon states in the Middle East.

Although the FSU remains the major potential source of nuclear and other radioactive material, it is not the only one. Thefts of nuclear material and radiation sources have been reported in many other countries. For example, uranium enriched

to 19.9 percent was stolen from the Kinshasa research reactor in the Congo in mid-1990's. Part of the material was seized from an Italian smuggling network in 1998 and the rest remains missing. Uranium concentrate stolen from Indian uranium mines was seized in India on several occasions, some of it destined for Pakistan. Multiple thefts of ionizing radiation sources have been recorded in the United States. Another problem facing many countries is the illegal transport of contaminated scrap metal or radioactive waste. Russian customs official have been complaining about multiple illegal shipments of radioactive waste from China stopped at the Russian border.

This paper will provide results of the analysis of the DSTO database and recommendations for strengthening international cooperation aimed at preventing illicit trafficking of nuclear and other radioactive material on a global scale

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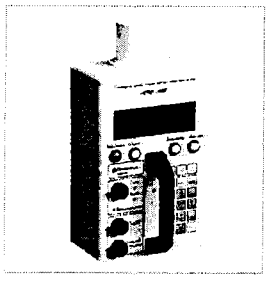

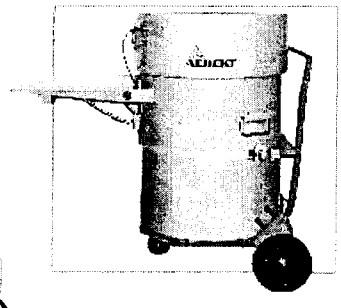

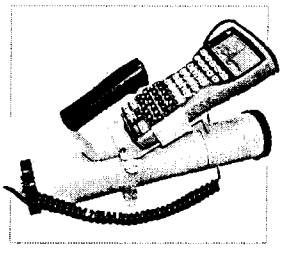

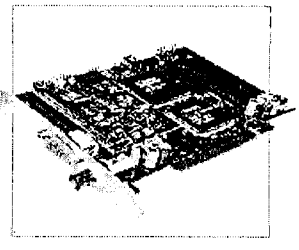

P.O. Box 62,
Dubna,Moscow reg.,
141980 Russia

Tel.: ++7 09621 65292, 63759, 62611
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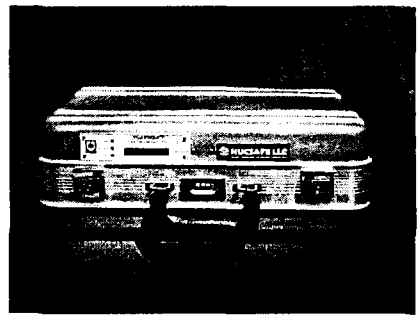
NUCSAFE

Nuclear Safeguards and Security Systems LLC

NucSafe LLC manufactures radiation measurement systems for the nuclear safeguards industry and to law enforcement and federal agencies tasked with providing nuclear safety and protecting public security. The company, founded in 1999, is located in Knoxville, Tennessee. NucSafe in conjunction with Pacific Northwest National Laboratory won a 1999 R&D100 award for the PUMA technology. Nucsafe also won a Tennessee Technology Award from the American Museum of Science and Energy in 2000.

Nucsafe's products are based on but not limited to an innovative and patented neutron-sensitive scintillating glass fiber. Designed to detect small quantities of Pu and other neutron emitting radionuclides, the PUMA technology is specifically designed to detect and monitor special nuclear materials in a variety of applications. Our products include freight, vehicle and passenger radiation monitoring systems sensitive to both gamma and neutron radiation. They are well suited for use at border crossings, ports of entry, airports and nuclear facilities. NucSafe's systems have met the requirements of the International Atomic Energy Agency's Illicit Trafficking Radiation Assessment Program (ITRAP).

Nucsafe also manufactures portable battery operated briefcase and backpack systems, container monitors, spent fuel monitors, multiplicity counters, neutron position sensitive detectors and industrial systems. The solid-state nature of these sensors provides high sensitivity, greater safety (no transport restrictions), less sensitivity to vibration and a large dynamic counting range. Because the sensors can be designed to conform to a various shapes, the products can be optimized for sample geometry. Our new low-power battery-operated electronics enable portable and wearable devices for inspection of undeclared nuclear materials, weapons inspection and emergency response applications.



Nucsafe's briefcase-sized Guardian™ Portable Radiation Search Tool utilizes a solid state design providing improved performance in harsh environments where vibration, temperature and humidity adversely affect the performance of conventional gas tubes. There is no transport hazard with the fibers so portable systems can be taken on commercial aircraft and are not considered hazardous cargo, which is not true for most ^{3}He pressurized gas tube systems.

The Technology

The neutron-sensitive glass fiber sensors represent the first commercial alternative to pressurized ^{3}He and $^{10}BF_3$ gas detectors for thermal neutron measurements. Their principal advantages include large areas that provide enhanced sensitivity in shorter counting times and the ability to conform fiber sensors to virtually any shape. The solid-state glass fiber sensors have high sensitivity because they contain more moles of ^{6}Li atoms than the number of moles of ^{3}He and ^{10}B atoms in the gas detectors. This results in comparable intrinsic efficiency (20%) to the gas tubes. In addition, the PUMA sensors are fabricated as multiple layers of glass-fiber ribbons that more effectively distribute the ^{6}Li atoms to allow fabrication of large area sensors that improve the geometric efficiency.

Although both gas tube and fiber optic sensors can be incorporated into a multitude of sensors sizes, the flexible fiber optic sensor provides greater versatility with less cost. These sensors can vary in both the length and number of fibers, ranging from 1 centimeter to 2 meters in length. A given sensor can consist of a single fiber or tens of thousands of fibers, depending on the neutron flux to be detected. Sensor arrays covering thousands of square centimeters provide exceptional sensitivity and value.

For additional information about this revolutionary new technology and products incorporating it, browse the NucSafe web site at www.nucsafe.com.

Contact Information

Telephone: +1.865.927-9999 **FAX:** +1.865.927-9997
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POLIMASTER has been established in 1992 by the employees of a number of scientific - research and production organisations, which had a many years' experience in designing and production of high quality products for military and space applications.
The main activity of the company is development and production of radiation control equipment of various types and applications, including:
- portal radiation monitors for an automatic detection of radioactive and nuclear materials on their gamma and neutron radiation. These monitors are the set of modules from which systems of various configuration, sensitivity and purpose may be assembled in accordance with a customer's requirements;
- portable instruments designed for detection and location of radiation sources including secretive detection with recording in its non-volatile memory a fact, date and time of source detection as well as radiation intensity level;
- portable radiation monitors equipped with a set of external detectors for detection, location and measurement of all kinds of radiation: gamma, alpha, beta and neutron. The instrument ensures as well a capability of storing up to 110 gamma spectra which can be transmitted to PC for further processing;
- family of various type dosimeters ensuring measurements and radiation control within a wide range of dose rate, dose and energies. The dosimeters of all types have such feature as setting dose and dose rate alarm thresholds, they provide 12 months of continuous operation from one set of batteries. Some models have a non-volatile memory, IR-interface for communication with PC and are capable of storing up to 1000 events according to which a history of the user's exposure can be restored. The dosimeters in a wrist watch format have no analogues in the world.
The equipment produced by the company can be used in a numerous spheres of applications, namely:
- for a control for illicit trafficking of radioactive and nuclear materials through the borders of the controlled territories including the state and customs borders of the countries;
- when working on overcoming the consequences of accidents and emergency situations concerned with ionising radiation sources;
- for ensuring dosimetric control and radiation protection, protection of the personnel of armed forces' personnel, police, security services and other law enforcement organisations;
- for control and accounting of personal radiation doses of workers and specialists whose activity is concerned with applying various types of radioactive sources;
- for radiation control of metal scrap and other industrial and domestic waste;
- when performing a wide spectrum of work concerned with search and location of ionising radiation sources, radiation survey and monitoring of territories and separate objects;
- searching of orphan radioactive sources.
All the devices produced by the company are to be necessarily certified at the metrological and standardisation authorities and specially tested within the framework of departmental certification before the serial production. In particular, a number of devices have the certificate of the Russian Ministry of Emergency, and the equipment designed for control over illicit trafficking of radioactive and nuclear materials has the reports of successful testing in the Russian Federal Nuclear Centre VNIITF (Chelyabinsk-70). Moreover, the company has successfully taken part in testing of the equipment within the framework of international program ITRAP (Illicit Trafficking Radiation Assessment Program). Upon the results of this testing 5 types of the equipment received a special certificate of the IAEA, Interpol and World Customs Organisation.

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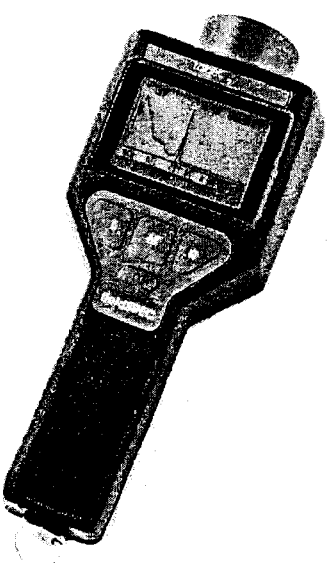

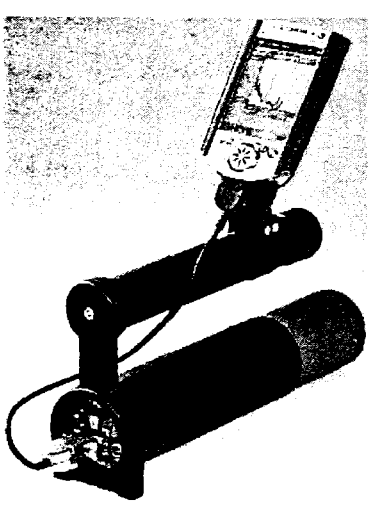

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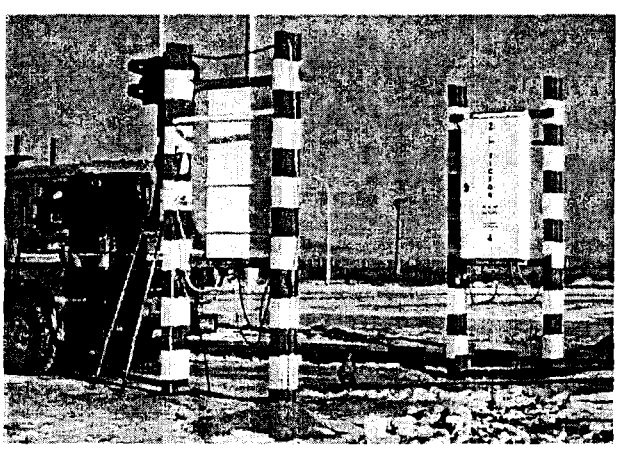

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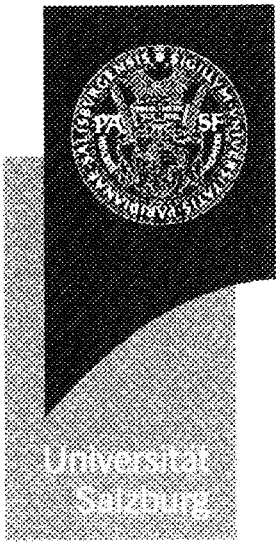

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