Issue No. 13, October 2005

# ESARDA
## Working Group on Containment and Surveillance

# COMPENDIUM

## PREFACE

At a workshop held in Salamanca in 1992, by the ESARDA Working Group on Containment and Surveillance, it was concluded that the development of containment and surveillance (C/S) devices had now reached a stage where products or basic expertise were available to assist with the solution of many problems. It was felt that a compilation, which contained outline information on a range of C/S products would help the potential user to know where to obtain further information and, thus, to judge whether a particular device might meet the requirements of a specific application.

The Compendium also complies with the 'ESARDA Strategic Planning' initialised in 1998.

This compendium is not intended to be comprehensive but collects together contributions provided by the members of the Working Group.

**Page intentionally left blank**

# INDEX

# SECTION 1

# DESIGN VERIFICATION

# SECTION 1 Design Verification

**Page intentionally left blank**

# SECTION 1 Design Verification

## Name of Device: 3D VERIFICATION SYSTEM (3DVS)

## Type: 3D Optical Measurement System

## Function:

- 3D scans of relevant parts of a plant (buildings, cells, equipment, piping, etc.)
- Constructs 3D reference models 'as-built'
- Verifies current 3D scans with previously acquired reference model or original CAD model.
- Tracks and documents changes in successive inspections.

## Application:

- Design Information Verification for large and complex industrial nuclear facilities

## Any reference to design or use:

- C.Creusot, B.Chesnay, S. Johnson, Y.Yamauchi, J G.M Goncalves, V.Sequeira - "Innovative Approaches to DIE/DIV Activities at the Rokkasho Reprocessing Plant", 7th International Conference on Facility Operations-Safeguards Interface, Charleston, South Carolina, February 29 - March 5, 2004.
- Gonçalves J.G.M., Sequeira V., Chesnay B., Creusot C., Johnson C. and Whichello J. – "3D Laser Range Scanner for Design Verification", Proc. INMM 44th Annual Meeting, Phoenix, Arizona, 13-17 July, 2003.
- Sequeira V., Gonçalves J.G.M.– 3D Verification of Plant Design, in Proc. 25th ESARDA Symposium on Safeguards and Nuclear Material Management, Stockholm, Sweden, 13-15 May 2003.

## Status:

- Implemented by IAEA at Rokkasho Reprocessing Plant, Japan
- Available commercially

## Name and address of contact:


- Vítor Sequeira, JRC-IPSC T.P. 210, I-21020 Ispra (VA), Italy

| Telephone | Fax | E-Mail |
|---|---|---|
| +39-0332-789017 | +39-0332-789185 | vitor.sequeira@jrc.it |


## Date: April 2005

# SECTION 1 Design Verification

**Page intentionally left blank**

# SECTION 2

# SEALS AND SEAL READERS

# SECTION 2 Seals and Seal Readers

**Page intentionally left blank**

# SECTION 2 Seals and Seal Readers

## Name of Device: ARC SEALING SYSTEM WITH IRUSS

## Type: Underwater Sealing and Seal Management System

## Function:

- The AECL Random Coil (ARC) Seal is used to contain irradiated reactor fuel in underwater storage. The associated In-situ Readable Ultrasonic Seal System (IRUSS) is the associated seal signature analysis and database management system.

## Application:

- To utilize these systems for spent fuel, a physical containment structure must be in place, surrounding the fuel. The ARC seal is the closure element on the containment access. It is an in-situ verifiable seal containing a single identity and integrity element. When the seal is removed, the identity and integrity are destroyed. Seal interrogation is done through a reading head connected to the IRUSS Seal Interface Unit. Software control (the Seal Interface Program) is obtained through a user interface running on the inspector's laptop computer. Signatures are recorded on a data transfer diskette prepared prior to sealing activities and returned to IAEA headquarters afterwards. The identity, location and status of seals and associated sealing hardware are also tracked. A Seal Evaluation and Management Program running on a desktop controlled by the Seals Clerk at IAEA headquarters organizes and retains all the field data and produces the required reports. To date, this system is applied to CANDU fuel as the containment element of a Dual C/S system.

## Any reference to design or use:

- E. Yellin and S. Morsey – IAEA, J. Brauneisen and J. Hodgkinson – AECB, D. Aubin – Hydro Quebec, M.T. Smith – AECL, "Field Evaluation of a Sealing System for CANDU Spent Fuel". Proceedings of the 29th Annual Meeting of the Institute for Nuclear Materials Management, 26 – 29 June 1988.
- R.N. Nishimura – AECL, and J.F. Brauneisen – AECB, "The In-Situ Readable Ultrasonic Sealing System", IAEA Symposium on International Safeguards, 14-18 March 1994.

## Status:

- Accepted for routine use. Commercially available from AECL

## Name and address of contact:


- Mr. R. Keeffe, Director, Technical Development and Service Division, Canadian Nuclear Safety Commission, P.O. Box 1046, Station B, Ottawa, Ontario, Canada K1P 5S9

| Telephone | Fax | E-Mail |
|---|---|---|
| +1 613 995-2546 | +1 613 943-8954 | keeffe.r@atomcon.gc.ca |


## Date: October 2002

## Name of Device: AUTOCOBRA VERIFIER

## Type: Seal Verifier

### Function:

- Reading a COBRA seal signature by using a built-in CCD camera and carrying out the signature comparison procedure on digital basis. The result of the signature comparison is given as a YES/NO answer. The verification results and seal signatures (images) are stored on a PC memory card.

### Application:

- In-situ verification of COBRA seals

### Any reference to design or use:

- Auto-identification Fiberoptical Seal Verifier, Y.Yamamoto, T.Mukaiyama, JAERI-Tech 98-035, 1998.

### Status:

- Available commercially from Mitsubishi Heavy Industries, LTD., Japan.

### Name and address of contact:


- Yoichi Yamamoto, Department of Fuel Cycle Safety Research, Nuclear Safety Research Center, Japan Atomic Energy Research Institute, Shirakata 2-4, Tokai-mura, Naka-gun, Ibaraki-ken, 319-1195 Japan.

| Telephone | Fax | E-Mail |
|---|---|---|
| +81-29-282-6781 | +81-29-282-5545 | yama@sglsun.tokai.jaeri.go.jp |


### Date: November 1998.

| | |
|---|---|
| **Name of Device:** | **CAP SEAL FOR BWR-MOX FUEL** |
| **Type:** | **Underwater Ultrasonic Seal and Reading Device** |

## Function:

- Ultrasonic Cap Seal to be attached on top of a MOX Fuel Bundle.
- One of the normal nuts of the upper tie plate has to be replaced by a special one.
- The Seal is fastened on that special nut for all "the life" of the bundle: from fabrication to reprocessing.
- It is verifiable either "in air" at manufacture plant or "underwater" in storage ponds.
- Ad-hoc portable readers for air or water verifications are available to Inspectorates.

## Application:

- Can be adapted on request to several designs of BWR Fuel Bundles

## Any reference to design or use:

- Object of a 2 Years Research Contract with JNF (GNF) for the Japanese BWR MOX Fuel. Study and First Evaluation of an Ultrasonic Cap Seal For BWR MOX Fuel".

## Status:

- Mechanically tested

## Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


**Date:** April 2003

## Name of Device: CIVES - Verifier for Metal Cap Seals

## Type: Seal Verifier

### Function:

- Provides acquisition and storage of seal reference images before installation and computer assisted verification of seal images after removal..

### Application:

- Computer assisted verification of metal cap seals at headquarter

### Any reference to design or use:

- User manual: CIVES – Colour based Image Verifier for E-metal Seals, by E.Bettendroffer, May 97.

### Status:

- Routine use by EURATOM.

### Name and address of contact:


- João Gonçalves, JRC T.P. 210, I-21020 Ispra (VA), Italy

| Telephone | Fax | E-Mail |
|---|---|---|
| +39-0332-789416 | +39-0332-789185 | joao.goncalves@jrc.it |


### Date: April 2005

## Name of Device: ELECTRONIC OPTICAL SEALING SYSTEM (EOSS)

## Type: Seal

## Function:

- monitoring of the integrity of a containment/cask
- attributing an identity to a container

## Application:

- any closure of a containment/cask which can be secured with a fibre optic cable (required minimum hole diameter is 7mm)
- any place within a facility where inspector access is possible
- e.g. transport and storage casks
- authentication, encryption, remote data transmission

## Any reference to design or use:

- S. Lange, G. Neumann, B. Richter; Authentication and Encryption Implemented in the Electronic Optical Sealing System EOSS, German Support Programme to the IAEA, report no. 335, Jülich, May 2002; and Proc. 24th ESARDA Annual Meeting, Luxembourg, 2002, EUR20385.
- B. Richter, G. Neumann, S. Lange, M. Goldfarb, R. Tzolov, R. Mackowiak, K. Schoop; Design Concept of the Electronic Optical Sealing System EOSS, German Support Programme to the IAEA, report no. 337, Jülich, June 2002; and Proc. 43rd INMM Annual Meeting, Orlando, 2002.
- G. Neumann, B. Richter, C. Korn, M. Goldfarb, M. Villa; The Qualification of the EOSS Seal – Test Programme and Results, German Support Programme to the IAEA, report no. 341, Jülich, May 2003; and Proc. 25th ESARDA Annual Meeting, Stockholm, 2003.

## Status:

- under evaluation

## Name and address of contact:


- (1) Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- (2) Dr. Neumann Beratungsbüro für elektronische und physikalische Technik, Schiffgesweg 9, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) +49-2461-614884 | (1) +49-2461-612496 | B.Richter@fz-juelich.de |
| (2) +49-2234-83917 | (2) +49-2234-83917 | G.Neumann@DRNE.de |


## Date: July 2005

## Name of Device: IN.TA.C.T.: INTEGRATED TAMPER CONTROL TRANSPONDER

## Type: Passive Transponder based Seal and Padlock

### Function:

- Multi-purpose two cups wire electronic seal and electronic padlock combining electronic identity with mechanical and electronic integrity

### Application:

- Low cost tagging and sealing of containers, doors, transports, valves…, with the possibility of in-field identity check using portable or stationary low frequency RF readers.
- Single use, easy use
- Padlock: by opening the padlock, the transponder is destroyed; no identity can be read
- Seal: mechanical marks remain when opening the seal
- Passive technology - no battery - long life of the seal (and padlock)
- Reduction in HQ verification activities
- Reduction in field verification activities
- 64 bit transponder unique code
- Possibility of programmable and / or encrypted transponder use

### Any reference to design or use:

- P. Meylemans, R. Mackowiak, P. Chare, C. Korn – "In situ Verifiable Seal" – Proceedings of the 23rd Esarda Symposium – Bruges – 8 / 10th may 2001

### Status:

- Commercially available
- JRC Patent granted for seal and padlock

### Name and address of contact:


- Marco Sironi – European Commission – Joint Research Centre Ispra – IPSC Institute – I – 21020 Ispra (Va)
- Gaziano Azzalin – European Commission – Joint Research Centre Ispra – IPSC Institute – I – 21020 Ispra (Va)

| Telephone | Fax | E-Mail |
|---|---|---|
| +39-0332-78-5754 | +39-0332-78-9431 | Marco.sironi@jrc.it |
| +39-0332-78-9008 | +39-0332-78-9757 | graziano.azzalin@jrc.it |


### Date: October 2005

## Name of Device: INTELLIGENT TERMINAL MOS-IT90

## Type: Seal Reader

## Function:

- user interface for integration of electronic seal and optical surveillance system

## Application:

- attachment or removal of electronic VACOSS-S seal by facility operator under unattended optical surveillance in the absence of inspectors
- seal data are recorded in one camera channel of the MOS system

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner; MOS-IT90 User Terminal for Seal/Video Operation, BMBF/IAEA Joint Programme Report No. 236, November 1992

## Status:

- Repair and maintenance possible
- New production not possible

## Name and address of contact:


- (1) Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- (2) Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) +49-2461-614884 | (1) +49-2461-612496 | B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | G.Neumann@DRNE.de |


## Date: July 2005

## Name of Device: LASER READER

## Type: Sealing System

## Function:

- Final disposal casks of the POLLUX type are sealed by weld seams, the surface structure of which provides for unique fingerprints of the casks. Laser techniques proved to be suitable for the identity and integrity verification of the casks by reproducible laser scanning of the weld seam profile.

## Application:

- Identification and proof of integrity of final disposal casks of the POLLUX type based on a weld seam applied to the lid and the cask body. Identification of any type of spent fuel cask based on a structured weld seam attached to the cask body.

## Any reference to design or use:

- D. Holm, W. Jüptner, U. Mieth, W. Osten, E. Leitner, K. Rudolf, E. Wogatzki - "Identification and Integrity Verification of Final Disposal Casks by Radiographical and Optical Techniques", BMBF/IAEA Joint Programme, Report 235, 1992
- K. Rudolf, R. Weh, B. Richter - "Identity and Integrity Verification of Final Disposal Casks by Weld Seam Examination", ESARDA 26, 15th Annual Symposium on Safeguards and Nuclear Material Management, 11-13 May, 1993, Rome, Italy, p. 781
- K. Rudolf, R. Noll, B. Richter - "Verification of Pollux Cask Seals by Laser Techniques" ESARDA 28, 19th Annual ESARDA Symposium, 13-15 May 1997, Montpellier, France, p. 635

## Status:

- Prototype Laser Reader available

## Name and address of contact:


- K. Rudolf, GNS Gesellschaft für Nuklear-Service mbH, Hollestr. 7a, D-45127 Essen

| Telephone | Fax | E-Mail |
|---|---|---|
| +49 201 109-1490 | +49 201 109-1135 | Krystyna.Rudolf@gns.de |


## Date: July 2005

| | |
|---|---|
| **Name of Device:** | **METALLIC THREE TRANSPONDERS SEALS** |
| **Type:** | **Self authenticating clamp with three transponders** |

## Function:

This product has a very promising potential market in containers sealing. Three transponders are used. Features:

- Univocal identification of each shipment (permanent transponder).
- Self verification that the seal is correctly clamped on the shipment lock (transponder that breaks at the seal closure).
- Possibility to keep track of the shipment travel through intermediate reading stations.
- Correlated database to locate the container worldwide.
- Detection of illegal conventional openings (transponder that breaks when opening the seal)
- Identification of a possible illegal opening done between two reading stations.
- Give confidence to the customer that if the seal is intact at the delivery the container has not been illegally opened.

## Application:

- Can be adapted on request to many kinds of bolts or screws.

## Any reference to design or use:

- M. Sironi, P. Tebaldi, A. Poucet, C. Korn: “Sealing Clamp based on multi-transponders technology” Patent Application n° 03290437.7, February 2002

## Status:

- Available for adaptation to specific applications
- JRC Patent granted

## Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


**Date:** October 2005

| | |
|---|---|
| **Name of Device:** | **METALLIC TWO TRANSPONDERS SEALS** |
| **Type:** | **Steel sealing bolt with two transponders** |

**Function:**

- The transponder transmits through the stainless steel
- A pin on the shaft breaks one transponder when the bolt is unscrewed.
- At the opening the torque wrench stores a signal inside the permanent transponder when the correct torque is reached

**Application:**

- Can be adapted on request to many kinds of bolts or screws.

**Any reference to design or use:**

- M. Sironi, P. Tebaldi, A. Poucet, C. Korn: "Sealing Clamp based on multi-transponders technology" Patent Application n° 03290437.7, February 2002

**Status:**

- Available for adaptation for specific applications
- JRC Patent granted

**Name and address of contact:**


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


**Date:** October 2005

## Name of Device: MK-4 SEALING BOLTS SYSTEM

## Type: Ultrasonic Seals and Reading Device

### Function:

- Ultrasonic Sealing Bolt to be screwed in place of one of the normal bolts of a container.
- If attempted to unscrew, a special part, the "Integrity Link" breaks.
- Both "Integrity" status and "Identity Signature" are read at once by an ad-hoc Reading-Head.

### Application:

- Used for the sealing of underwater containers or boxes
- Can be adapted for specific applications on request.

### Any reference to design or use:

- "Result of 15 months field test with JRC-Ispra Sealing-Bolts installed on 53 MEB transport/storage containers at the BNFL plant of Sellafield". Proceedings INMM, Orlando, Florida, USA, July 19-22, 1992. B.C.d'Agraives & J.Toornvliet & E.Mascetti & A.Linge (JRC-Ispra); A.Jeffrey & P.Detourbet (Euratom-Luxemb.); A.Reynolds & R.Warren (BNFL-Sellafield); R.Olsen (IAEA).
- "Operational experience of Ultrasonic Sealing-Bolts for Safeguards Containment of Multi-Element Bottles in British Nuclear Fuel's Thorp spent fuel storage pond". Proceeding INMM, Palm Desert, California, USA, July 9-12, 1995. C.D.Hatt & A.Reynolds (THORP,BNFL-Sellafield); A.Jeffrey & P.Detourbet (Euratom-Lux.); B.C.d'Agraives & J.Toornvliet (JRC-Ispra); B.Wilt (IAEA).
- "Sealing-Bolts", a brochure issued by ISEI / CCR Ispra in 1994.

### Status:

- In routine use since several years for the safeguarding of MultiElement Bottles ( MEB= spent fuel containers) at BNFL plant of Sellafield (UK).
- To date, about 1200 units and 10 reading-devices sold to Euratom and IAEA.
- Commercially available.

### Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


### Date: April 2003

## Name of Device: MK-5 CLAMPING SEALS

## Type: Ultrasonic Seals and Reading Device

### Function:

- An Ultrasonic Seal to be clamped on one stud or pin belonging for instance to the cover of a nuclear transport container. Normally used only in air.
- The seal embodies a "Unique Identity Signature" as well as an "Integrity" features (patented), so that an Inspector can read both of them at once with an ad-hoc light easy-to-fit Reading-Head.
- Once "clamped", the seal can't be removed without breaking a special internal part called "Integrity Link". It is removed by turning it anti clockwise with a light torque wrench (about 10N.m) which causes the internal "Integrity Link" to break.

### Application:

- A version for the cover/shock-absorber of a FS-47 PuO2 transport container already exist.
- Can be adapted for specific applications on request.

### Any reference to design or use:

- "Presentation of a new portable ultrasonic sealing system for nuclear containers". Proceeding 17th Annual Symposium ESARDA, Aachen, Germany, May 9-11,199$\tilde{5}$ B.C.d'Agraives, E.Mascetti, P.Tebaldi, J.Toornvliet (SILab,JRC-Ispra); B.Silber (RMT, Ger.); T.Hayakwa, T.Hosoma (PNC-Japan).
- "First tests with a new portable Ultrasonic Sealing System for PuO2 Transport Containers." Proceeding 36th Annual Meeting INMM, Palm Desert, California, USA, July 9-12, 1995. B.C.d'Agraives et al. T.Hosoma et al.

### Status:

- Has been studied under contract for the safeguarding of FS-47 COGEMA Transport Containers in use by PNC (JNC) in Japan for the transportation of PuO2 from La Hague (F) reprocessing plant to Tokay (J)
- Test in real conditions were conducted successfully in France, with actual transports from La Hague to Cadarache, as well as in Japan at Tokay facility.

### Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


### Date: April 2003

## Name of Device: MK-6 SEALING NUTS SYSTEM

## Type: Ultrasonic Seals and Reading Device

### Function:

- Ultrasonic Seal to be screwed on a fix screw passing a transversal locking bar, to prevent its removing and subsequent access to the container content..
- If attempted to unscrew, a special part, the "Integrity Link" breaks.
- Both "Integrity" status and "Identity Signature" are read at once by an ad-hoc Reading-Head.

### Application:

- Used as a locker to underwater containers or boxes.
- Can be adapted for specific applications on request.

### Any reference to design or use:

- "Sealing-Bolts", a brochure issued by ISEI / CCR Ispra in 1994.

### Status:

- In routine use since several years for the safeguarding of NPH (Nouvelle Piscine La Hague) Storage Baskets in use by COGEMA at La Hague plant (F).
- To date, about 200 units and 4 reading-devices sold to Euratom.
- Commercially available.

### Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


### Date: October 2005

| | |
|---|---|
| **Name of Device:** | **T1A ESP (ELECTRONIC SENSOR PLATFORM)** |
| **Type:** | **Radio frequency seal and tag** |

## Function:

- Sophisticated battery powered electronic RF seal and tag providing bi-directional communication. Supports protected private key encryption and authentication, an active fiber-optic loop seal, integral active tamper monitoring of the device housing and temperature, as well as internal storage (EEPROM) of over 500 previous messages for selective message recovery. Immediate event reporting and periodic state-of-health reporting with real-time reference. Provides many user programmable features through a standard serial port. Adaptable to support additional analog/digital internal/external sensors. Extended battery life. Light weight and portable. Fiber-optic loop easily terminated and cut to length.

## Application:

- Long term monitoring in storage applications of materials, high value assets, and/or security or surveillance applications.

## Any reference to design or use:

- Available upon request

## Status:

- Currently in Beta testing phase

## Name and address of contact:


- Steve Blankenau
- Sandia National Laboratories
- Special Radars Department 2346
- PO Box 5800
- Albuquerque, New Mexico, USA 87185

| Telephone | Fax | E-Mail |
|---|---|---|
| 505.844.4443 | 505.844.0858 | sjblank@sandia.gov |


**Date:** September 2003

**Name of Device:** **TAMPER-EVIDENT SHRINK WRAP SEAL**

**Type:** **Whole Volume Seal**

## Function:

- Shrink-wrap seals were proposed as a method of securing strategic elements (valves, flanges, etc.) of a shut down chemical weapons facility to assure that chemical weapon production could not be resumed undetected. However, the Sandia version of the shrink-wrap seal is versatile enough for a variety of treaty and non-treaty verification applications.

## Application:

- Shrink-wrap seals can be used to verify that items have not been accessed or tampered with while unattended. They can be used to secure complex shapes, which is not practical using other existing tag/seal technologies. The seals are also compatible with and easily incorporated into other tamper-indicating technologies.
- A family of whole volume seals has been developed using clear shrink films of polyvinyl chloride, polyvinylidene chloride, and a polyoelifin. Each shrink film contains uniquely inked patterns and a clear fluorescent coating, both of which discourage the transfer or replacement of a seal once it is applied to an object to be protected. The seals were designed to be easily applied by one person using commercially available equipment. The seal signature can be verified using a polaroid camera, a digital camera system, or a video camcorder

## Any reference to design or use:

- BDM draft Environmental Test Report "Polyvinylidene Chloride (PVDC) and Polyvinyl Chloride (PVC) Shrink-Wrap Seal", June 1993
- BDM draft Final Test Report "Initial Operational Test and Evaluation (IOT&E) Report of the Shrink-Wrap Seal Developed by Sandia National Laboratories", June 1993.

## Status:

- The development of the sealing system is complete. The films are commercially available from Progressive Packaging and Design Inc., Milwaukee, WI, USA.

## Name and address of contact:


- Keith Tolk, Sandia National Laboratories, MS 0764, Albuquerque, NM 87185-0764, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| 505-845-9014 | 505-844-0708 | kmtolk@sandia.gov |


**Date:** December 1998

## Name of Device: ULTRASOUND READER

## Type: Sealing System

### Function:

- Final disposal casks of the POLLUX type are sealed by weld seams applied to the lid and the cask body. The microstructure of the cask material as well as of the weld seam provides for a unique fingerprint of the cask. Ultrasound backscattering techniques proved to be suitable for the identity and integrity verification of the casks by reproducible ultrasound scanning of the microstructure

### Application:

- Identification and proof of integrity of final disposal casks of the POLLUX type based on the microstructure of the cask and weld seam material. Identification of any type of spent fuel cask based on a small part of the cask material structure.

### Any reference to design or use:

- E. Leitner, K. Rudolf, E. Wogatzki - "Identity and Integrity Verification on Spent Fuel Casks by Means of the Ultrasound Technique", ESARDA 25, 14th Annual ESARDA Meeting, 05-08 May, 1992, Salamanca, Spain, 1992, p. 55
- K. Rudolf, R. Weh, U. Netzelmann, B. Richter, G. Giersch, D. van der Eecken - "Ultrasound Reader for POLLUX Cask Seals", 37th INMM Annual Meeting, 28-31 July, 1996, Naples, Florida

### Status:

- Prototype Ultrasound Reader available

### Name and address of contact:


- K. Rudolf, GNS Gesellschaft für Nuklear-Service mbH, Hollestr. 7a, D-45127 Essen

| Telephone | Fax | E-Mail |
|---|---|---|
| +49 201 109-1490 | +49 201 109-1135 | Krystyna.Rudolf@gns.de |


### Date: July 2005

## Name of Device: VACOSS

## Type: Seal

## Function:

- monitoring of the integrity of a containment/cask
- associating an identity with a container

## Application:

- any closure of a containment/cask which can be secured with a fibre optic cable (required minimum hole diameter is 7mm)
- any place within a facility where inspector access is possible
- e.g. transport and storage casks

## Any reference to design or use:

- B. Richter, G. Stein, R. Günzel, K.J. Gärtner, E. Yellin; The Design and Quality Assurance of the VACOSS Series Production Model, German Support Programme to the IAEA, report no. 162, June 1988; and JNMM Vol. XVII, 1988, p. 666.
- B. Richter, G. Stein, R. Günzel, K.J. Gärtner, E. Yellin; The Environmental Qualification of the VACOSS-S Seal: Test Programme and Results, German Support Programme to the IAEA, report no. 184, July 1989; and JNMM Vol. XVIII, 1989, p. 870.

## Status:

- Implemented by IAEA and Euratom
- Available commercially

## Name and address of contact:


- (1) Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- (2) Aquila Technologies Group, Inc., 8401 Washington Place NE, Albuquerque, NM 87113, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) +49-2461-614884 | (1) +49-2461-612496 | B.Richter@fz-juelich.de |
| (2) +1-505-828-9100 | (2) +1-505-828-9115 | Kadner@aquilagroup.com |


## Date: July 2005

# SECTION 2 Seals and Seal Readers

**Page intentionally left blank**

# SECTION 3

# IDENTIFIERS

# SECTION 3 Identifiers

**Page intentionally left blank**

# SECTION 3 Identifiers

**Name of Device:** **FUEL ASSEMBLY IDENTIFYING SYSTEM (ID MK2)**

**Type:** **Ultrasonic Identification System**

## Function:

- A small cylindrical block, called "insert", about 1cc in vol. (Ø 1mm, h 1.2mm) is drilled on one side with parallel holes of different depths about 0.1mm diameter.
- By means of a circular ultrasonic exploration, the different depths are measured and recorded, providing a code that can be used numerically. Flat or drilled side can be used indifferently.
- That block can be easily incorporated or welded in or on top of a structure, allowing an independent system for the numbering of that structure (reading of its identification number).
- The associated reading equipment for underwater or air readings has been developed.

## Application:

- Has been studied/demonstrated for the identification of PWR Fuel Bundles, to avoid the lateral reading of the conventional engraved numbers.
- With a 1cc s/s insert, can allow the numbering of more than 800,000 different items.
- Can be applied to any kind of similar structures to be identified or recorded.

## Any reference to design or use:

- "Recent Progress at JRC-Ispra SILab Laboratory on Ultrasonic Sealing and Identification Techniques" . B.C.d'Agraives, M.Chiaramello, P.Tebaldi, E.Mascetti. 21st Annual Symposium ESARDA, Sevilla, Spain, 4-6 May 1999.

## Status:

- Ready for implementation.
- Commercially available.

## Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |


**Date:** April 2003

# SECTION 3 Identifiers

**Name of Device:** **INTERFEROMETRIC SURFACE IDENTIFICATION SYSTEM (ISIS)**

**Type:** **Optical identification**

## Function:

- A means to identify directly the natural rough surface of any solid item without the need to mark or sign that item.
- The very surface of the item to identify produces "Speckle pictures" when the surface is lit in certain conditions by laser light.
- The first recorded image is kept as reference. Then, identification is obtained by correlating the new images with this reference one. Correlation closed to 1 means identification.

## Application:

- Could be applied to the identification of many kinds of items or structures.
- For the time being, it is easier to bring the items (if small) to the reading device.
- In the future, we are looking forward to develop a portable reading-head which would be easily re-positioned on large items such as a fuel bundles, containers, casks, etc...

## Any reference to design or use:

- "Identification by Speckle Interferometry". Poster Presentation. 23rd Annual Symposium ESARDA, Bruges, Belgium, May 8-10, 2001. B.C.d'Agraives, M.Chiaramello, (SILab, JRC-Ispra)

## Status:

- A laboratory bench has been installed and produces satisfactory results that are reported in the above-mentioned presentation. Actually under evaluation.

## Name and address of contact:


- Marco SIRONI – JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY
- Michel CHIARAMELLO - JRC Ispra – IPSC / NPNS / SILab – TP 450 – 21020 ISPRA (VA) – ITALY

| Telephone | Fax | E-Mail |
|---|---|---|
| +39 0332 78 57 54 | +39 0332 78 94 31 | Marco.Sironi@jrc.it |
| +39 0332 78 57 81 | +39 0332 78 94 31 | Michel.Chiaramello@jrc.it |


**Date:** April 2003

# SECTION 3 Identifiers

**Name of Device:** **NUCLEAR CONTAINERS IDENTIFICATION READING SYSTEM**

**Type:** **3D Laser and Video Technologies**

## Function:

- The system uses 3D laser-scanning and video technologies to provide an automated robust and efficient reading of any identification string present in any surface of a nuclear container.
- The system reads alphanumeric characters, which can be engraved, embossed or flame-etched.
- An integrated solution was created to automatically recognise the type of characters (i.e., embossed, engraved or flame-etched) without operator intervention.
- A confidence measurement is computed for character recognition. This is relevant for the system's self-evaluation when operating unattended.

## Application:

- The identification reading system was designed to be used in an unattended mode to identify automatically fuel elements, waste drums or other nuclear containers.
- The system can be used with any container type with identification strings engraved, embossed or flame-etched.

## Any reference to design or use:

- "Automatic Identification of Fuel Elements using 3D Laser Technologies", V. Sequeira, E. Bovisio, J.G.M. Gonçalves, ESARDA, Luxembourg, 28-30 May, 2002.
- "Identification of Nuclear Containers using 3D Laser Technologies", E. Bovisio, V. Sequeira, J.G.M. Gonçalves, ESARDA, Stockholm, 13-15 May, 2003.
- "Unattended Measurement Station (UMS): Towards the complete Characterisation of fresh LEU Assemblies ", M. Boella et al., Phoenix, Arizona, 13-17 July, 2003.

## Status:

- Fuel Element Identification System installed at a Fabrication Plant.
- Waste Drum Identification System prototyped and ready to be installed at a nuclear facility.
- A third prototype for an industrial type of waste drums was realised and is current under evaluation.

## Name and address of contact:


- João G.M. Gonçalves, TP210, EC-JRC, 21020 Ispra (VA), Italy

| Telephone | Fax | E-Mail |
|---|---|---|
| +39-0332-789416 | +39-0332-789185 | joao.goncalves@jrc.it |


**Date:** April 2005

# SECTION 3 Identifiers

| | |
|---|---|
| **Name of Device:** | **REFLECTIVE PARTICLE TAGGING (RPT) TECHNOLOGY** |
| **Type:** | **Unique Verifier** |

## Function:

- Reflective Particle Tags can be applied to uniquely identify individual items. The tag consists of reflective particles mixed in a transparent adhesive matrix, which is applied to the surface of the item to be identified and then cured. A reader consisting of a number of lights and some means of recording an image is used to read the patterns formed by the reflectors in the tag. Comparing images of the tag to images taken when the tag was applied verifies the identity of the tag and therefore the item.

## Application:

- Reflective Particle Tags were developed and proposed for counting mobile nuclear missiles for the Strategic Arms Reduction Treaty. The technology is also being used for uniquely identifying other items, such as fiber optic seals

## Any reference to design or use:

- Tolk, K. M., "Reflective Particle Technology for Identification of Critical Components", 33rd Annual Meeting Proceedings of the Institute of Nuclear Materials Management, July, 1992.

## Status:

- Prototype systems have been developed for a number of applications, but there are currently no commercial readers available at this time.

## Name and address of contact:


- Keith Tolk, Sandia National Laboratories, MS 0764, Albuquerque, NM 87185-0764, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| 505-845-9014 | 505-844-0708 | kmtolk@sandia.gov |


| | |
|---|---|
| **Date:** | December 1998 |

# SECTION 4

# OPTICAL SURVEILLANCE

# SECTION 4 Optical Surveillance

**Page intentionally left blank**

# SECTION 4 Optical Surveillance

## Name of Device: ALL-IN-ONE-SYSTEM (ALIS)

## Type: Optical surveillance system

## Function:

- recording of scenes from one camera
- recording modes are by time-triggering and by scene change detection (front end triggering)

## Application:

- unattended optical surveillance of strategic points within a facility
- one-channel digital image surveillance system built into the standard IAEA camera housing with power supply and set-up monitor
- authentication, encryption, remote data transmission

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner, H. Meier, K. Schoop; Digital Image Surveillance Systems based on the Digital Camera Module DCM 14, Proc. 21st ESARDA Annual Meeting, Sevilla, 1999, pp. 615-619.

## Status:

- Implemented by IAEA and Euratom
- Available commercially

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


## Date: July 2005

# SECTION 4 Optical Surveillance

## Name of Device: COMPACT SURVEILLANCE AND MONITORING SYSTEM

## Type: Single Camera System powered by batteries

## Function:

- 3 months(90 days) continuous recording in 5 minutes interval time base powered by a Lithium battery and also used by AC 100 to 250 V, 48 to 62 Hz. The system consists of a main recording unit and a set-up/review unit.

## Application:

- Storage vaults and areas for nuclear materials, and spent fuel ponds for nuclear fuel assemblies

## Any reference to design or use:

- Development of compact CCTV surveillance system "COSMOS", T.Mukaiyama, H.Ogawa, T.Kawaguchi, Y.Sadamatsu, K.Chiang, International Nuclear Safeguards 1994 (Proc. Symp. Vienna, March 1994), Vol.2 IAEA SM-333/47, p141-151, Vienna 1994.
- Development of Compact Surveillance and Monitoring System "COSMOS", H.Ogawa, T.Mukaiyama, JAERI –Research 98-, to be published this year 1998.

## Status:

- Available commercially from Sony Corporation, Japan. Implemented at LWR power plants by the IAEA in the world

## Name and address of contact:


- Hironobu Ogawa, Department of Fuel Cycle Safety Research, Nuclear Safety Research Center, Japan Atomic Energy Research Institute, Shirakata 2-4, Tokai-mura, Naka-gun, Ibaraki-ken, 319-1195 Japan.

| Telephone | Fax | E-Mail |
|---|---|---|
| +81-29-282-5760 | +81-29-282-5545 | ogawa@sglsun.tokai.jaeri.go.jp |


## Date: November 1998.

# SECTION 4 Optical Surveillance

## Name of Device: DIGIQUAD SURVEILLANCE SYSTEM

## Type: Multi-camera optical surveillance system

### Function:

- Up to 4 CCTV cameras can be recorded simultaneously via a commercial Quad splitter (Digiquad) on a commercial time lapse S-VHS video cassette recorder.
- Onsite review of recorded images in different speeds.
- Review by using MORE

### Application:

- unattended optical surveillance of 4 points within a facility (max. 730,000 images, max 1 year unattended, picture taking interval selectable from 20 ms to 99,9 s)
- housed in 19" cupboard with build in uninterruptible power supply and power down feed back

### Any reference to design or use:

- Training course for DQ/UPX video system, Euratom Safeguard Office, video group, 1999

### Status:

- Implemented by IAEA and Euratom
- Available upon request

### Name and address of contact:

- European Commission, DG TREN I 01, Bat. EUFO, L-2920 Luxembourg

| Telephone | Fax | E-Mail |
|---|---|---|
| +352 4301 33244 | | vitor.oliveira-martins@cec.eu.int |

### Date: June 2004

# SECTION 4 Optical Surveillance

## Name of Device: DIGITAL CAMERA MODULE DCM 14

## Type: Subsystem of digital image surveillance system

## Function:

- digitization of video scenes from low power CCD camera
- authentication
- encryption
- scene change detection
- remote data transmission
- local data storage

## Application:

- unattended optical surveillance in facilities
- uninterrupted data acquisition due to backup battery
- subsystem of ALIS, DSOS, DMOS and VDIS

## Any reference to design or use:

- B. Richter, K.J. Gärtner, J.V. Whichello, J.J. Goerten, K. Schoop, G. Neumann; The Design of a Digital Video Data Authentication and Encryption Device, BMBF/IAEA Joint Programme Report No. 262, May 1995.
- K.J. Gärtner, J. Whichello, A. Owen, A. Vincent, D. Sorokowski. G. Neumann, B. Richter, K. Schoop; The Design and Testing of a Digital Video Data Authentication and Encryption Device, BMBF/IAEA Joint Programme Report No. 268, July 1996.

## Status:

- Implemented by IAEA and Euratom
- Available commercially

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


## Date: July 2005

# SECTION 4 Optical Surveillance

| | |
|---|---|
| **Name of Device:** | **DIGITAL MULTI-CAMERA OPTICAL SURVEILLANCE (DMOS) SYSTEM** |
| **Type:** | **Optical surveillance system** |

## Function:

- recording of video scenes from one up to 32 cameras

## Application:

- unattended optical surveillance in facilities
- authentication, encryption, remote data transmission

## Any reference to design or use:

- K.J. Gärtner, G. Neumann, B. Richter, K. Schoop; Digital Multi-camera Optical Surveillance System DMOS – Functions and Applications, Proc. 41st INMM Annual Meeting, New Orleans, 2000.

## Status:

- Implemented by IAEA
- Available commercially

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


**Date:** July 2005

# SECTION 4 Optical Surveillance

| | |
|---|---|
| **Name of Device:** | **DIGITAL SINGLE-CAMERA OPTICAL SURVEILLANCE (DSOS) SYSTEM** |
| **Type:** | **Optical surveillance system** |

## Function:

- recording of video scenes from one camera
- recording modes are by time-triggering and by scene change detection (front end triggering)

## Application:

- unattended optical surveillance within a facility
- camera unit separated from control and recording unit
- authentication, encryption, remote data transmission

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner, H. Meier, K. Schoop; Digital Image Surveillance Systems based on the Digital Camera Module DCM 14, Proc. 21st ESARDA Annual Meeting, Sevilla, 1999, pp. 615-619.

## Status:

- Implemented by IAEA and Euratom
- Available commercially

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


**Date:** July 2005

# SECTION 4 Optical Surveillance

| | |
|---|---|
| **Name of Device:** | **EURATOM MULTIPLE OPTICAL SURVEILLANCE SYSTEM (EMOSS)** |
| **Type:** | **Optical surveillance system** |

**Function:**

- Recording of scenes from one camera with redundant system in the same cabinet
- Recording mode is by time-triggering

**Application:**

- Unattended optical surveillance of strategic points within a facility.
- One-channel digital image surveillance built into the standard EURATOM/IAEA camera housing with power supply
- Authentication and remote status-of-health transmission
- Two full redundant recording systems are located in the same cabinet

**Any reference to design or use:**

**Status:**

- Implemented by IAEA and EURATOM
- Available commercially

**Name and address of contact:**


- Bernard TAILLADE

| Telephone | Fax | E-Mail |
|---|---|---|
| +33 467 87 46 46 | +33 467 70 85 44 | space@hymatom.mnet.fr |


**Date:** January 2001

# SECTION 4 Optical Surveillance

## Name of Device: FAST SURVEILLANCE SYSTEM

## Type: Multi-camera optical surveillance system

## Function:

- Up to 64 video server controlling a camera and authenticate the images can be connected via commercial hubs or switchers to a FAST Alpha station on which a dedicated recording (time lapse, motion detection and external trigger) and review software is running. Image will be stores in dynamic ring buffers on the internal 36 GB HD or the external 80 GB RAID5 system.
- The system support the whole network capabilities. Via ISDN or ATM different Alpha stations can be connected to transmit remotely all data's and images.
- The inspector interface and the observer allowing an easy handling and review on the system.

## Application:

- unattended optical surveillance of up to 64 points within a facility (max. images depends on HD size, picture taking interval selectable from 20 ms to few hours)
- image digitisation, authentication, encryption, remote data transmission and remote set-up
- housed in 19" cupboard with build in uninterruptible power supply and SVGA monitor

## Any reference to design or use:

- Digital Video Management System – Alpha, User Manual, FAST media integrations AG, 2000-03-30

## Status:

Evaluated by IAEA and Euratom
Commercially available

## Name and address of contact:

- 1) European Commission, DG TREN I 01, Bat. EUFO, L-2920 Luxembourg
- 2) FAST media integrations AG. Herr Neufing, CH Rot-Kreuz

| Telephone | Fax | E-Mail |
|---|---|---|
| 1) +352 4301 33801 | | michel.maggi@cec.eu.int |
| 2) +49 7541 50 22 00 | 2) +49 7541 20 22 01 | Carsten.Tschritter@fast-security.com |

## Date: June 2004

## Name of Device: GEMINI

## Type: Optical surveillance system

## Function:

- Recording of scenes from one camera with redundant system in the same cabinet
- Recording mode is by time-triggering

## Application:

- Unattended optical surveillance of strategic points within a facility.
- One-channel digital image surveillance built into the standard EURATOM/IAEA camera housing with power supply
- Authentication and remote status-of-health transmission
- Two full redundant recording systems are located in the same cabinet

## Any reference to design or use:

## Status:

- Implemented by IAEA and EURATOM
- Available commercially

## Name and address of contact:


- Steve KADNER, Aquila TG, 8401 Washington Pl NE, ALBUQUERQUE NM, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| +1 505 828 91 00 | +1 505 828 91 15 | Kadner@aquilagroup.com |


## Date: January 2001

| | |
|---|---|
| **Name of Device:** | **GEMINI ADVANCED REVIEW STATION (GARS)** |
| **Type:** | **Digital review station** |

**Function:**

- Technical and safeguards reviews of images recorded on different digital surveillance system (GEMINI, DSOS, ALIS)

**Application:**

- Evaluation of digital recording images on site or at HQ

**Any reference to design or use:**

**Status:**

- Implemented by IAEA and EURATOM
- Available commercially

**Name and address of contact:**

- Steve KADNER, Aquila TG, 8401 Washington Pl NE, ALBUQUERQUE NM, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| +1 505 828 91 00 | +1 505 828 91 15 | Kadner@aquilagroup.com |

**Date:** January 2001

# SECTION 4 Optical Surveillance

## Name of Device: LASER SURVEILLANCE SYSTEM (LSS)

## Type: Provides plane of detection of penetration

## Function:

- Measures location, size and speed of penetrating object
- Real-time detection
- Self-illuminated device, independent from external illumination
- Periodic time-synchronisation with DCM-14
- User-selectable alarm areas

## Application:

- Complements conventional video surveillance systems
- Stand alone surveillance
- Authentication for "in front of the lens tampering"

## Any reference to design or use:


- Gonçalves J.G.M., Whichello J. and Lundqvist M. – "Laser Surveillance System and Safeguards", Proc. of the 41st Annual Meeting of the Institute of Nuclear Materials Management, New Orleans, Louisina, USA, 16-20 July, 2000.
- Gonçalves J.G.M., Sequeira V. and Whichello J. – "Laser Technologies for
- On-Site Surveillance", International Atomic Energy Agency's Symposium on International Safeguards: Verification and Nuclear Material Security, 29 Oct - 1 Nov, Vienna, Austria, 2001.
- Gonçalves J.G.M., Sequeira V. – "Laser Technologies for Unattended Remote Monitoring", Proc. of the 43rd Annual Meeting of the Institute of Nuclear Materials Management, Orlando, USA, 23-27 June 2002.


## Status:

- Prototype made of commercial off-the-shelf components
- Available Review software

## Name and address of contact:


- João G.M. Gonçalves, JRC T.P. 210, I-21020 Ispra (VA), Italy

| Telephone | Fax | E-Mail |
|---|---|---|
| +39-0332-789416 | +39-0332-789185 | joao.goncalves@jrc.it |


## Date: April 2003

# SECTION 4 Optical Surveillance

| | |
|---|---|
| **Name of Device:** | **MULTI-CAMERA OPTICAL SURVEILLANCE (MOS) SYSTEM** |
| **Type:** | **Optical surveillance system** |

## Function:

- recording of video scenes from up to 16 cameras
- recording modes are by time-triggering and external triggering

## Application:

- unattended optical surveillance of strategic points within in a facility

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner, G. Laszlo, P. Otto, H. Wagner; The Multi-Camera Optical Surveillance System (MOS) - Design and Reliability, BMBF/IAEA Joint Programme Report No. 214, May 1991.
- B. Richter, G. Neumann, K.J. Gärtner, G. Laszlo, P. Otto, H. Wagner; The Reliability of the Multi-Camera Optical Surveillance (MOS) System, BMBF/IAEA Joint Programme Report No. 218, June 1991.

## Status:

- Repair and maintenance possible
- New production not possible

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


**Date:** July 2005

## Name of Device: MULTI-SYSTEM OPTICAL REVIEW STATION (MORE)

## Type: Video review station

## Function:

- technical and safeguards reviews of video scenes recorded on different optical surveillance systems (MOS, MUX, MIVS, COSMOS, Uniplex, ...)

## Application:

- evaluation of video tapes on site or at HQ

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner, J.V. Whichello; The Generic Review Station MORE, Design and Evaluation, BMBF/IAEA Joint Programme Report No. 242, July 1993.

## Status:

- Repair and maintenance possible
- New production not possible

## Name and address of contact:


- (1) Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- (2) Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


## Date: July 2005

## Name of Device: TAMPER RESISTANT TV-LINK (TRTL)

## Type: Subsystem of optical surveillance system

### Function:

- authentication of video scenes transmitted from camera to recording unit via standard transmission line (coax, fibre optic cable)

### Application:

- unattended optical surveillance systems in facilities
- standard interface to match with optical surveillance systems (e.g. MOS, MUX)
- subrack with receiver unit, power supply and network controller
- transmitter unit in camera housing

### Any reference to design or use:

- B. Richter, G. Stein, G. Neumann, K.J. Gärtner, J.V. Whichello; Design and Evaluation of the Tamper Resistant TV-Link, BMBF/IAEA Joint Programme Report No. 183, July 1989.

### Status:

- Repair and maintenance possible
- New production not possible

### Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


### Date: July 2005

# SECTION 4 Optical Surveillance

## Name of Device: UNIPLEX SURVEILLANCE SYSTEM

## Type: Multi-camera optical surveillance system

### Function:

- Up to 16 CCTV cameras can be recorded sequentially via a commercial video multiplexer (Uniplex) on a commercial time lapse S-VHS video cassette recorder.
- Onsite review of recorded images channel by channel in different speeds.
- Review by using MORE

### Application:

- unattended optical surveillance of up to 16 points within a facility (total max. 730,000 images, max 1 year unattended, picture taking interval selectable from 20 ms to 20 s)
- housed in 19" cupboard with build in uninterruptible power supply and power down feed back

### Any reference to design or use:

- Training course for DQ/UPX video system, Euratom Safeguard Office, video group, 1999

### Status:

- Implemented by IAEA and Euratom
- Available upon request

### Name and address of contact:

- European Commission, DG TREN I 01, Bat. EUFO, L-2920 Luxembourg


| Telephone | Fax | E-Mail |
|---|---|---|
| +352 4301 33244 | | vitor.oliveira-martins@cec.eu.int |


### Date: June 2004

# SECTION 4 Optical Surveillance

## Name of Device: VIDEO TERMINAL DCMVT100

## Type: Subsystem of digital surveillance systems DSOS and ALIS

## Function:

- user interface for on-site set-up and on-site image viewing of digital image surveillance systems DSOS and ALIS

## Application:

- unattended optical surveillance in facilities
- integrated into standard camera housing of ALIS
- mounted on base plate of DSOS

## Any reference to design or use:

- B. Richter, G. Neumann, K.J. Gärtner, H. Meier, K. Schoop; Digital Image Surveillance Systems based on the Digital Camera Module DCM 14, Proc. 21st ESARDA Annual Meeting, Sevilla, 1999, pp. 615-619.

## Status:

- Implemented by IAEA and Euratom
- Available commercially

## Name and address of contact:


- Mr. Bernd Richter, Forschungszentrum Jülich GmbH, Programme Group STE, D-52425 Jülich, Germany
- Dr. Neumann elektronik GmbH, Wolfhelmstr. 39d, D-50259 Pulheim, Germany

| Telephone | Fax | E-Mail |
|---|---|---|
| (1) 49-2461-614884 | (1) 49-2461-612496 | (1) B.Richter@fz-juelich.de |
| (2) 49-2234-986091 | (2) 49-2234-986090 | (2) G.Neumann@DRNE.de |


## Date: July 2005

# SECTION 4 Optical Surveillance

| | |
|---|---|
| **Name of Device:** | **VXI DIGITAL IMAGING SURVEILLANCE SYSTEM (VDIS)** |
| **Type:** | **VXI based multi-camera video surveillance system** |

## Function:

- Video Surveillance with nuclear event cross-triggering.

## Application:

- Video surveillance of critical areas. System uses purpose built digital cameras with autonomous data storage. All camera functions are provided by a single RS-485 connection to the VXI interface module. 8 video channels per VXI module. Each channel can be configured to respond to trigger events from NDA detection systems (i.e. gamma and neutron detectors).

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keffe, R.Messner, Atomic Energy Control Board, Ottawa, Canada; Bernd Richter, Forschungszentrum Juelich, D-52425 Juelich, Germany - 'Enhanced VXI Integrated Safeguards Instruments', INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keffe, R.Messner, Atomic Energy Control Board, Ottawa, Canada - 'Multiple Radiation Detector type Support for VIFM Safeguards Instruments', INMM 1998
- These and additional papers are available at http://www.vifm.com

## Status:

- under development

## Name and address of contact:


- Chris Rampen, Bot Engineering Ltd., 7393 Twiss Road, Campbellville, Ontario, L0P 1B0, Canada

| Telephone | Fax | E-Mail |
|---|---|---|
| (905) 876-4301 | (905) 875-0525 | chris_rampen@botcorp.com |


**Date:** November 1998

# SECTION 4 Optical Surveillance

**Page intentionally left blank**

# SECTION 5

# MOVEMENT MONITORS

# SECTION 5 Movement Monitors

**Page intentionally left blank**

| | |
|---|---|
| **Name of Device:** | **SATELLITE SENSITIVE ASSET MONITORING SYSTEM** |
| **Type:** | **Compact satellite transmission system of GPS and low data rate information** |

## Function:

- To provide GPS location data and/or low data rate information (security and environmental data) for sensitive assets. GPS location and speed can be directly displayed on electronic maps. Temperature, vibration, security and radiation data is available via a secure internet browser. System available on subscription basis.

## Application:

- Where cost efficient, secure satellite based tracking of sensitive items/shipments and/or low data rate telemetry capability is required. System uses advanced data encryption methods.

## Any reference to design or use:

- For the most up to date information see http://www.mobilacom.com

## Status:

- Under development

## Name and address of contact:

- Chris Rampen, Bot Engineering Ltd., 7393 Twiss Road, Campbellville, Ontario, L0P 1B0, Canada

| Telephone | Fax | E-Mail |
|---|---|---|
| 1-905- 876-4301 | 1-905-875-0525 | chris_rampen@botcorp.com |

**Date:** November 1998

# SECTION 5 Movement Monitors

**Page intentionally left blank**

# SECTION 6

# ACCESS CONTROL

# SECTION 6 Access Control

**Page intentionally left blank**

# SECTION 6 Access Control

**[This section is currently void]**

# SECTION 6 Access Control

**Page intentionally left blank**

# SECTION 7

# STATION MONITORING

# SECTION 7 Station Monitoring

**Page intentionally left blank**

| | |
|---|---|
| **Name of Device:** | **COAXIAL TO TWISTED PAIR INTERFACE** |
| **Type:** | **Coaxial to Twisted Pair Interface for in reactor detection systems** |

## Function:

- A cost effective radiation hardened alternative to costly new coax cable penetrations where twisted pair penetrations already exist. Intended for connection of monitoring systems to in-reactor detection systems.

## Application:

- Currently used for core discharge monitors at a number of CANDU facilities. High reliability totally passive and radiation hardened design. System is designed for rapid swap out and is housed in a tamper indicating enclosure.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Autonomous Data Acquisition Module for Radiation Monitoring in Integrated Systems or Stand-alone Modes , ESARDA 1997

## Status:

- Operational

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


**Date:** December 2003

## Name of Device: DATA COLLECTION UNIT (DCU)

## Type: Remote Monitoring System

### Function:

- The data collected, stored and distributed from this suite of sensors and active seals is managed inside a secure DCU. The DCU provides facility monitoring using an Echelon based suite of sensors and item monitoring via the Sandia National Laboratories T-1 Electronic Sensor Platform. The secure enclosure contains both passive and active tamper indicators for detection. The data management system within the DCU provides data authentication of the stored "day" files for security during file distribution to ends users.

### Application:

- Any facility that requires secure data collection and distribution. The system detects and collections any system access.
- Technology has been evaluated for applications involving the storage of nuclear materials at multiple U.S. storage facilities.

### Any reference to design or use:

- Available upon request

### Status:

- Evaluations are complete.

### Name and address of contact:


- Bobby H. Corbell, Sandia National Laboratories, PO Box 5800 MS-1361, Albuquerque, NM USA 87185

| Telephone | Fax | E-Mail |
|---|---|---|
| (505) 844-8468 | (505)284-5437 | bhcorbe@sandia.gov |


### Date: September 2003

| | |
|---|---|
| **Name of Device:** | **HE3, BF3, CDTE & ION CHAMBER INTERFACE FOR VIFM & VIP BASED PLATFORMS** |
| **Type:** | **He-3, BF-3, CdTe and Ion Chamber detector Interfaces using single wire coax** |

## Function:

- Interface for He-3, BF-3, CdTe and Ion Chambers to low voltage single wire interconnection. Interface is fully compliant with VIFM/VIP based system.

## Application:

- The interface employs a radiation hardened pre-amplifier and HV supply at the detector. The interface is connected via low voltage single wire coax minimizing signal loss and ground loop problems typically encountered with long cable runs. The interface is fully compliant with ADAM specifications. Different detectors types may be quickly integrated into VIFM/VIP software as a result of the single wire connection used with this system.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Autonomous Data Acquisition Module for Radiation Monitoring in Integrated Systems or Stand-alone Modes , ESARDA 1997

## Status:

- Operational

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


## Date:

December 2003

| | |
|---|---|
| **Name of Device:** | **NEUTRON SIGNATURE MONITOR FOR VIFM AND VIP BASED PLATFORMS** |
| **Type:** | **Neutron (with gamma) detection system** |

## Function:

- Monitoring of neutron and gamma events specific to in-core insertion and removal of hot fuel. System is currently in use in CANDU facilities as a Core Discharge Monitor (VIFC).

## Application:

- System employs a detector assembly consisting of a pair of fission chambers and a pair of radiation hardened solid-state gamma detectors with self-authenticating/tamper indicating circuitry. Detector assemblies are connected using low voltage single wire coax and are fully compliant with ADAM specifications as used in VIFM and VIP systems. Detector assemblies are available in two different packages: wall mount or camera mount. VIFM Review Software allows analysis/accounting of typical and unusual in core events.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998

## Status:

- Operational in CANDU facilities

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


**Date:** December 2003

| | |
|---|---|
| **Name of Device:** | **SPENT FUEL TRANSFER MONITOR FOR VIFM AND VIP BASED PLATFORMS** |
| **Type:** | **Spent fuel discharge monitor system using gamma detector array** |

## Function:

- To detect and automate the accounting of spent fuel transfers. System is currently in use as bundle transfer monitor (VIFB)

## Application:

- System is currently employed in CANDU facilities as a bundle counter. The system can use from two to eight detectors allowing accurate detection of the number and direction of transfers. System employs radiation hardened solid-state gamma detectors with self-authenticating/tamper indicating circuitry. Detectors are provided with waterproof stainless steel housing. Detectors use low voltage single wire coax connection for minimization of signal loss and installation requirements. System is fully compliant with ADAM specification as used in VIFM and VIP systems.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Autonomous Data Acquisition Module for Radiation Monitoring in Integrated Systems or Stand-alone Modes , ESARDA 1997

## Status:

- Operational

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


**Date:** December 2003

| | |
|---|---|
| **Name of Device:** | **VIRTUAL INSTRUMENT PLATFORM (VIP)** |
| **Type:** | **Host for Multi-Mission Monitoring System** |

## Function:

- Standalone/small foot print data acquisition system using Ethernet enabled ADAM data acquisition module. Current operational systems: spent fuel monitoring (VIFB), Core Discharge Monitoring (VIFC), Yes/No monitors (VIFD)

## Application:

- Standalone system using single ADAM (See VIFM system) where a small foot print data acquisition system is desirable. System has independent power supply and battery backup (30 days in standard configuration) in a seismically qualified standard NEMA cabinet. 8 channels of data are stored on up to 2 removable flash cards. Data is periodically transferred to collect computer for storage/analysis via standard Ethernet connection. The VIP offers a Web Server interface and is also fully compliant with VIFM collect software version 4.0.5 and above.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; P.Button, Canadian Nuclear Safety Commission, Canada– 'The Stand-alone ADAM, a networked option for radiation monitoring', INMM 2003

## Status:

- Operational

## Name and address of contact:

- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |

**Date:** December 2003

**Name of Device:** **VXI INTEGRATED FUEL MONITOR (VIFM)**

**Type:** **VXI Host for Multi-Mission Monitoring System**

## Function:

- Acquisition and analysis of data acquired by VXI based safeguards systems with remote monitoring capability. Current operational systems: spent fuel monitoring (VIFB), Core Discharge Monitoring (VIFC), Yes/No monitors (VIFD)

## Application:

- Standard system has sufficient memory and backup battery capacity for more than 3 months unattended operation. System capacity for 12 VXI modules. System features fully redundant backup of data and isolated independent battery back-up for Main and Backup modules. 19" rack-mount cabinet has been fully qualified for hydrogen safety and meets IAEA requirements for tamper proofing. Standard system uses ADAMs (Autonomous Data Acquisition Modules) – VXI based data acquisition modules featuring 8 channel single wire low voltage detector interconnection and data storage on removable flash cards. A large number of sub-systems/accessories have been developed for this system (i.e. remote battery conditioning, high stability clock, etc). System provides for remote monitoring and can function as the collect computer for VIP systems (See other Station Monitors made by Bot). System incorporates Windows based review software tools for off-line analysis.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998

## Status:

- Operational

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


**Date:** December 2003

# SECTION 7 Station Monitoring

| | |
|---|---|
| **Name of Device:** | **YES/NO MONITORING FOR VIFM AND VIP BASED PLATFORMS** |
| **Type:** | **Yes/No monitoring system for use with VIFM and VIP platforms** |

## Function:

- Monitoring of non-usual nuclear material transfer paths. System is currently in use as yes/no monitor (VIFD)

## Application:

- System is currently employed in CANDU facilities as a Yes/No monitor. The system can accommodate any number of detectors and employs radiation hardened solid-state gamma detectors with self-authenticating/tamper indicating circuitry. Detectors use low voltage single wire coax connection for minimization of signal loss and ground loop problems associated with long cable runs. System supersedes maintenance/inspection intensive single use passive devices and can be used for real time environmental monitoring. The system is fully compliant with ADAM specification as used in VIFM and VIP systems.

## Any reference to design or use:

- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; Bernd Richter, Forshungszentrum Juelich, D-52425 Juelich, Germany – 'enhanced VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Multiple Radiation Detector Type Support for VXI Integrated Safeguards Instruments, INMM 1998
- D.Bot, Bot Engineering Ltd; R. Keeffe, R.Messner, Atomic Energy Control Board, Canada; 'Autonomous Data Acquisition Module for Radiation Monitoring in Integrated Systems or Stand-alone Modes , ESARDA 1997

## Status:

- Operational

## Name and address of contact:


- Chris Rampen, Bot Engineerng Ltd., 7393 Twiss Road, Campbellville, Ontario, Canada, L0P 1B0

| Telephone | Fax | E-Mail |
|---|---|---|
| 905-876-4301 | 905-875-0525 | Chris_Rampen@Botcorp.com |


**Date:** December 2003

# SECTION 8

# SECURE CONTAINERS

# SECTION 8 Secure Containers

**Page intentionally left blank**

# SECTION 8 Secure Containers

| | |
|---|---|
| **Name of Device:** | **SAMPLE VIAL SECURE CONTAINER (SVSC)** |
| **Type:** | **Secure Container** |

## Function:

- The Sample Vial Secure Container (SVSC) is a passive tamper-indicating device which is intended to provide evidence of a tamper attempt to safeguard samples. The SVSC is a "one-time use" secure container. After the sample vial is placed inside the container and the cover is secured properly, the only way to remove the sample vial is to cut open the SVSC. Each SVSC is uniquely identified with a serial number and a random swirl pattern, which is generated during the injection molding process.

## Application:

- Within a reprocessing plant, from the time a sample is taken to the beginning of sample treatment, a sample is unattended by an inspector. At the present time there is no assurance that the sample being analyzed is the original sample. This product will provide a technique to assure the integrity of a sample vial from the point where the sample is drawn to the point where it is analyzed.

## Any reference to design or use:

- Mark J. Baumann, "Sample Vial Secure Container", 34th Annual Meeting Proceedings of the Institute of Nuclear Materials Management, July 18-21, 1993.

## Status:

- Under Development

## Name and address of contact:


- Mark Baumann, Sandia National Laboratories, MS 1213, P.O.Box 5800, Albuquerque, NM, USA, 87185

| Telephone | Fax | E-Mail |
|---|---|---|
| 1-505-844-9887 | 1-505-844-6067 | mjbauma@sandia.gov |


| | |
|---|---|
| **Date:** | November 1998 |

# SECTION 8 Secure Containers

**Page intentionally left blank**

# SECTION 9

# SAFEGUARDS COMMUNICATION SYSTEMS

# SECTION 9 Safeguards Communication Systems

**Page intentionally left blank**

## Name of Device: VIRTUAL PRIVATE NETWORK

## Type: Networking Equipment

## Function:

- Encrypting/authenticating router

## Application:

- to securely connect either facility-to-site or site-to-site computers or networks
- to securely connect remote users to facility or site computers or networks

## Any reference to design or use:

- YH. Smartt, S. Caskey, R. Martinez; Application of a Virtual Private Network to International Safeguards, ESARDA, May 2000.
- H. Smartt, S. Caskey, R. Martinez; Application of a Virtual Private Network to the Finnish Remote Monitoring System, INMM, July 2000.

## Status:

- Under evaluation by IAEA for remote monitoring and remote users (e-mail)
- Available commercially

## Name and address of contact:


- Ms. Heidi Smartt, Sandia National Laboratories, P.O. Box 5800-1371, Albuquerque, NM 87185, USA

| Telephone | Fax | E-Mail |
|---|---|---|
| 1-505-844-3798 | 1-505-284-5055 | hasmart@sandia.gov |


## Date: September 2000

# SECTION 9 Safeguards Communication Systems

**Page intentionally left blank**

# SECTION 10

# MATERIAL MONITORING SYSTEMS

# SECTION 10 Material Monitoring Systems

**Page intentionally left blank**

# SECTION 10 Material Monitoring Systems

## Name of Device: MMS (MATERIAL MONITORING SYSTEM)

## Type: Remote Monitoring System

## Function:

- Collecting and storing data from a variety of sensors
- Send data to the user for review

## Application:

- Any facility that requires monitoring of material
- any place within a facility where inspector access is required to be minimized
- e.g. spent fuel pond at a nuclear facility

## Any reference to design or use:

- J. Damico and L. Desonier, "An Internet-Based Object-Oriented Hierarchical Information System for Material Monitoring", 39th Annual Meeting, Proceedings of the Institute of Nuclear Materials Management, 1998.
- J. Damico and L. Desonier, "Material Monitoring System Update: Enhancements and Applications", 40th Annual Meeting, Proceedings of the Institute of Nuclear Materials Management, 1999.
- L. Desonier, "SNL Material Monitoring System: Sensor Configurations and Latest Applications", 41th Annual Meeting, Proceedings of the Institute of Nuclear Materials Management, 2000.

## Status:

- Implemented by Sandia National Laboratories at various locations
- To be used for USA, Savannah River Site KAMS Storage Monitoring for IAEA

## Name and address of contact:


- Mr. Lawrence M. Desonier, Sandia National Laboratories, PO Box 5800 MS 1361, Albuquerque, New Mexico, USA, 87185-1361

| Telephone | Fax | E-Mail |
|---|---|---|
| 505-845-8332 | 505-284-5437 | lmdeson@sandia.gov |


## Date: November 2000

# SECTION 10 Material Monitoring Systems

**Page intentionally left blank**

# ANNEX 1

# IAEA & EURATOM COMMON EQUIPMENT

# ANNEX 1 IAEA & Euratom Common Equipment

**Page intentionally left blank**

# IAEA & EURATOM COMMON EQUIPMENT

# STATUS OF ACCEPTANCE

| CODE | DESCRIPTION | INSPECTION USE | | EVALUATION | | DEVELOPMENT | | PROMOTION | | COMMENTS | REVISION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | IAEA | EUR | IAEA | EUR | IAEA | EUR | IAEA | EUR | | |
| **C & S** | | | | | | | | | | | |
| ACIV | Auto Cobra Image Verifier | * | * | | | | | | | Aquila System for Euratom Japanese System for IAEA | |
| ADPS | Adhesive/Paper Seals | * | * | | | | | | | | |
| ALIS | All in one Surveillance System | * | * | | | | | | | | |
| CAPS | Cap Seals (Metallic Types E & X) | * | * | | | | | | | | |
| FBOS | Fibre Optic Seal e.g. Cobra + Verif. | * | * | | | | | | | | |
| GARS | Gemini Advanced Review Station | * | * | | | | | | | | |
| GDTV | GEMINI surveillance System | * | * | | | | | | | | |
| MEBS | MEB Bolt Seal | * | * | | | | | | | IAEA notation: USSB | |
| MORE | GRS - MORE | * | * | | | | | | | | |
| MOSS | Multicamera Surveillance System | * | * | | | | | | | | |
| MXTV | Multiplex TV system (IAEA) | * | * | | | | | | | Eur. notation: MUX | |
| PSU | Portable Surveillance Unit | * | * | | | | | | | To be phased out. (STVS.) | |
| VCOS | VACOSS III Electronic Seal + Verifier | * | * | | | | | | | All old ones to be scrapped | |
| VMOS | VACOSS MOS Interface | * | * | | | | | | | | |
| VSEU | Video System (Eur) Multiplex, Digiquad | * | * | | | | | | | Note 1: QCAX, QS19 Front End Motion Sensors | |
| UEMS | Upgraded Euratom Multi-Camera Optical Surveilla | * | * | | | | | | | Upgraded EMOSS | |
| DSOS | Digital surveillance system (Neuman) | * | * | | | | | | | | |
| DMOS | Multi camera system | | | * | * | | | | | | |
| FAST | Digital multi camera system | | | | * | * | | | | Part of the common R&D program. | C |
| OSVS | In-situ Verifiable Seal | | | | | * | * | | | Transponder seal | |
| MARI | Maritime Sealing System | | * | * | | | | | | Multiple sealing system | |

## NDA & C&S USED FOR MONITORING

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CONS | CONSULHA (Data Acquisition Equipment) | * | * | | | | | | | | |
| INTM | Integrated MOS/VACOSS/SWEIGH System | * | * | | | | | | | | |
| MLS | Monitor Logging System | * | * | | | | | | | | |

# ANNEX 1 IAEA & Euratom Common Equipment

**Page intentionally left blank**

# ANNEX 2

# LIST OF DEVICES APPROVED BY IAEA

# ANNEX 2 List of Devices Approved by IAEA

**Page intentionally left blank**

# ANNEX 2 List of Devices Approved by IAEA

**1. Optical Surveillance Systems**

**1.1 Photo**

1.1.01 Photo-surveillance Unit (Minolta)
PHSR

**1.2 Video Single Camera**

1.2.01 Compact Surveillance and Monitoring System COSMOS
CSMS

1.2.02 Modular Integrated Video System
MIVS

1.2.03 Short Term TV System
STVS

1.2.04 Sample Identification System
SIDS

1.2.05 Underwater TV
UWTV

1.2.06 Underwater Viewing Device
UWVD

1.2.07 Gemini Digital Video System
GDTV

1.2.08 Digital System Optical Surveillance
DSOS *

1.2.09 All-In-One-System
ALIS *

**1.3 Video Multiple Camera**

1.3.01 CCTV System
FTPV

1.3.02 Multi Camera Optical Surveillance Systems
MOSS Multi Camera Optical Surveillance System
VMOS VACOSS-S/MOSS System

1.3.03 Multiplex TV Surveillance System
MXTV

1.3.04 "Video System (Multiplex, Digiquad, Euratom)"
VSEU

1.3.05 Video System
VSPC

1.3.06 Upgraded Euratom Multi-Camera Optical Surveillance System
UEMS

1.3.07 Server Digital Image Surveillance
SDIS *

1.3.08 Digital Multi-camera Optical Surveillance System
DMOS

**1.4 Video Review Stations**

1.4.01 MIVS Advanced Review Station
MARS

1.4.02 Multi-system Optical Review Station
MORE

1.4.03 Mark 2 Video Review Station
MK-2

1.4.04 Mark 4 Video Review Station
MK-4

# ANNEX 2 List of Devices Approved by IAEA

**2. Seals**

**2.1 Single Use Seals**

2.1.01 Improved Adhesive Seal
VOID

2.1.02 Metallic Seals
CAPS

**2.2 In-Situ Verifiable Seals**

2.2.01 Fibre-optic General Purpose Seal (COBRA)
FBOS

2.2.02 Ultrasonic Seals (ARC with IRUS)
ULCS

2.2.03 Ultra-sonic Sealing Bolt
USSB

2.2.04 VACOSS-S Electronic Seal
VCOS *

**3. Unattended Monitoring Systems**

**3.1 Fuel Transfer and Radiation Monitor Systems**

3.1.01 Shift-Register Based Monitor Systems
ENGM Entrance Gate Monitor System
FAAS Fuel Assembly/Capsule Counter System
MAGB Glove Box Counter
PCAS Canister Counter

3.1.02 Grand-Based Monitor Systems (UFFM)
CCRM Cask Car Radiation Monitor
CTRM Core Top Radiation Monitor
ERVM Exit Gate Radiation Monitor
EVRA "Ex-vessel Radiation Monitor, Unit A"
EVRB "Ex-vessel Radiation Monitor, Unit B"
EXGJ Exit Gate Radiation Monitor
EXGM Exit Gate Monitor
FUGM Fugen Chute Monitor
FUGR Gate Monitor System
TOKB "Radiation Monitor, Backup"
TOKM TOKAI Chute Monitor
UFFM Unattended Fuel Flow Monitor

3.1.03 VXI-Adam Based Monitor Systems (VIFM )
VIFB VXI Integrated Fuel Monitor - CANDU Bundle Counter (VIFM-CBC)

3.1.05 Thorp Product Store Integrated Verification and C&S System
QS34

3.1.06 CANDU Core Discharge Monitor
CCDM

3.1.07 CANDU Spent Fuel Bundle Counter System
CSFC

3.1.08 Input Flow System for reprocessing plants (CONSULHA)
CONS

**3.2 Reactor Power Monitor Systems**

3.2.01 Reactor Power Monitor System
REPM

3.2.02 GRAND-Based Reactor Power Monitor
GRPM

* indicates the system has critical components which must be removed prior to sale or scrapping.

**End of the document**