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WINS / WNTI INTERNATIONAL GOOD PRACTICE GUIDE

Electronic Tracking for the Transport of Nuclear and other Radioactive Materials

Revision 1.0

Dedicated to the safe, efficient and reliable transport of radioactive materials



A WINS/WNTI International Best Practice Guide

Electronic Tracking for the Transport of Nuclear and other Radioactive Materials

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Why You Should Read This Guide

Governments and operators take their responsibility to transport nuclear and other radioactive materials seriously. Thousands of shipments are carried out every year, both safely and securely. However, because nuclear and other radioactive materials are potentially at their most vulnerable while they are being shipped from one location to another, the shipments need to be monitored carefully. One way of monitoring the shipments is to track them.

To accomplish this mandate, organisations around the world use many different kinds of tracking methods. The most basic requires transport operators to contact their organisations at certain fixed time periods or checkpoints along the route. Amongst a variety of physical and operational approaches, more advanced methods could include electronic tracking systems that monitor conveyances or even individual packages. Although the IAEA provides general recommendations and guidance for tracking, no specific requirements pertaining to electronic tracking exist.

Electronic tracking systems can have many benefits, depending on the particulars of the shipment; if applied effectively, they could add an extra layer of security and functionality to materials transport. However, electronic tracking systems also involve important logistical issues and challenges; each of these must be carefully considered when deciding whether or not to implement such systems in particular circumstances.

The purpose of this Guide is to help stakeholders, including government policy makers, regulators, operators, shippers, and guard force personnel, understand the potential merits, challenges, viability and cost-effectiveness of electronic tracking systems. The Guide does not imply that every shipment of nuclear or radioactive materials must be tracked electronically or require complex response procedures, but discusses what is required to track nuclear and other radioactive material electronically during shipment, why such systems may be appropriate, and how they can be designed and implemented effectively.

About the Appendices

Appendix A contains a set of questions that will help your stakeholders assess the need for, and the effectiveness of, an electronic tracking system for the transport of nuclear and other radioactive materials. Appendix B contains metrics defining different levels of organisational success in implementing a security tracking system. We have also attached a link to a case study in the US that describes an advanced electronic tracking system that uses radio frequency identification to track individual packages of nuclear materials while they are being transported (see page 6). You have to be online to access this case study.

About the Preparation of this Guide

In preparing this Guide, we have taken note of the real life experiences of organisations including those that have applied remote electronic tracking systems to the transport of nuclear and other radioactive materials. This Guide also reflects discussions from a workshop titled “Advanced Technologies for Nuclear/Radioactive Inventory Management and Transport Security” that was co-sponsored by WINS and the Korea Institute of Nuclear Nonproliferation and Control (KINAC) in Seoul 21-22 November 2011.

We Welcome Your Comments

We plan to update the information in this Guide frequently to reflect best practices and new ideas. Therefore, we ask that you read it carefully and then let us know how to improve it. If you need help or assistance with any aspect of this Guide, please email us at either WINS or WNTI.

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What is meant by Electronic Tracking Transport of Nuclear and Other Radioactive Materials?

Almost all nuclear and other radioactive materials are placed in packages which comply to the regulation for transport. The packages are loaded onto different types of conveyances (e.g. lorries, rail cars, airplanes, and ships) and transported from one location to another by various different modes. The transport of materials may take place on a single conveyance from the shipping site to the receiving site; it often involves, however, multiple modes of transport. For example, the material may depart from the shipping site on a lorry and be taken to a port where it is loaded onto a ship. When the ship arrives at a new port, the material may be loaded onto a rail car for transportation to an interior location. It may then be loaded once again onto a lorry for transport to its final destination at a nuclear power facility, hospital, university research lab, etc. The material may also be stored temporarily while it is en route.

The transportation of nuclear and other radioactive materials often involves crossing international borders and international waters. As a result, responsibility for the security of the consignment may pass from one entity to another —perhaps several times. This means that the transport managers, response personnel, and nature of the threat itself may all change during transport.

To enhance security and monitor the state of health of such in-transit materials, more and more organisations are implementing remote electronic tracking and monitoring systems. If applied effectively and integrated successfully into a proper transport control system appropriate to the particular nature of the consignment, such systems can provide an added layer of security and functionality. If properly configured, they can also provide early warning of unauthorised activities and movements, thereby allowing activation of a timely security response.

How Electronic Tracking Works

An electronic tracking device is affixed to a conveyance (e.g. rail car, lorry cab, ship) or package in order to visibly track materials while they are in transit. Electronic tracking commonly uses a global positioning system (GPS) and a

satellite communication or cellular general packet radio service (GPRS) working together to provide and transmit information. The GPS unit can identify the location of the device to within three meters anywhere in the world where GPS coverage exists. Either the satellite transponder or the GPRS unit transmits the GPS data (location) information over the communication network to a server that enables viewing of the information. The system is only as good as the quality of the GPS coverage and there are areas of the world and particular terrains where this is not good; and of course one needs to be aware of the possibility that signals could be being jammed intentionally.

In addition to such systems, several countries are developing—or have already developed and applied—radio frequency identification (RFID) systems. RFID is a rapidly growing technology that consists of passive and active devices operating over selective radio frequency spectra. It is generally considered to be part of the automatic identification and data capture industry, which also includes bar codes, biometrics, magnetic stripes, optical character recognition, smart cards and voice recognition. RFID is now being applied to fields ranging from asset management, healthcare and animal tracking to energy and defense.

Hosted and self-hosted monitoring

Two types of electronic monitoring are typically offered. The first is a hosted service that is engaged to receive and store on its server all data regarding the location of the device, as well as any other information requested. Employees of the company that contracts with the hosted service can view the data via a secure web browser using the appropriate usernames and passwords. The second monitoring option is for organisations to host the service themselves. This enables them to protect their information within their own computer network, have full control of all data received, and decide how it will be displayed.

Should You Implement an Electronic Tracking System?

When considering whether or not to implement an electronic tracking programme, your first step is to clearly identify why you want to track nuclear and other radioactive materials, the method of transport that will be used to move the material, what you want to track and how best to track it. For example, do you want to track the nuclear or other radioactive material itself or just the vehicle? It is also extremely important to know the type of data you want to receive.

For example, do you want:

- To be able to locate the item by giving GPS coordinates?
- To be alerted if the device has been tampered with or moved (motion detection)?
- The device to have a panic alarm?
- The driver to carry a remote panic alarm?
- An alert to go off if the vehicle leaves a predetermined path (geo-fencing)? (If the system is required to create an alert when irregularities occur, you must ensure that defined, tested and proved response methods are in place.)

Identifying the granularity of what is being tracked is the key to fully understanding what kind of technology to use and how it will affect procedures. The transport method (mode or modes of transport, transfer between modes, the crossing of international borders, or travel in international waters) will usually be dictated by where the materials are currently located and the location of the site to which they will be moved. The necessity for or position of the tracking device depends on the level of accuracy desired. The type of data to be monitored depends on your organisation's needs and goals.

The Potential Benefits of Electronic Tracking

An electronic tracking system provides machine-to-machine, near real-time, two-way communication. It also provides instant and automatic alert/alarm notification, incident response and emergency management capabilities, adequate radiation resistance, adequate authentication of devices, and data encryption. The best systems are characterised by few false alarms, low consumption of power, ease of use and reasonable cost.

One of the most important benefits of electronic tracking systems is that their automatic alarm notification capabilities decrease response times in the event of emergency. Because monitors know where the alert is coming from, they can provide emergency services with the exact location of the shipment—whether it is static or in motion—far faster than is possible with any other means.

A second benefit is that such systems can be highly efficient and cost-effective. Because tracking and monitoring are done continuously, management of the system is by exception only.

Staffs become more efficient because they can determine, with reasonable certainty, when a load will be expected to pass through certain checkpoints and hence a more accurate time of arrival can be given to the consignee. This enables teams to be deployed at just the right time. Some organisations use it for commercial purposes to confirm that the delivery of nuclear and other radioactive materials has been completed (as the vehicle enters the customer site) so that invoicing for the shipment can be made with the minimum of delay.

A third benefit is that electronic tracking systems create a fully-logged history of every step the consignment has taken. This helps to reassure operators that no interference has occurred. Electronic tracking can detect unplanned door openings, emergency stops, the unhooking of a trailer and physical attacks on packages; all of which provide added confidence and assurance. It also helps to ensure the correct processing of shipments.

Barriers to implementation

Despite their known benefits, remote electronic tracking systems also face a number of barriers to implementation. Reasons for this include the practicality of operating electronic tracking systems cost-effectively in an international industry that crosses local, regional and national boundaries every day; uses multiple transport modes; sometimes takes place in remote regions of the world that lack a robust communications infrastructure. Furthermore, authorities and emergency responders at all levels (local, regional, national and international) have different requirements that must be identified, coordinated and adhered to.

When considering whether to use electronic tracking system, it is important to answer the following questions:

- Who is legally accountable for the safe transport of the nuclear and other radioactive materials at every stage of the transport operation?
- Who is legally accountable for the secure transport of the nuclear and other radioactive materials at every stage of the transport operation?
- Whose reputation is at stake if the transportation of these materials results in the loss or compromise of the materials?
- Who should run the transport control centre for national and international shipments?
- Who should bear the costs of implementing a fully integrated, remote electronic tracking system?

Electronic Tracking: Examples and Evolution

The electronic tracking of transport and in-transit storage of materials has been occurring for decades. Early tracking was accomplished using such simple techniques as periodically monitoring the location of a conveyance and/or a package using bar codes scanned at designated points. In fact, many large carriers of commodities, both dangerous and non - dangerous goods, still use this technique for tracking the movement of packages through their systems.

One major drawback to bar code systems is that they do not provide timely information about location if such real-time information is deemed essential according to the characteristics of the particular consignment. They only inform a shipper, carrier or receiver about the time a conveyance or package departed from, arrived at, or passed through a designated location.

As technology has developed, many shippers of nuclear and other radioactive materials have begun to implement increasingly sophisticated tracking systems. For example:

Pacific Nuclear Transport Ltd. uses satellite navigation and tracking system on its ships that monitors the ships' location and velocity vector when they are carrying irradiated nuclear fuel, high-level radioactive waste and plutonium. The ships automatically transmit their position back to a staffed control centre, providing a view of their location and enabling monitors to predict where the ships will be located between monitoring periods.

The United States Department of Energy (DOE) has been using the TRANSCOM Tracking System for over a decade to track shipments of radioactive materials. The system provides authorised users with a Web portal through which they can track shipments and communicate messages to their truck drivers. It uses satellite communications and computer networks to pinpoint the location of shipments while they are en route and communicates this information to the control centre via satellite. This system not only provides a view of where the shipment is, but it also gives drivers of the vehicles the ability to instantaneously notify the centre of any potential threats or unplanned events. Please click [here](#) to access an article on the system.

Several U.S. commercial trucking companies that specialise in the shipment of radioactive and dangerous goods track their vehicles electronically. The systems they use give their customers online access so they can view the status of their loads and the actual location of their cargo. The systems also enable the exchange of data via the internet. This provides a timely, cost-effective way to increase accuracy and productivity; it also eliminates the time delays associated with paperwork.

What kinds of material would benefit from Electronic Tracking?

Over the last few years, the IAEA has published several documents that address the security of nuclear and other radioactive materials during transport and storage. (See the References section for more information.) The various IAEA security series documents take into account the properties of the material for the protection of nuclear and other radioactive materials. Nuclear and other radioactive materials must be protected against unauthorised removal for the construction of a nuclear explosive device, and both types must be protected against radiation exposure to persons or dispersal of the package contents that could lead to harmful consequences.

Included in these recommendations is the concept that the level of security that must be provided depends upon the risk posed by the material involved should it be sabotaged or removed in an unauthorised manner. Consequently, the materials are categorised according to a graded approach that depends on the level of threat they pose to workers, members of the public and the environment.

Nuclear material categories

The IAEA categorises nuclear material in terms of element, isotope, quantity and extent of irradiation. Four levels result from this categorisation:

Uncategorised	Very small quantities of material that pose minimal risk in the event of unauthorised removal
Category III	Somewhat more significant quantities requiring an increased level of protection
Category II	Larger quantities that require additional levels of protection
Category I	The largest, most significant quantities. These pose the greatest threat to unauthorised removal and require the greatest levels of protection.

Radioactive material categories

The IAEA categorises radioactive material according to the isotopes and quantities that are contained in a package. Four levels are recommended for this categorisation as well, depending on the required level of security:

Prudent Management Practices	Small quantities of material that pose a very low potential for radioactive consequences
Basic Security Level	Larger quantities of material with limited potential for radioactive consequences
Enhanced Security Level	Even larger quantities of material, with a higher potential for radioactive consequences
Additional Security Measures	The largest quantities of material. The measures to be imposed for this category depend on the design basis threat, an assessment of the prevailing threat, and the nature of the material being transported.

About in-transit storage

It is generally recommended that materials being stored temporarily while they are in transit be subject to the same security measures as when they are being transported, used at a facility, or stored at a facility.

Required Response Capabilities

To implement an effective response for the physical protection and security of nuclear and other radioactive materials during transport and in-transit storage, it is essential to monitor and communicate their location. Unless a transportation tracking system provides continuous monitoring of the location, timely detection, delay and response may not be possible.

To provide such capabilities, the organisation needs to incorporate a continuous, reliable communication system and a continuously operated control centre. Furthermore, the tracking and monitoring functions must be fully integrated with the personnel involved, including those who are staffing the control centre.

Develop a response plan with response forces

Depending on the sensitivity of the material being transported, organisations may have to rely on local law enforcement agencies (typically police) to respond to an event during transportation. It is essential, therefore, that a response plan be designed, agreed to, and coordinated with every concerned response force throughout the entire route—well before transportation actually takes place. In respect to electronic tracking, questions for both operators and response forces to consider include:

- Does the response force have access to the electronic tracking information? (Or can they be given access to it during an emergency?)
- How can the electronic tracking device help the response.
- What resources would be required if the electronic tracking devices indicate that the cargo has been disturbed?
- What degree of assistance is expected from the response force? For example, will the response be armed or unarmed? Who makes this decision?

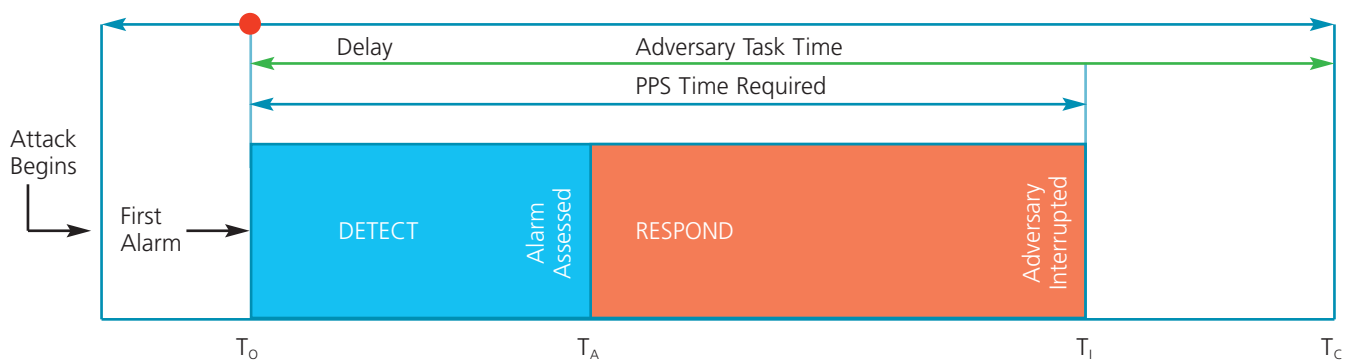
Develop Protocols or Create a Memorandum of Understanding or

The answers to these questions and all other relevant issues should be systematically defined and documented in either Protocols or preferably a Memorandum of Understanding (MOU) signed by all relevant stakeholders. The MOU can be used to define accountabilities, necessary procedures, and other important issues. (To learn more about MOUs, see the WINS International Best Practice Guide titled Working Effectively with External Response Forces.)

Requirements for the design of Electronic Tracking Systems

A classic consideration for enhancing security is the understanding that the time for detection and response must be less than the adversary task time. The graphic below depicts the details of an attack by an adversary, beginning when the detection system first sounds the alarm.

The overall time from the beginning of the attack until a response is implemented and the adversary is interrupted must be less than the overall adversary task time.



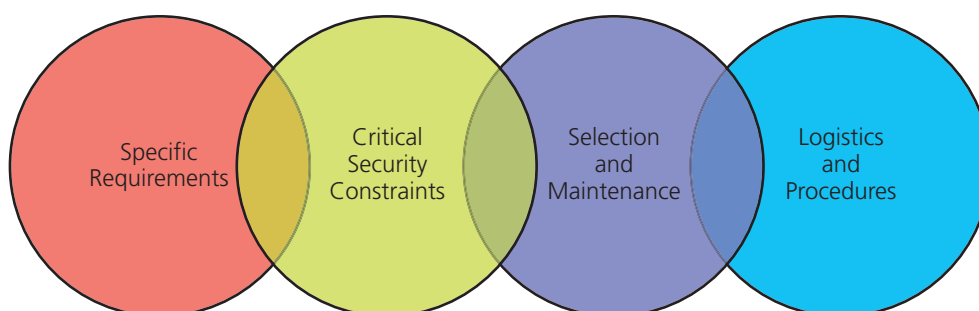
Thus, in order for a tracking system to be effective, the system response time (T_I) must be less than the adversary task time (T_C). The time between when an attack begins and the time of first alarm (T_0) needs to be kept to a minimum. Furthermore, the physical protection system (PPS) time required, which encompasses the combined detect and respond times, needs to be less than the delay time.

Adequate response can be accomplished by 1) having the tracking and integrity monitoring system query the integrity of each package and the security features of the conveyance on a frequent basis, 2) having response force capability within close proximity to the shipment, and 3) ensuring rapid, reliable communication between the shipment, control centre and response force personnel. The system must also be designed to ensure that the tamper-indicating electronic tags on the packages and conveyance entry points are capable of detecting malicious acts and can rapidly and reliably communicate alarms of such acts to the control centre.

Provide defence in depth

In applying this logic, other features of the security system must also come into play and be integrated into the security system design. This includes the use of mechanical devices that enhance the delay time so that the adversary's overall task time is increased sufficiently to allow detection and response to occur. One way to accomplish this is by applying the defence-in-depth concept described in various guidance documents on security and ensuring that the electronic tracking device is fully integrated with such delaying devices. Such an approach includes automatically triggered conveyance incapacitation devices; penetration-resistant walls in the conveyance; robust locks; electronically-tagged door seals; and electronically-tagged tie-down systems.

The decision about whether or not to adopt an electronic tracking system for nuclear and other radioactive materials transport begins by conducting a thorough cost-benefit analysis. Topics to consider include:



When deciding whether an electronic tracking system is a viable, reliable, cost-effective option, a graded approach should be taken to the characteristics and hazards posed by the nuclear and other radioactive materials to be transported. Consignors and transport service providers will need to determine their transport security requirements for specific consignments, including the types of data and level of detail necessary to ensure that the transport is secure and that challenges are detected and responded to appropriately.

To achieve such goals, the data relevant to transport security must be defined carefully. For example, should the tracking system provide continuous tracking, monitoring and communication in real time? Or is a passive system that provides an alert within a specified period of time acceptable? Is additional information required to verify whether the shipment has been tampered with?

One critical consideration is the security of the transmission of data end-to-end. Another is who the data handling/service provider will be. The supplier of the tracking system must provide adequate auditing results to ensure the security compliance of the

system, as well as to ensure correct conditions of timely data protection, retrieval, storage and access. The security managers from the consignor and transport service provider must be involved in the definition of the requirements and processes. Access to data must be secured through a proven, reliable encryption system.

It is also important to identify who needs to have access to specific data and why they need access to it. Measures must be taken to ensure that only personnel with sufficient security clearance and a need to know have access to the data. Furthermore, personnel must be well aware of the confidentiality rules and properly trained in crisis management. Finally, there should be recognised lines of responsibility, communications and access—both internally and externally.

A prime consideration will be regulatory compliance for the entire transport chain, wherever it may lead geographically and administratively. The requirements of authorities and emergency response plans at all levels (local, regional, national and international) must be respected. Once all issues have been defined and agreed upon, a written legal agreement should be prepared and signed between the consignor and the transport service provider.

3. Determine how the electronic tracking system will be selected and maintained

The next step is to select an electronic tracking system that meets the identified requirements, is user-friendly, cost-effective and robust. It is crucial to verify that the system being considered has been tested and proven—both in laboratory conditions and in real-life conditions—on the mode(s) of conveyance that will be used. It is also important to consider the geographic areas in which transport will take place: Within one country? Across a continent? Worldwide? Only after this information has been determined can the technology and/or operations be selected that will meet the necessary requirements.

Furthermore, the consignor and transport service provider must agree in advance upon issues of redundancy in the event of breakdown, recovery of tracking devices at the end of a transport operation, transfers of responsibility for devices in the event of trans-shipment, training procedures and parameters, and financial responsibilities and liability.

They must also provide for the procurement of spare parts to ensure that no disruption to the tracking system takes place. Reliable batteries with appropriate specifications (assured life, proven capacity to power the tracking devices on transport conveyances with uninterrupted service, adequate protection from damage on the conveyance) must be assured. Provision should be made as well for the training of personnel on all operational aspects, including maintenance and testing of the system for robustness, quality of repairs and signals.

4. Plan logistics and procedures

The cost efficiency of the system includes logistic support to ensure reliability. To ensure reliable data transmission and avoid technical problems during transit, the procedures that will be used to test the system, install and remove devices, load materials, and test and unload batteries before transport must be carefully assessed. To ensure system functionality, the electronic tags must be designed to be properly attached to the packages, tie-downs, and cargo-carrying area entry points that will be monitored.

Procedures and protocols between the consignor and transport service provider for response arrangements must be put in place to meet all conceivable eventualities, including authorities' requirements for timely notice to first responders and the concerned jurisdictions. These procedures will depend in part on whether the electronic tracking system is built around active, real-time tracking or whether it simply responds to alerts and alarms. For example, it may be that the system is calibrated to trigger an alarm if the conveyance deviates from a pre-specified route. If the deviation is caused by a benign cause such as road construction or a traffic accident, a procedure will need to be in place that enables the transporter to communicate such information to the tracking centre, perhaps via radio.

Training will be required to ensure accurate and timely interpretation of the tracking data. Those with access to the data must be equipped with encryption devices—perhaps manual keys or equipment that generates ephemeral keys of codes of short duration. These systems are able to identify and authenticate legitimate data users.

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Appendices

APPENDIX A

– QUESTIONS TO ASSESS THE NEED FOR AND EFFECTIVENESS OF ELECTRONIC TRACKING SYSTEMS FOR NUCLEAR AND OTHER RADIOACTIVE MATERIALS TRANSPORT

APPENDIX B

– DEFINING DIFFERENT LEVELS OF ORGANISATIONAL SUCCESS IN IMPLEMENTING AN ELECTRONIC TRACKING SYSTEM FOR NUCLEAR AND OTHER RADIOACTIVE MATERIALS TRANSPORT

Appendix A

Questions To Assess The Need For And Effectiveness Of Electronic Tracking Systems For Nuclear And Other Radioactive Materials Transport

The questions in Appendix A will help you evaluate the need for a remote electronic tracking system for transport and in-transit storage of nuclear and other radioactive materials. They will also help you assess the effectiveness of your system's design and implementation. Using the questions as prompts for generating discussion will help individuals at all levels of your organisation reflect critically on their actions and behaviour and identify how they can contribute personally to developing, implementing and enhancing an effective remote electronic tracking system.

State authorities should consider establishing a parallel set of questions for use in their own organisations. This will help them understand and assess their potential role in the application of remote electronic tracking systems that assure adequate security during the transport and in-transit storage of nuclear and other sensitive radioactive materials in their state.

Questions For The Board And Senior Management

Do you believe a credible threat (theft or malicious act) exists to your nuclear or other radioactive material while it is in transit?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Would the reputation of your organisation be damaged should there be an incident while this material is in transit?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does your organisation have a transport security plan? If so, does it require the use of an electronic tracking/monitoring system for the transport and in-transit storage of nuclear and other radioactive materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you perform your own threat analysis for nuclear and other radioactive materials that are being transported? Or do you depend upon the States through which your materials travel to provide you with this?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you thoroughly understand the requirements for transport security imposed by the States from, through and into which shipments of your nuclear and other radioactive materials will travel?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does your State—or the States through which your nuclear and other radioactive materials travel—require you to use electronic location identifiers on your shipments?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Have you designed and implemented an electronic tracking system for your shipments of nuclear and other radioactive material as recommended by IAEA or dictated by your state authority?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you know the level of resources your organisation is using to monitor transports?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Questions For Transport Operators And Security Managers

Do either executive management or the States' Competent Authorities from, through and into which your nuclear or other radioactive materials travel require you to follow a graded approach to security?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do the states from, through and into which your nuclear or other radioactive materials travel require you to develop a transport security plan?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does your organisation have its own transport security plan?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does your transport security plan require development and implementation of a robust electronic tracking system?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Have you developed, tested and implemented an electronic tracking system yet?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you perform readiness reviews on the operation of your electronic tracking/monitoring system prior to every shipment of nuclear and other radioactive materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are all security personnel involved in the shipments thoroughly trained in the use of the system?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does the electronic tracking/monitoring system adequately monitor package and conveyance integrity?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If the system detects a possible threat to the integrity of a package or transporting conveyance, will an alarm immediately notify a continuously-staffed control centre?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are trained escort, guard and/or response forces available to take immediate action?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Appendix B

Defining Different Levels Of Organisational Success In Implementing An Electronic Tracking System For Nuclear And Other Radioactive Materials Transport

The following chart presents five stages, each with its own set of characteristics, for developing and implementing an effective, electronic tracking system for nuclear and other radioactive materials whilst in transport or transit, by

identifying where your organisation falls on this chart, you will know what you need to do to move to the next stage to improve your ability to secure the nuclear and other radioactive materials being transported to and from your site.

LEVEL	CHARACTERISTICS
1	<p>No tracking systems are in use regardless of the sensitivity of the material to be shipped.</p> <p>The organisation has no interest in spending any more money on transportation than is absolutely required.</p> <p>Senior management has no visibility or interest in the transportation arrangements.</p> <p>The regulatory framework and threat analysis are either weak or non-existent. There are no arrangements in place to provide for a security response in the event of an incident and probably no way of knowing in a timely way if the shipment has been compromised</p>
2	<p>Transportation is managed by generalist staffs that have limited training or awareness of more effective monitoring and tracking systems .</p> <p>Transportation arrangements comply with the domestic regulations but senior management has no visibility or interest in transport operations .</p> <p>Drivers of vehicles have mobile phones to report any incidents, assuming that there is adequate communications coverage along the route.</p> <p>There are no specific response plans in place and the relevant response agency (e.g. police) has no knowledge of the shipments taking place .</p>
3	<p>The Transport Managers are well trained and aware of more advanced systems for monitoring their shipments.</p> <p>Transport operations are compliant with regulations and IAEA recommendations. Further investment in tracking and monitoring systems is seen as an unnecessary overhead to assure security.</p> <p>Basic provisions are in place for a response to an incident and vehicle drivers have clear instructions on what to do.</p>

LEVEL	CHARACTERISTICS
4	<p>Transport operations are seen as an important operational issue by the organisation and the Management expects to see it performed competently and efficiently.</p> <p>Remote monitoring and tracking is used on a case-by-case basis, based on the categorisation of the materials and the prevailing threat assessment .</p> <p>Response arrangements have been discussed and agreed with the appropriate agencies and table-top exercises have been conducted to identify any logistical issues.</p> <p>Developments in tracking and monitoring technology are followed with interest.</p>
5	<p>The integrity and tracking of transported materials is seen as essential to the reputation of the organisation and senior management take a proactive interest in training, performance, testing and response. Metrics and procedures are in place which give very high assurance that an immediate response would be activated in the event of any unauthorized interference with the shipment.</p> <p>Relationships with other stakeholders including regulators and armed re sponse agencies are excellent and communications and response arrangements are tested on a regular basis using realistic and challenging scenarios. Responsibilities have been agreed and documented in Memoranda of Understanding or comparable documents.</p> <p>Based on the threat assessment, nuclear and other radioactive materials are monitored. They may be tracked electronically using a Web portal and 24/7 communications centre enabling the organisation to keep constant vigilance over the status of the transportation operation and integrity of the cargo.</p> <p>The organisation is a leading authority on the application of tracking and monitoring technology and systems and is consulted by peer groups for advice and assistance.</p>



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