

### Development of Security Supporting Guidance for Road Transport Licensing of Radioactive Material in Thailand

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### Abstract

Radioactive materials are in widespread use and they need to be transported from one place to another. Transportation in Thailand is mainly by road. However, the regulating authority has no clear information on security regulations. Thus, the development of the security manual to support the application for transport of radioactive materials by road in Thailand will be very useful to related agencies. Studies were done to assess the status of security measures of relevant authorities and identify corrective actions necessary to ensure compliance with international standards. Result from the study is the security plan for the road transport of radioactive materials in Thailand.



Keywords: Radioactive sources, Transport, Security plan, Road

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### Introduction

Radioactive sources are used globally in a wide range of beneficial applications in the health care industry, industrial exploration and development, as well as basic scientific research and discovery. In fact, some 45% of the world's medical disposable products are gamma-ray sterilized using cobalt-60 in processing plants located around the world. Other vital applications such as cancer treatment, nuclear medicine, oil exploration and industrial radiography routinely and extensively use radioactive sources. In addition, radionuclides and radiopharmaceuticals are used tens of millions of times every year in the diagnosis and treatment of diseases in patients globally. The widespread uses of ionizing radiation have resulted in the huge transport quantity of the radioactive materials from places to places. Radioactive material shipments are made by road, rail, water and air. Most Thai radioactive material shipments are carried out by road. Transportation of radioactive materials in Thailand is governed and regulated by the Office of Atoms for Peace (OAP), but there have been few discussions about regulations on the transport security of radioactive materials. Thus, studies were done to assess the status of security measures of relevant authorities and identify corrective actions necessary to ensure compliance with international standards. Result from the study is the security plan for the road transport of radioactive materials in Thailand.

### **Objectives of Research**

The objective of this research work is to develop the security supporting guidance for road transport licensing of radioactive materials in Thailand.

### **Research methodology**

The methodology of this study includes the following steps:

**1. Formulate questionnaires:** The generated questionnaires are based on the minimum standard requirement following International Atomic Energy Agency (IAEA)'s Nuclear Security Series Publications. Questionnaires consisted of 4 parts:

- 1. General data
- 2. Description of radioactive material transport
- 3. Security element of radiation source
- 4. Regulation Data collection method
- 2. Use the questionnaires at related facilities: The main methods of collecting data are:

Face-to-face interview 2. By post 3. Via the internet by an electronic mail (E-mail)
Compare obtained results from questionnaires with IAEA's fundamental nuclear security documents.

4. Develop the security supporting guidance for road transport licensing of radioactive materials in Thailand.

#### Result

The percentage of respondents

No	Type of Facility	Number of sample	Number of Respondents	Percentage
1	Co-60 Gamma Irradiators	17	11	64.71
2	Industrial Radiography	34	15	44.12
3	Well Logging	11	7	63.64
	Total	62	33	

**Co-60 Gamma Irradiators** 











Well Logging





## Discussion

**Co-60 Gamma Irradiators** 

Security Requirements	Compliance percentage	Comments (Specify details)
General data		
Radiation Safety Officers (RSOs)	100	All of the facilities follow the rule of the Office of Atoms for Peace (OAP) on the regulation of radioactive material transport.
License	100	All of the facilities have license to occupy radioactive material and license to import radioactive material.
Transport container certificate	100	All of the facilities have transport container certificate.
Transport warning sign	100	All of the facilities display transport warning sign .
Transport Index (TI)	100	TI value accordance with the regulations of the International Atomic Agency (IAEA).
The radiation level	100	The radiation levels around the container according to the standard limit.
Radioactive material not leakage	100	Unable to find the radioactive materials to leakage.
Security element of		
radiation source		
Transportation &	81.82	Most of the facilities have transportation & emergency
emergency planning certified by OAP standard	1.37	planning certified by OAP standard.
Port Authority of Thailand or Airports of Thailand allowed transport for radioactive material (import case)	100	All of the facilities have permission from the port authority of Thailand or Thailand International Airport company limited, to transport of radioactive material.
Choose the most appropriate route.	63.64	Most of the facilities also choose the most appropriate route.
Pre-screening of personnel involved in the shipments	54.55	Half of the facilities have perform pre-screening of personnel involved in the shipments.(national police certificate)
Search of vehicles before loading	90.91	Most of the facilities also search of vehicles before loading radioactive materials.
Decision on specific route to be taken shortly before shipment	45.45	Half of the facilities have decision on specific route to be taken shortly before shipment.
Provision for overnight stays at a prearranged secure area	36.36	The travel is quite short so most of the facilities don't provision for overnight stays at a prearranged secure area. (Most of the facilities located near port authority of Thailand or Thailand International Airport company limited )
Communications		
Provision of an escort to ensure communications are not interrupted by an incident	81.82	Most of the facilities have Provision of an escort to ensure communications are not interrupted by an incident.
Satellite tracking of shipments	72.73	Most of the facilities use the vehicles have tracking system .(vehicle tracking only, no transport container tracking)



A direct hotline to the relevant police force from the tracking room	18.18	The minority of the facilities have direct hotline to the relevant police force. Most will call 191.
Delay		
Shipment vehicles equipped with immobilizing devices	100	All of the facilities use the vehicles have immobilizing devices.
Containers locked and sealed, and secured to the vehicles	100	Containers had been locked and sealed, and secured to the vehicles.
Contingency plans in the event of mechanical breakdown	100	All of the facilities also have contingency plans in the event of mechanical breakdown.
Response		
Provision of armed guards or armed escort	100	Highway patrol officers to control the security all time during transport.
Regular exercises and drills with the response force	100	All of the facilities have regular exercises and drills with the response force.
Pre-notification of shipments to the response force	100	All of the facilities have pre-notification of shipments to the response force.
Notification to tracking room if shipment stops	100	All of the facilities have notification to tracking room if shipment stops.

## Industrial Radiography

Security Requirements	Compliance percentage	Comments (Specify details)
General data		
Radiation Safety Officers (RSOs)	100	All of the facilities follow the rule of the Office of Atoms for Peace (OAP) on the regulation of radioactive material transport.
License	100	All of the facilities have license to occupy radioactive material and license to import radioactive material.
Transport container certificate	100	All of the facilities have transport container certificate.
Transport warning sign	100	All of the facilities display transport warning sign .
Transport Index (TI)	100	TI value accordance with the regulations of the International Atomic Agency (IAEA).
The radiation level	100	The radiation levels around the container according to the standard limit.
Radioactive material not leakage	100	Unable to find the radioactive materials to leakage.
Security element of		
radiation source	02.22	Marca - Caller Cardillation for a standard strategy of
I ransportation &	93.33	Most of the facilities have transportation & emergency
certified by OAP standard		planning certified by OAP standard.
Port Authority of Thailand or Airports of Thailand allowed transport for radioactive material (import case)	100	All of the facilities have permission from the port authority of Thailand or Thailand International Airport company limited, to transport of radioactive material.



Choose the most	46.67	Half of the facilities also choose the most appropriate
appropriate route	+0.07	route
Pre-screening of personnel	86.67	Most of the facilities have perform pre-screening of
involved in the shipments		personnel involved in the shipments.(national police
		certificate)
Search of vehicles before	86.67	Most of the facilities also search of vehicles before
loading		loading radioactive materials.
Decision on specific route	0	The facilities don't have decision on specific route to
to be taken shortly before		be taken shortly before shipment.
shipment	00	Marta Cala Carillatian Incorporation Companyation
Provision for overnight	80	Most of the facilities have provision for overnight
stays at a prearranged		stays at a prearranged secure area.
Communications		
Provision of an escort to	100	All of the facilities have Provision of an escort to
ensure communications are	100	ensure communications are not interrupted by an
not interrupted by an		incident.
incident		
Satellite tracking of	53.33	Half of the facilities use the vehicles have tracking
shipments		system .(vehicle tracking only, no transport container
	100	tracking)
A direct hotline to the	100	All of the facilities have direct hotline to the relevant
the tracking room		police force. Most will call 191.
Delay		
Shipment vehicles	60	Most of the facilities use the vehicles have
equipped with	00	immobilizing devices.
immobilizing devices		
Containers locked and	100	Containers had been locked and sealed, and secured to
sealed, and secured to the		the vehicles.
vehicles		
Contingency plans in the	86.67	Most of the facilities also have contingency plans in
event of mechanical		the event of mechanical breakdown.
Besponse		
Drouision of armod guards	72.22	Most of the facilities have highway petrol officers to
or armed escort	73.33	control the security all time during transport.
Regular exercises and drills	100	All of the facilities have regular exercises and drills
with the response force		with the response force.
Pre-notification of	100	All of the facilities have pre-notification of shipments
shipments to the response		to the response force.
torce	100	
notification to tracking	100	All of the facilities have notification to tracking room
room it sinpinent stops		n supment stops.



Well Logging	,
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Security Requirements	Compliance percentage	Comments (Specify details)
General data		
Radiation Safety Officers (RSOs)	100	All of the facilities follow the rule of the Office of Atoms for Peace (OAP) on the regulation of radioactive material transport.
License	100	All of the facilities have license to occupy radioactive material and license to import radioactive material.
Transport container certificate	100	All of the facilities have transport container certificate.
Transport warning sign	100	All of the facilities display transport warning sign .
Transport Index (TI)	100	TI value accordance with the regulations of the International Atomic Agency (IAEA).
The radiation level	100	The radiation levels around the container according to the standard limit.
Radioactive material not leakage	100	Unable to find the radioactive materials to leakage.
Security element of radiation source	E	
Transportation & emergency planning certified by OAP standard	100	All of the facilities have transportation & emergency planning certified by OAP standard.
Port Authority of Thailand or Airports of Thailand allowed transport for radioactive material (import case)	100	All of the facilities have permission from the port authority of Thailand or Thailand International Airport company limited, to transport of radioactive material.
Choose the most appropriate route.	57.14	Half of the facilities also choose the most appropriate route.
Pre-screening of personnel involved in the shipments	71.43	Most of the facilities have perform pre-screening of personnel involved in the shipments.(national police certificate)
Search of vehicles before loading	85.71	Most of the facilities also search of vehicles before loading radioactive materials.
Decision on specific route to be taken shortly before shipment	0	The facilities don't have decision on specific route to be taken shortly before shipment.
Provision for overnight stays at a prearranged secure area	57.14	Half of the facilities have provision for overnight stays at a prearranged secure area.
Communications		
Provision of an escort to ensure communications are not interrupted by an incident	100	All of the facilities have Provision of an escort to ensure communications are not interrupted by an incident.
Satellite tracking of shipments	28.57	A few of the facilities use the vehicles have tracking system .(vehicle tracking only, no transport container tracking)
A direct hotline to the relevant police force from the tracking room <b>Delay</b>	42.86	Almost half of the facilities have direct hotline to the relevant police force.



Shipment vehicles	100	All of the facilities use the vehicles have immobilizing
equipped with		devices.
immobilizing devices		
Containers locked and	100	Containers had been locked and sealed, and secured to
sealed, and secured to the		the vehicles.
vehicles		
Contingency plans in the	100	All of the facilities also have contingency plans in the
event of mechanical		event of mechanical breakdown.
breakdown		
Response		
Provision of armed guards	0	Use guards from the facilities to control the security
or armed escort		all time during transport.
Regular exercises and drills	28.57	A few of the facilities have regular exercises and drills
with the response force		with the response force.
Pre-notification of	28.57	A few of the facilities have pre-notification of
shipments to the response		shipments to the response force.
force		
Notification to tracking	28.57	A few of the facilities have notification to tracking
room if shipment stops		room if shipment stops.

### Suggestions

The transport security levels of different types of radioactive materials are provided in Appendix I, which is based on the risk assessment. Co-60 gamma irradiators and industrial radiography are classified into transport security level 3, and sources should satisfy the performance requirements for security in this group. In addition, they should also satisfy the recommendations issued in IAEA publications on security in transport, as well as comply with national and international legislation and agreements on security in transport.

As an example of these performance objectives for sources under transport security level 3, facilities using Co-60 gamma irradiators and industrial radiography must follow the following requirements:

- Must have radiation safety officers (RSO)
- Must have license to occupy radioactive material and license to import radioactive material
- Must have transportation & emergency planning certified by OAP standard
- Must choose the most appropriate route (e.g., the selected way is not through a community district)
- Must perform background check on trustworthiness of the transport organization and operatives
- Must have satellite tracking of shipments and have direct hotline to the relevant police force from the tracking room
- The Port Authority of Thailand or Airports of Thailand must allow transport of radioactive material (import case)

#### Communications

The shipper of Co-60 gamma irradiators and industrial radiography sources should, in advance of the planned shipment, inform the receiver of the characteristics of the source and expect the date, time and place of arrival before starting to transport. Before the transport begins, the shipper should verify that the receiver is willing and ready to transfer. Upon arrival of the shipment, the receiver should inform the sender of the arrival. If the shipment does not arrive at the destination after the time agreed in advance by the shipper, the receiver should immediately inform the shipper of the event.

Reliable and secure communications are essential during the transport of Co-60 gamma irradiators and industrial radiography sources, and should contain only encrypted messages. During transport the escort should be in frequent contact with the shipper, the receiver, the local authorities and



the response forces along the transport route. The shipper should also consider establishing a central security control of the transport.

### Delay

- Must have deterrence through use of transport packages locked and sealed and in a dedicated transport unit, which is locked
- Must have shipment vehicles equipped with immobilizing devices
- Must have contingency plans in the event of mechanical breakdown **Response**
- Must have provision of armed guards or armed escort
- Must have regular exercises and drills with the response force
- Must notify the tracking room if the shipment stops

Radioactive sources used in well logging facilities are classified under transport security level 2, which is less than level 3. As an example of these performance objectives for sources under transport security level 2, well logging facilities must follow the following requirements:

- Must have radiation safety officers (RSO)
- Must have license to occupy radioactive material and license to import radioactive material
- Must have transportation & Emergency planning certified by OAP standard
- Must choose the most appropriate route (e.g., the selected way is not through a community district or has decision on specific route to be taken shortly before shipment )
- Must perform background checks on trustworthiness of the transport organization and operatives
- The Port Authority of Thailand or Airports of Thailand must allow transport of radioactive material (import case)

### Communications

The shipper of well logging source should, in advance of the planned shipment, inform the receiver of the characteristics of the radioactive material and its anticipated date, time and location of arrival.

### Delav

- Must have deterrence through use of transport packages locked and sealed and in a dedicated transport unit, which is locked
- Must have shipment vehicles equipped with immobilizing devices
- Must have contingency plans in the event of mechanical breakdown **Response**
- Must have regular exercises and drills with the response force
- Must notify the tracking room if the shipment stops

For the transport of radioactive materials by road, the licensee must strictly comply with all of the established rules and regulations in order to share the road without causing any risk to the public.



APPENDIX-I					
No	Type of Radioactive Material	Type of Package	Transport Security Level		
1	Reference sources	Excepted	Level 1		
2	Consumer goods (smoke detectors,				
	luminous painted dials, tritium light sources)	Excepted	Level 1		
3	Uranium/thorium ores or ore concentrates, depleted uranium, un-irradiated fresh natural uranium fuel assemblies	IP-1, IP-2 or IP-3	Level 1		
4	Surface contaminated objects defined as				
	SCO I/II	IP-1, IP-2 or IP-3	Level 1		
5.	Radiopharmaceuticals	Type A	Level 2		
6.	Nucleonic gauges	Type A	Level 2		
7.	Neutron sources used in oil-well logging	Туре А	Level 2		
8.	Manually handled brachytherapy sources	Type A	Level 2		
9.	Industrial radiography sources	Type B (U/M)	Level 3		
10.	Remotely handled brachytherapy sources	Type B (U/M)	Level 3		
11.	Teletherapy sources	Type B (U/M)	Level 3		
12.	Gamma irradiator sources	Type B (U/M)	Level 3		
13.	Decayed sealed sources for disposal	Type A	Level 2		
		Type B (U/M)	Level 3		
14	Uranium Hexafluoride (enriched)	Type HF	Level 3		
15	Wastes arising from the nuclear fuel cycle	Type B (U/M)	Level 3		
16	Fresh enriched nuclear fuel	IP-2 (F) or IP-3 (F)	special security		
17.	Special nuclear material in different types of packages	IP-2 or IP-3 or Type A Type B(U)F or Type B(M)F	special security measures		
18.	Irradiated nuclear fuel	Type B(U)F or Type B(M)F	special security measures		



#### Note

- 1. The symbol 'F' used for type of package at No. 14, 16 to 18, is to indicate that these packages may contain fissile material.
- 2. The Type HF package mentioned at No. 14 is specially used for packages containing uranium hexafluoride (fissile).

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