Asia-Pacific
Economic Cooperation

CTI – Sub-Committee on Customs Procedures (SCCP)

Annex II
to the report

Experience exchange
on the use of tools and Information Technology
for goods identification

Background Information
to the Questionnaire

SUNAT
Lima, Peru
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Background information on issues related to Goods Identification

The following documents form part of a basic background information on issues related to Goods Identification:

Brief note on Non-Intrusive Inspection Devices (NIID)

NIID were originally developed to address the threat of smugglers using increasingly sophisticated techniques to conceal narcotics deep in commercial cargo and conveyances. These systems, in many cases, give Customs inspectors the capability to perform thorough examinations of cargo without having to resort to the costly, time consuming process of unloading cargo for manual searches, or intrusive examinations of conveyances by methods such as drilling and dismantling.

Non-Intrusive Inspection (NII) technology serves as a force multiplier and to complement the work of Customs officers, canine enforcement officers and Border Patrol agents in guarding countries from terrorism. These technologies serve a vital function in day-to-day inspection and movement of tens of thousand of passengers, pedestrians, vehicles, trucks, cargo containers and baggage, at our borders and ports of entry.

NIID can be grouped into **active detection** systems and **passive detection** systems.

ACTIVE DETECTION SYSTEMS

The active detection systems emit x-rays or gamma rays to stimulate the material within the cargo unit so that detectors may analyze the effects of stimulation and produce an image of a container's content. Customs officers analyze these images to determine where there are anomalies associated with the cargo listed on the manifest.

Gamma-ray radiography uses a radioactive source, such as Cobalt-60 or Cesium-137. The X-ray systems typically use an energy spectrum ranging from 2.5 to 9 MeV. These units can be fixed, semi-fixed or mobile. Some operate by the driver passing through the equipment, while others require the driver to exit the vehicle while the unit passes over the container or the conveyance is pulled through the NII system. Caution must be exercised when utilizing NII equipment, as healthy safety concerns associated with radiation emissions need to be addressed in accordance with national, local and union regulations.

Gamma Ray

Gamma ray systems are active detection systems that use a radioactive element to produce gamma rays, which are directed at the cargo unit. An image is displayed on a screen as the gamma rays interact with the material in the container. These machines may be fixed in place, or they may be placed on a vehicle for mobility. The downsides to gamma ray systems are that they cannot identify specific threats, and they have difficulty differentiating between materials when scanning high-density cargo. Costs range from $500,000 to about $3 million per machine, and they can scan a cargo unit in 2 to 5 minutes.

Examples of Gamma ray systems may include:

- Vehicle and Container Inspection System (VACIS), a fixed gamma ray technology used to scan tankers, commercial trucks, sea and air containers at the rate of 20 vehicles per hour.
- Rail Vehicle and Container Inspection System (R-VACIS), a fixed gamma ray technology used to freight cars at the rate of five miles per hour or 260 rail cars per hour.
- Pallet VACIS, a fixed gamma ray technology used to scan pallets at the throughput rate of 24 pallets per hour.

- Mobile Vehicle and Container Inspection System (M-VACIS), a mobile, truck-mounted gamma ray technology used to scan tankers, commercial trucks, sea and air containers at the rate of 20 vehicles per hour.
- Mobile Truck X-ray (MTXR), a mobile x-ray system used to scan commercial vehicles at the rate of 6 vehicles per hour.
- Mobile Sea Container X-Ray System (MCXR), a prototype, self-propelled x-ray system used to examine sea containers at the throughput rate of 25 containers per hour.

X-Ray

X-ray systems generally take a few minutes to scan a standard 40-foot container. More advanced x-ray systems can take only a few seconds. However, total inspection cycle times may range from 7-15 minutes or longer due to image analysis.

Examples of X-ray systems may include:

- Backscatter and Transmission X-Ray Scanning: The backscatter X-ray technology is complementing the transmission X-rays that penetrate layers of materials and are capable of detecting weapons, metallic bomb components concealed in cargo, etc. Transmission X-rays can miss out on items such as plastic weapons, explosives and drugs that are usually transparent to X-rays, particularly if they are placed in false compartments on the surface of cargo containers. The backscatter X-ray technology allows easy detection of contraband hidden in false compartments and near the surface region of a typical container/truck.
- Truck X-Ray (TXR) system, a fixed x-ray system used to scan commercial vehicles at the rate of 6 vehicles per hour.

Neutron techniques

Pulsed Fast Neutron Analysis (FNA)

The Fast Neutron Analysis (FNA) is among the low-cost methods in neutron techniques with the ability to probe deep into the material content of the object and recognise multiple signatures. However, the imaging is limited to smaller objects.

The Pulsed FNA, though expensive, is an improvement over the above method. It uses short bursts of neutrons travelling at specific velocity to scan the complete volume of the containers and measure cargo density to identify the chemical composition of the container's contents. Pulsed neutrons are directed at the cargo unit, interact with the cargo's material, and "create gamma rays with energies characteristic of its elemental composition" that are used to display an image of the contents on a screen. This can reveal the presence of any material with specific elemental concentrations similar to known threat objects and materials. It can require building modifications due to its size. The cost per machine ranges from $10 million to $25 million, and inspection time takes a minimum of one hour per cargo unit.

Thermal Neutron Activation (TNA)

Thermal neutrons are directed at the cargo unit and absorbed by the material within. As a result, a gamma ray photon is emitted and its energy signature is detected by sensors, which can then determine specific element concentrations that might be a sign of an explosive. Thermal neutron activation systems can either be fixed in place or mounted on a vehicle for mobility. The applications include detection of explosives and drugs. TNA is designed to prevent vehicle and container bombs. It is the simplest of all neutron-based techniques and can be deployed independently. Costs range from $500,000 to $3 million per machine. The system takes a minimum of one hour to scan a cargo unit.

PASSIVE DETECTION SYSTEMS

Passive detection systems do not require the stimulation of materials to determine a threat presence. In general, these systems are transportable systems.

Radiation Portal Monitor (RPM)

The RPM is a detection device that provides Customs with a passive, non-intrusive means to screen trucks, cargo containers, rail cars, passenger vehicles, and other conveyances for radiation emanating from nuclear devices, dirty bombs, special nuclear materials, natural sources, and isotopes commonly used in medicine and industry.

RPMs detect the presence of gamma and neutron radiation and are used in the interdiction and location of radioactive materials. As passive systems, no safety concerns exist during regular equipment operations. RPMs are used wherever there is a CSI port. Customs officers monitoring RPMs are also equiped with Personnel Radiation Detectors (PRDs) and Radiation Isotope Identification Device (RIID) to determine the presence of radiation. They are used for officer safety and warn an officer of a radiation danger.

Radiation Isotope Identifier (RIID)

The RIID is a hand-held instrument capable of detecting gamma and neutron emissions from radioactive sources, including nuclear, medical and industrial isotopes. Customs officers use this device to determine the exact identity of a radioactive source causing an alarm. RIIDs typically cost about $3,000 to $18,000.

Personal Radiation Detector (PRD)

All radioactive substances emit radiation (i.e., x-rays, alpha rays, neutrons), which is detected and measured by a detector in the radiation detection system. High levels of specific types of radiation may indicate a threat object. Radiation detectors are small and are easily portable, and they can be operated either by a battery, a computer, or electronically. Machines typically cost between $10,000 and $50,000 and can scan a cargo unit in 30 to 60 seconds.

The PRD is a small, but highly sensitive, device carried by Customs officers at ports of entry and Customs Border Patrol agents at roadway checkpoints. It will sound an alarm if radiation is detected during an inspection or enforcement operation. It is a portable gamma ray radiation detector for use in interdiction and location of radioactive materials, especially nuclear materials. Handheld radiation detection equipment is generally less expensive than fixed radiation portal monitors, in part, because there are no installation costs associated with providing handheld equipment.

Note: Radiation pagers are small radiation detection devices worn on belts by border security personnel to continuously monitor levels of radiation in the area. Pagers are considered personal safety devices and, therefore, should not be relied upon to implement secondary inspections. Radiation pagers cost about $1,500.

Vapor and Trace Detection systems

Vapor detection machines are equipped with a sensor that collects air samples from around the cargo unit. Spectrographic analysis is performed to determine the molecular makeup of the material within the unit. Commercial information indicates that this technology can identify more than 20 different narcotics or explosive compounds. Vapor detection machines are relatively small and light, and they can be battery-operated, computer-operated, or electrically-operated. Vapor detection is a passive detection system, meaning it does not require the stimulation of materials to determine a threat presence.

Trace detection devices use a swipe to wipe the cargo unit and pick up particulate matter. Spectrographic analysis is performed on the swipe to determine the molecular makeup of the material picked up on the unit. Like vapor detection devices, trace detection devices are relatively small and can be operated by battery, computer, or electronically. According to US Transportation Security Administration (TSA), these machines have "shown few problems" when screening cargo.

Both vapor and trace detection systems have a cost per unit ranging from $30,000 to $50,000, and can process a cargo shipment in about 30 to 60 seconds.

Itemizer

An Itemizer is a trace particle detection device capable of identifying both explosives and narcotics. The device is portable and based upon ion trap mobility spectrometry capable of detecting and identifying 40 different narcotics or explosive compounds.

Canine

Drug- and explosives-detecting canines are widely considered by security experts to be the most effective way to screen cargo since they have the fewest drawbacks of any method currently available. Dogs have a very sensitive sense of smell, and they can be trained to passively alert handlers of the presence of explosive materials or drugs. Properly trained canines very rarely give false positive alerts. Canines can be trained to detect either explosives or drugs, but should never be trained to detect both. Canines used for drug detection may work 2 or 4 hour shifts each day with periodic rest. Canines trained to detect explosives may only work 30 to 60 minutes before taking a 20-minute rest. Canines can clear 400 to 500 cargo parcels for both drugs and explosives in about 30 minutes. It is very important for a canine to receive extensive training, care, and rest for it to perform properly. Yearly maintenance costs can range from $7,000 to $50,000 per canine unit (a canine unit consists of 2 to 4 teams with 1 handler and 1 to 2 dogs per team).

TRACK DEVICES

Optical Character Recognition (OCR) and Image recognition

Within a container port, inspections are typically tracked by container numbers. The process of identifying the container number ranges from manual input using approximately 4 mounted video or still image cameras to automated Optical Character Recognition (OCR). These cameras are positioned in close proximity of the scanning equipment. OCR is utilized in all current SFI deployments to facilitate the speed and accuracy of data transmission. Without OCR, manually inputting the container numbers for all non-alarming containers could potentially become a full-time job.

Radio Frequency Identification Device (RFID)

This technology is used for tracking cargo and vehicles. RFID tags can be used to track container movements based on a radio frequency signal. Radio frequency transceivers are now in common use. The latest radiation detection portals and container scanning equipment are being combined into a single unit and capture images of trucks moving at speeds up to ten mph. Large ports would need several devices to ensure that the screening process would not slow the flow of trucks.

Integrated Surveillance Intelligence System (ISIS)

It consists of the Remote Video Surveillance (RVS) camera systems, sensors, and the Integrated Computer Assisted Detection (ICAD) database. ISIS serves to detect intrusion, aid in agent dispatching, and estimating attempts of illegal entry.

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It consists of the Remote Video Surveillance (RVS) camera systems, sensors, and the Integrated Computer Assisted Detection (ICAD) database. ISIS serves to detect intrusion, aid in agent dispatching, and estimating attempts of illegal entry.

Table 4.1. Technology characteristics

	Descriptions	Indicates potential presence of threat	Provides material discrimination	Time for inspection	Installation	Cost (in 2005)
Active systems						
Acoustic	An ultrasonic transducer is put into the container and a sensor detects the reflection and forms an image.	Yes, in liquids	No	2-5 minutes/ object	Portable/ desktop equipment, which can be operated by battery or wall plug power	$$
Gamma ray	The gamma rays interact with the object and are displayed as an image.	Yes	No		Mobile, fixed or relocatable sites. Fixed and relocatable sites require local infrastructure of power, road access, personnel facilities and attention to radiation safety	$$$
Pulsed Fast Neutron Analysis (PFNA)	Pulsed neutrons are directed at the object and create gamma rays with energies characteristic of its elemental composition.	Yes	Yes	90+ minutes/ object		$$$$$
Thermal Neutron Activation (TNA)	Sophisticated sensors detect the energy of the gamma ray photon emitted when the thermal neutron is absorbed by material within the object.	Yes	Yes			$$$
X-ray						
Standard transmission	The transmission of x-rays is directed through the cargo to a detector and presents one “shadowgram” image to that overlays all items in the beam path.	Yes	No	2-5 minutes/ object		$$$/$$$$
Dual energy transmission	Two different x-ray energy spectra are used. Generally ineffective for large cargoes.	n.a.	Not in high density cargos			n.a.
Dual view transmission	Two views of the object are displayed.	Yes	No			$$$$$
Backscatter with transmission	Two or more views are displayed. Backscatter images highlight items in the object that contain low atomic number elements.	Yes	Yes			$$$$
Passive systems						
Canine use	Dogs are trained to alert the presence of explosives and other threat objects.	Yes	Yes	0.5-1 minute/ object	Requires care, feeding and shelter, together with trained handlers	$
Radiation detection	A detector measures the ionizing radiation or other characteristic radiation emitted from a radioactive substance.	Yes	Yes		Portable/ desktop equipment, which can be operated by battery or wall plug power	$
Trace detection/ vapour detection	A “sniffer” type sensor collects and analyses air samples.	Yes	Yes			$

Cost key: **$** ≤ $50 k; **$$** ≤ 100 k; **$$$** ≤ $1 M; **$$$$** ≤ $5 M; **$$$$$** ≥ $10 M.

Source: This table was created based upon the information in COAC Border Security Technical Advisory Group
Volume 6 – Report on Non-intrusive Detection Technologies.
This table appears on page 50 of the document accessible from http://www.internationaltransportforum.org/europe/ecmt/pubpdf/05ContainerSec.pdf

Table 2.1: Breakdown of Screening Method Characteristics

	COST (in 2004)	SCREEN FOR	TIME TO INSPECT	MAT'L DISCR.	MAT'L ID	INSTALLATION
ACTIVE SYSTEMS						
X-ray	$1 - 10 million	Explosives, stolen/mislabeled goods, illegal drugs	2 - 5 min	No	No	Mobile or fixed.Fixed sites needpower, road access, personnel facilities, and attention to radiation safety. Vehicles needed for mobility.
Standard	$1 - 5 million		2 - 5 min	No	No	
Dual View	$10 million		2 - 5 min	No	No	
Backscatter	$2 - 5 million		2 - 5 min	No	No	
Gamma Ray	$500,000 - $3 million		2 - 5 min	No	No	
Pulsed Fast Neutron Analysis	$10 - 25 million	Explosives, illegal drugs	1 hr +	Yes	Yes	
Thermal Neutron Activation	$500,000 - $3 million	Explosives	1 hr +	Yes	Yes	
PASSIVE SYSTEMS						
Vapor Detection	$30,000 - $50,000	Prohibited gases	30 - 60 sec	Yes	Yes	Portable or desktop equip. operated by battery or wallplug.
Trace Detection	$30,000 - $50,000	Explosives, illegal drugs	30 - 60 sec	Yes	Yes	
Radiation Detection	$10,000 - $50,000	Radioactive materials	30 - 60 sec	No	Yes, for radioactive material	
Canines	$7,000 - $120,000 per unit per year	Explosives, illegal drugs	10 - 60 sec	Limited by amt. of training	Yes	Require care, feeding, shelter.

Source: U.S. Treasury Advisory Committee on Commercial Operations of the United States Customs Service
This table appears on page 26 of the document accessible from http://www.cts.virginia.edu/docs/UVACTS-5-14-63.pdf

Cost estimations of cargo identification tools[1] in the context of a small container port

Small Container Port – Port Authority Level Installation

Table 11. Small Container Port – Port Authority Initialization Costs (US$)

	Description	Equipment Quantity	Initialization Cost
Primary Inspection	RPM	2	870 000
	NII	2	6 453 334
Secondary Inspection	HPGe	1	70 000
	NaI RIID	2	20 600
	Survey Meter	2	6 800
	Pager	12	12 000
	ASP	0	0
Stations	RPM Alarm Station	1	0
	Secondary Inspection Team	1	0
Fiber Optic Lease	Port Fiber Network	N/A	0
	Total Initialization Cost		**7 432 734**

Table 12. Small Container Port – Port Authority Annual Operational Costs (US$)

	Description	Maintenance Fee	FTE	Personnel Cost
Primary Inspection	RPM	11 000	0	0
	NII	569 333	18	2 480 454
Secondary Inspection	HPGe	7 000	0	0
	NaI RIID	2 060	0	0
	Survey Meter	11 000	0	0
	Pager	4 080	0	0
	ASP	0	0	0
Stations	RPM Alarm Station	0	5	573 530
	Secondary Inspection Team	0	5	631 273
Fiber Optic Lease	Port Fiber Network	0	0	400 000
	Subtotal Cost	604 473		4 085 257
	Total Operational Cost	**4 689 730**		

***FTE** refers to the Full Time Equivalent staffing required to operate the tool.*

[1] Tables extracted from the MSc thesis “100% Container Scanning: Security Policy Implications for Global Supply Chains” by Allison C. Bennett and Yi Zhuan Chin, Massachusetts Institute of Technology, June 2008 (http://web.mit.edu/scresponse/repository/Bennett_Chin_MIT_Thesis_June_08.pdf)

Table 13. Small Container Port – Port Authority Annual Costs (US$)
Based on 10 Year Equipment Life-Cycle

	Description	Annual Cost
Initialization cost	RPM	98 000
	NII	3 695 121
Operating cost	HPGe	14 000
	NaI RIID	4 120
	Survey Meter	11 680
	Pager	5 280
	ASP	0
Stations	RPM Alarm Station	573 530
	Secondary Inspection Team	631 273
Fiber Optic Lease	Port Fiber Network	400 000
	Total Annual Cost	**5 433 004**

Small Container Port – Terminal Operator Level Installation

Table 15. Small Container Port – Terminal Operator Initialization Costs (US$)

	Description	Equipment Quantity	Initialization Cost
Primary Inspection	RPM	4	1 740 000
	NII	4	12 906 668
Secondary Inspection	HPGe	2	140 000
	NaI RIID	4	41 200
	Survey Meter	4	13 600
	Pager	24	24 000
	ASP	0	0
Stations	RPM Alarm Station	2	0
	Secondary Inspection Team	2	0
Fiber Optic Lease	Port Fiber Network	N/A	0
	Total Initialization Cost		**14 865 468**

Table 16. Small Container Port – Terminal Operator Annual Operational Costs (US$)

	Description	Maintenance Fee	FTE	Personnel Cost
Primary Inspection	RPM	22 000	0	0
	NII	1 138 667	36	4 960 908
Secondary Inspection	HPGe	14 000	0	0
	NaI RIID	4 120	0	0
	Survey Meter	22 000	0	0
	Pager	8 160	0	0
	ASP	0	0	0
Stations	RPM Alarm Station	0	10	1 147 060
	Secondary Inspection Team	0	10	1 262 545
Fiber Optic Lease	Port Fiber Network	0	0	400 000
	Subtotal Cost	1 208 947		7 770 513
	Total Operational Cost	**8 979 460**		

***FTE** refers to the Full Time Equivalent staffing required to operate the tool.*

Table 17. Small Container Port – Terminal Operator Annual Costs (US$) Based on 10 Year Equipment Life-Cycle

	Description	Annual Cost
Initialization cost	RPM	196 000
	NII	7 390 242
Operating cost	HPGe	28 000
	NaI RIID	8 240
	Survey Meter	23 360
	Pager	10 560
	ASP	0
Stations	RPM Alarm Station	1 147 060
	Secondary Inspection Team	1 262 545
Fiber Optic Lease	Port Fiber Network	400 000
	Total Annual Cost	**10 466 007**

Cost estimations of cargo identification tools[2] in the context of a large container port

Large Container Port – Port Authority Level Installation

Table 19. Large Container Port – Port Authority Initialization Costs (US$)

	Description	Equipment Quantity	Initialization Cost
Primary Inspection	RPM	4	1 740 000
	NII	4	12 906 668
Secondary Inspection	HPGe	2	140 000
	NaI RIID	4	41 200
	Survey Meter	4	13 600
	Pager	24	24 000
	ASP	0	0
Stations	RPM Alarm Station	2	0
	Secondary Inspection Team	2	0
Fiber Optic Lease	Port Fiber Network	N/A	0
	Total Initialization Cost		**14 865 468**

Table 20. Large Container Port – Port Authority Annual Operational Costs (US$)

	Description	Maintenance Fee	FTE	Personnel Cost
Primary Inspection	RPM	22 000	0	0
	NII	1 138 667	36	4 960 908
Secondary Inspection	HPGe	14 000	0	0
	NaI RIID	4 120	0	0
	Survey Meter	22 000	0	0
	Pager	8 160	0	0
	ASP	0	0	0
Stations	RPM Alarm Station	0	10	1 147 060
	Secondary Inspection Team	0	10	1 262 545
Fiber Optic Lease	Port Fiber Network	0	0	400 000
	Subtotal Cost	1 208 947		7 770 513
	Total Operational Cost	**8 979 460**		

2 Tables extracted from the MSc thesis "100% Container Scanning: Security Policy Implications for Global Supply Chains" by Allison C. Bennett and Yi Zhuan Chin, Massachusetts Institute of Technology, June 2008 (http://web.mit.edu/scresponse/repository/Bennett_Chin_MIT_Thesis_June_08.pdf)

Table 21. Large Container Port – Port Authority Annual Costs (US$)
Based on 10 Year Equipment Life-Cycle

	Description	Annual Cost
Initialization cost	RPM	196 000
	NII	7 390 242
Operating cost	HPGe	28 000
	NaI RIID	8 240
	Survey Meter	23 360
	Pager	10 560
	ASP	0
Stations	RPM Alarm Station	1 147 060
	Secondary Inspection Team	1 262 546
Fiber Optic Lease	Port Fiber Network	400 000
	Total Annual Cost	**10 466 008**

Large Container Port – Terminal Operator Level Installation

Table 23. Large Container Port – Terminal Operator Initialization Costs (US$)

	Description	Equipment Quantity	Initialization Cost
Primary Inspection	RPM	20	8 700 000
	NII	20	64 533 340
Secondary Inspection	HPGe	10	700 000
	NaI RIID	20	206 000
	Survey Meter	20	68 000
	Pager	240	240 000
	ASP	0	0
Stations	RPM Alarm Station	2	0
	Secondary Inspection Team	2	0
Fiber Optic Lease	Port Fiber Network	N/A	0
	Total Initialization Cost		**74 447 340**

Table 24. Large Container Port – Terminal Operator Annual Operational Costs (US$)

	Description	Maintenance Fee	FTE	Personnel Cost
Primary Inspection	RPM	110 000	0	0
	NII	5 693 334	180	24 804 540
Secondary Inspection	HPGe	70 000	0	0
	NaI RIID	20 600	0	0
	Survey Meter	110 000	0	0
	Pager	81 600	0	0
	ASP	0	0	0
Stations	RPM Alarm Station	0	50	5 735 300
	Secondary Inspection Team	0	50	6 312 725
Fiber Optic Lease	Port Fiber Network	0	0	400 000
	Subtotal Cost	6 085 534		37 252 565
	Total Operational Cost	**43 338 099**		

Table 25. Large Container Port – Terminal Operator Annual Costs (US$) Based on 10 Year Equipment Life-Cycle

	Description	Annual Cost
Initialization cost	RPM	980 000
	NII	36 951 210
Operating cost	HPGe	140 000
	NaI RIID	41 200
	Survey Meter	116 800
	Pager	105 600
	ASP	
Stations	RPM Alarm Station	5 735 300
	Secondary Inspection Team	6 312 725
Fiber Optic Lease	Port Fiber Network	400 000
	Total Annual Cost	**50 782 835**

MAIN TECHNOLOGY PROVIDERS (2008)

This information has been extracted from pages 72 and following, of the MSc thesis "*100% Container Scanning: Security Policy Implications for Global Supply Chains*" presented by Allison C. Bennett and Yi Zhuan Chin at the Massachusetts Institute of Technology (June 2008). This thesis can be downloaded from http://ctl.mit.edu/index.pl?iid=10139 (Bennett_Chin_MIT_Thesis_June_08.pdf)

Nuctech

Nuctech Company Limited, which originated out of Tsinghua University China, has exported scanning technology solutions to more than 70 countries. They claim to hold the largest market share in the field of high-energy security inspection systems. Although an international standard has yet to be established for RPMs and NII scanners, US government agencies are currently conducting a comprehensive evaluation of Nuctech's NII scanner and RPMs in Beijing, China. Nuctech's NII prices range from US$1.9 million to $3.5 million. The average throughput for Nuctech's NII equipment in actual operations is 20-25 vehicles per hour, with a unit that requires the driver to exit the vehicle prior to scanning. Nuctech's Fast Scan System for RPM allows vehicles to drive through the portals at a speed of 5-15 km/hour, with theoretical throughput of 150 vehicles per hour. Nuctech's mobile scanner is 4 MeVs, with a radiation safety zone requirement of 43 meters long and 38 meters wide. This safety zone is established to reduce the amount of radiation received by personnel in the area. Unlike the RPM equipment, NII emits radiation. Nuctech's mobile model requires the driver to exit the vehicle prior to scanning. The drive through scanner is 2.5 MeV, with a radiation safety zone is 20 meters long and 7 meters wide

SAIC

SAIC, a US-based company is another major supplier of NII equipment. Their P7500 is currently deployed in a number of CUSTOMS installations overseas, including the SFI installation in Southampton, United Kingdom. This 7.5 MeV high-energy X-ray also advertises a theoretical scanning capability of 150 containers per hour. The price for this system is US$2.4 million (SAIC, 2007).

Smith Detection

Smith Detection, a United Kingdom based public company, is active in NII equipment sales around the world. According to the authorized federal supply schedule catalogue price, valid through July 31, 2001, the cost for a low throughput Mobile Scan Cab2000 is US$1.33 million, while the high throughput HCV Mobile 2500II NII is US$2.96 million. Currently the delivery schedule of these 2 units is 8 to 10 months. The warranty consists of 1 year for parts, labor and travel, with additional details outlined in individual proposals. Smith also provides a system-training course for $10,653 per week.

TSA

Additionally, TSA Systems, a vendor to DOE international installation, provided their July 2007 standard product price list. The list was referenced to obtain an estimate for survey meters utilized in secondary inspection. Prices vary based on capability, but the approximate single unit purchase price is $3,400 (personal communication, April 10, 2008). At SFI Ports and under the Megaports Initiative, high-purity germanium (HPGe) (for gamma detection) and moderated 3He tubes (for neutron detection) based RIID systems are used in addition to NaI systems. These HPGe detectors have better resolution when compared to NaI detectors; however, they are not currently being deployed at US ports. We contacted one vendor, Ortec, which provided us single unit pricing for the Ortec Detective-EX, which contains both a gamma and neutron identifier at US$70,000 (personal communication, April 17, 2007). A summary of vendor pricing is included in the Table below.

Equipment Type	***Equipment Cost (in 2007)***
Nuctech NII	$1,900,000 -$3,500,000
SAIC P7500 NII	$2,400,000
Smith Detection Cab2000	$1,330,000
Smith Detection HCV Mobile 2500II NII	$2,960,000
TSA Survey Meter	$3,400
Ortec Detective-EX HPGe	$70,000

Some of the major ports in APEC Member Economies

The following non-exhaustive list includes some of the major ports in APEC Member Economies that make use of port security technologies (18 ports in 16 APEC economies):

- Port of Melbourne, Australia
- Port of Vancouver, Canada
- Port of Shanghai, China
- Port of Shenzhen, China*
- Port of Hong Kong*
- Port of Tanjung Priok, Indonesia
- Port of Yokohama, Japan
- Port of Busan, Korea
- Port Klang, Malaysia
- Port of Auckland, New Zealand*
- Port of Callao, Peru
- Port of Manila, Philippines
- Port of Singapore
- Port of Kaohsiung, Chinese Taipei*
- Port of Laem Chabang, Thailand
- Port of Los Angeles, USA*
- Port of New York/New Jersey, USA*
- Port of Ho Chi Minh, Viet Nam