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REPORT

International Workshop 2011: "How to handle import containers safely"

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INTRODUCTION

The range of topics of the Workshop: "How to handle import containers safely" was more broadly structured than in years past. We will be looking at questions of analysing dangerous substances and the spectrum of noxae to be taken into consideration, which can be answered only partially but not conclusively. Besides early clinical diagnosis, this time we will also shed light on potential risks due to exposure to radioactively contaminated containers and transported goods.

The Fukushima disaster was a new challenge necessitating the development of strategies to prevent the import of radioactively contaminated freight.

The workshop was attended by representatives from the widely varying areas, including doctors and scientists, employees from customs, the fire department, the police, the logistics industry, fumigation companies, and from ministries and authorities, who, in increasing numbers, are also coming to us from neighbouring countries and thus are reflecting the international aspects of the topic.

Our concern within the context of the workshop was the continuation of the exchange of experiences and the initiation of coordinated, cross-regional, qualified preventive strategies and approaches, with the final objective of avoiding health risks both in the transport sector and for the end consumer. Concrete steps in this direction will be: to increase awareness about the health risks associated with handling import containers, to inform adequately importing companies and endangered workers, to improve regulations on an international level, to control and to realise sanctions if minimal standards are not followed, and last but not least, to initiate research where there are unanswered health questions.

WHAT HAVE WE LEARNED FROM THE FUKUSHIMA CATASTROPHE? PRECAUTIONS TO BE TAKEN WITH SHIPS, CONTAINERS, AND GOODS POTENTIALLY CONTAMINATED WITH RADIOACTIVITY

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Precautions and assessment of ships arriving from Japan

On 11 March 2011 a destructive earthquake and tsunami caused a nuclear accident in the Fukushima Nuclear Power Plant. The Japanese Nuclear and Industrial Safety Agency classified the accident as a major accident (level 7 on the INES scale). Due to the results of the release from the Fukushima Nuclear Power Plant they had to take precautions for the maritime traffic between Japanese and German ports. In addition to the determination of precautions for the crews in the concerned sea area, for example decontamination and the intake of iodine tablets, potentially contaminated ships from Japan were identified. The relevant ships have been identified by a questionnaire given to the ships by the point of contact. Evaluating the questionnaire, we accounted for measuring that took place in other harbours. When a ship that had called a Japanese port or navigated within a range of 50 nautical miles from the Fukushima Nuclear Power Plant was identified, the ships were measured at selected points by the Hamburg Waterways Police. When the results of the measurement at these points were higher than 0.2 μSv/h per hour, radiation experts of the Hamburg Ministry for Health and Consumer Protection were required to take more exact measurements. Following these exact measurements in case

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of exceeding the threshold of 0.2 μSv/h decontamination by specialists or blocking parts of the ship would be necessary.

April 8, 2011: Results of the German Commission of Radiological Protection for the effects of nuclear accident in the Fukushima Power Plant for contaminated ships, cargo and products: maximum measured value for the Contamination 4 Bq per square centimetre or 0.2 μSv per hour by an alternative method (on the surface).

April 14, 2011: Federal Environment Ministry recommends using precautionary radiation levels for ships and goods from Japan, maximum measured value for the Contamination of ships: 4 Bq per square centimeter.

April 14, 2011: Recommendation of European Commission for ships an cargo from Japan, reference level 0.2 μSv per hour (one metre from the surface).

Ute Gramm

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Border control of food and products of animal origin following the Fukushima accident

The Border control regime of food and products of animal origin in general

All consignments of products of animal origin (food and non food) have to undergo import control at an EU border inspection post (BIP). It is based on an EU harmonised external border regime and covers animal and public health requirements as well as certain animal welfare aspects. The main import requirements are: origin from a listed third country for the relevant food category, a production in an approved EU establishment, and the relevant EU import certificate. Currently Japan is not listed e.g. for fresh meat or milk products for human consumption.

With regard to food of non-animal origin, there is not the same border control regime as for products of animal origin. In general, these food imports are monitored according to Article 15 Regulation (EC) No. 882/ /2004 on the basis of the multi-annual national control plan (MANCP). Certain food products have to go through a re-enforced check control on the basis of Regulation (EC) No. 669/2009 or an EU safeguard measure.

Legal basis of the border control of food and products of animal origin following the Fukushima accident (07.12.2011)

The European Commission implemented Regulation (EU) No. 297/2011, which imposes special conditions governing the import of feed and food originating in or consigned from Japan following the accident at the Fukushima nuclear power station. It was amended three times by EU Regulations No. 351/ /2011, 506-2011, and 657/2011 and repealed by Regulation (EU) 961/2011.

Council regulation (EURATOM) No. 3954/87 lays down maximum permitted levels of radioactive contamination of foodstuffs and of feedingstuffs following a nuclear accident or any other case of radiological emergency. For the control of food consignments from Japan only, the maximum levels set in Annex II of Regulation (EU) No. 961/2011 are applicable.

The Controls (07.12.2011)

Consignments of food and feed from Japan have to be pre-notified to the border inspection post resp. the point of entry at least two days before physical arrival and must undergo 100% documentary and identity check. A declaration signed by the Japanese authorities according to Annex II Regulation (EU) No. 961/2011 is required, stating the origin (prefectures/ /coastal waters), the production/harvesting date as well as an analytical report stating the levels of the radionuclides iodine-131, caesium-134, and caesium-137.

The physical and laboratory check includes 10% of the consignments originating from the restricted prefectures and 20% of the consignments originating from other prefectures or consigned from the restricted from prefectures. Moreover, monitoring of pacific fish and fishery products from determined fishing areas following the recommendations of the European Commission is performed.

More information: see http://www.hamburg.de/ /grenzdienst/

Lutz Dreyer

Hamburg Waterways Police

Measurements on board

In connection with the escape of radioactive substances from a nuclear power plant in Fukushima (Japan), selected ships from the shipping routes around Japan were examined by the Hamburg water police for an increased dosage rate due to contamination with radioactive substances upon the order of the authorities for health and consumer protection (BGV). The measurements were conducted at various locations on the ships. The values measured were then forwarded to the responsible authority BGV. Any measures that became necessary would then be determined by the BGV.

Uwe Manow

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Measurements and the experience of customs officers

The core task of customs offices consists of fulfilling their legal mandate of monitoring the cross-border traffic of goods — in simple terms: fighting smuggling. This includes the monitoring of adherence to the statutory provisions with regard to the illegal import of nuclear materials. Customs agencies are equipped with the corresponding detection technology.

When the reactor accident in Fukushima on 11 March became publicly known, its potential impact on the German federal territory was continuously analysed by the agency first and foremost responsible, the German Federal Environment Ministry, with the participation of other offices. The German Customs Offices controlled goods arriving by sea and air with regard to any radioactive pollution in a coordinated control strategy as part of the risk-oriented handling of the task. Imported goods were tested for increased values at random. The scope of the spot checks was geared to the concrete circumstances of the transport, taking into account the situation as it developed in Japan.

Within the context of this coordinated control strategy, well over 1,000 containers that originated from the region of the catastrophe were checked in the customs checkpoint of Hamburg harbour with regard to any radioactive pollution and tested for possible excessive values of ionising radiation. The measured data lay in the range between 32 and 78 nanosievert per hour. These are values that correspond to normal environmental radiation. A comparison of the values detected during the container control by the harbour customs with the local dosage rates stated in the map of the Federal Office for Radiation Protection (BFS) shows that these measurement results lie well under the values of naturally occurring radioactivity in certain regions of Germany. The gamma local dosage rate monitoring network of the BFS labels areas with a local dosage rate of over 600 μSV/h as natural radiation.

The results of the data produced by customs in Hamburg harbour coincide with the results found in the remaining federal territory, according to which no alarming values of ionising radiation were determined during the testing of shipments of goods imported to Germany from Japan.

FUMIGANTS, VOCS, AND OTHER HAZARDOUS MATERIALS: EXPERIENCES FROM VARIOUS COUNTRIES

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Results and reflections from measurements of import containers in Sweden

Individuals, who in their professional duties need to enter into import containers for inspection, stripping, or cleaning, may be exposed to gaseous pesticides and other gaseous chemicals. Previous reports from studies in the ports of Hamburg and Rotterdam, as well as a few incidents in Sweden, have raised concerns about the present situation in Swedish ports and container terminals. Since systematic studies in Sweden were missing, a pilot study consisting of three parts was initiated to: 1) determine the frequency and levels of gaseous pesticides and other gaseous chemicals in import containers; 2) determine the personal exposure during stripping of containers; and 3) determine the most effective way to ventilate a container prior to stripping.

Part 1: The air in 101 randomly selected arriving import containers was investigated in the port of Gothenburg. Most containers carried merchandise; however, some were reported to be empty. Samples were taken as the containers were transported out of the harbour and briefly halted at the import inspection station. None of these containers were labelled that they had been treated with pesticides. The measurements, carried out with FTIR spectrometry, showed that only one of the containers contained detectable residues of gaseous pesticides, namely, 1 ppm carbonyl sulphide. On the other hand, as in other studies, this study also revealed a large number of other gaseous chemicals, mostly believed to derive from the merchandise itself. The most common chemicals were methanol (detected in 78% of the containers) and carbon monoxide (45%). All levels of methanol and carbon monoxide were below the Swedish occupational short-term exposure limits. It is suggested that methanol and CO are degradation products from the plywood floors in the containers since they were also detected in containers that were reported to be empty. Short-chained compounds are known to emit from wood products. Other frequently detected chemicals were hydrocarbons (unspecified, 47%) and ammonia (15%) where individual readings were above or well above the short-term exposure limit values. Part 1 of the study has been published in Swedish (IMM Report 1/2011, Karolinska Institutet).

Part 2: Eight import containers arriving to a private company container terminal were opened and primed with nitrous oxide as a tracer gas. Two of the containers were also primed with ethyl acetate. The containers were then closed and the tracer gases were left to equilibrate for 12–36 hours. During the following two days, three of the containers were used for personal exposure measurements while stripping. In this manner, the personal exposure could be determined in relation to the initial tracer gas concentration in the container. Preliminary results from this limited study show that the personal exposure in a naturally ventilated container is well below the initial tracer gas concentration in the primed container. The initially high concentrations were rapidly removed from the working zone during stripping.

Part 3: Five of the containers primed with tracer gas were used to study the effect of different types of ventilation practices. A battery-operated portable 24-volt radial fan (400 m^3/h free flowing capacity) was equipped with an 8-metre suction hose and stiff 68 mm diameter PVC pipe (200 m^3/h final capacity). After determining the initial tracer gas concentration in the container the PVC pipe was inserted as far as possible into the container in the available space above the goods and the container ceiling. The decay of the tracer gas was measured in the exhaust pipe from the fan. Measurements were also carried out about 7 metres inside one container while using the common practice of just leaving the doors open for natural ventilation or simply blowing fresh air onto the goods in the open container. Preliminary results show that suction ventilation is 5–10 times faster than blowing or natural ventilation. 5–10% of the initial concentration was reached within 5 minutes. Simply blowing fresh air towards the goods was just marginally more effective over natural ventilation. The initial measurements further indicate that the tracer gases and the natural emissions from the goods have similar decay curves.

Conclusions: Overall, this limited study signals that professionals working inside containers should have: 1) access to equipment to provide mechanical ventilation of the container; 2) equipment for gas measurement; and 3) personal protective equipment. Containers should be redesigned and equipped with connectors in order to facilitate ventilation from the outside without opening the doors. This should be a legal requirement when new containers are put on the market. Old containers should be retrofitted with such connectors in due course.

More studies are needed in order to better understand the dynamics of container ventilation and personal exposure with the final aim to come up with the best recommendations on the safe handling and managing of containers. The experiences assembled from this pilot project will shortly be implemented in a follow-up study.

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Toxic contamination in containers according to type of goods and country of origin

Already at the beginning of the last decade, the improper implementation of the EU directive on the fumigation of packaging materials and transport aides led to the exposure of those employed who were the first to come into contact with the contents of import containers. Within the context of the occupational medical exposure assessment, the at times grave risks to health that stem from fumigants such as methyl bromide, phosphine, or hydrocyanic acid were analysed. The risk to occupational health and safety that is linked to the term "fumigated container" became an established term. Due to the scientific examinations of this exposure, the findings prevailed that at least an equally significant exposure potential is present with the short-lived organic connections that in particular emit from plastic goods. Ever since, the risk is more accurately labelled overall with the umbrella term "contaminated" container.

With regard to the origin of scheduled services, Hamburg harbour focuses on the area of Southeast Asian transports, with the import area from the People's Republic of China representing the largest share of the transports. The clear exposure focus with regard to pollutant content are the shoe containers originating from this region. The customs clearance officers, therefore, never allow those required to report to open the shoe containers without special precautionary measures. With regard to exposure potential, textiles follow in second place from this area of origin. Also maximising the impact of risk: The method used to package import shipments from the industrial emerging markets leads to little air exchange in containers. While due to the higher labour costs for the packaging personnel from industrial markets only pallet goods are exported, in order to optimally exploit the storage space in containers from markets with low labour costs, goods are load-ed very tightly and frequently without using packaging materials. Ventilation of the load and the reduction in the pollutant concentration effected by the addition of fresh air occurs — if at all — only with considerable time delay.

The leading principle of occupational health and safety or — as is said in the implementation area: self-protection — during container checks therefore reads: No customs officer comes near, let alone steps into any opened container without previously measuring toxic substances!

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Measuring fumigants and industrial chemicals in import containers — volatile and experiences

The principles of analysis from different common devices for the investigation of freight-container-air was introduced. For this purpose, for each technique, an overview of sample uptake, signal generation processes, and information content regarding quality

Table 1. Methods and their characteristics for measuring fumigants and volatile toxic chemicals in air samples

Method	Principle	Selectivity
Photoionisation detector	Upon ionisation with UV light, analytes produce an electrical signal in proportion to their concentration	Analytes with an ionisation energy ≤ 10.6 eV are detectable but cannot be discriminated from one another
Colorimetric test tube	Intensity of a colour reaction along a quartz tube filled with an indicator is proportional to compound concentration. Quantification is read from predefined scales on the quartz tube	Preselection of indicator test tubes is required for each analyte, and false positives from similarly reactive substances are possible
Metal oxide sensor	Surface adsorption of the analyte alters the measured electrical resistance in proportion to its concentration	Different metal oxide sensors are required for individual substances or analyte classes
Electrochemical cell	Redox reactions of the analyte in an electrochemical cell produce an electrical signal proportional to the compounds concentration	Various cells specific for individual substances are available
Infrared cell	Reduced transmission of IR light at a specific wavelength is proportional to analyte concentration	Variety of IR cells specific for individual substances/classes are available
FT-infrared spectroscopy	The reduced transmission of infrared light by a mixture of analytes is subjected to Fourier transformation for resolution of the components	Substances can be discriminated and a separate quantification is usually possible
Ion mobility spectrometer	Ionised analytes are identified from the speed of their transit time through a drift tube to a detector, where they produce an electrical signal in proportion to their concentration	Substances are separated before identification, although competitive reactions can influence the outcome
TD-GC	Analytes are enriched on an adsorbent and are subsequently introduced to a gas chromatograph (GC) by heat-induced desorption. GC-separation is followed by appropriate detection (e.g. FID or MS)	Enrichment and separation enable precise quantification and identification using retention times from defined standards. Not appropriate for unstable analytes, e.g. formaldehyde
TD-GC-MS	Concentration and resolution of analytes as above. Specific identification by mass spectrometry	High selectivity with analyte mixtures resulting from comparisons of retention times and spectra with the available databases. Precise quantification is also possible. Not appropriate for unstable analytes, e.g. formaldehyde
SIFT-MS	Generated precursor ions react with analytes to give product ions. Different product ions travel down a drift tube to a mass spectrometer. Velocities in the drift tube and mass spectrometric identification provide quantitative and qualitative information, which is complemented by alterations in the decay and intensity of the precursor ion signals	Good selectivity when no competitive reactions lead to discrimination of the signal

and degree of air contamination was given. The following techniques were presented: photoionisation detector (PID), metal oxide sensors (MOS), ion-mobility spectrometers (IMS), infrared measuring cells (IR), Fourier transform spectroscopy (FT-IR), single ion flow tube-mass spectrometry (SIFT-MS), and gas chromatography-mass spectrometry (GC-MS) (Table 1).

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Measurement comparison of 30 container air samples using various devices

Import containers very often exhibit chemically contaminated atmospheres caused by fumigation or the use of toxic or carcinogenic chemicals for production or transportation purpose of container goods. Several measurement techniques are currently used to detect container air contamination — but the results are often questionable. The huge variety of substances involved, with different physical and chemical properties, interacting with different goods complicates the analytical task. Sometimes even analytical specialists meet their limitations. Here appropriate measurement techniques and their ranges of application and reachable limits of detection are presented. Actually used techniques cover colorimetric methods, single sensors, sensor arrays, infrared, and mass spectrometric applications. The use of a single detector or sensor arrays might be sufficient in some cases, but usually a combination of devices is necessary to satisfy the analytical task. Some of these techniques may be executed by low-level trained users although some need expert knowledge. But for the effective use of a device, knowledge of the application area and detection limits is necessary. Measurement activities accomplished by untrained users, or the application of high-end techniques by analytical laymen and not least economic factors actually increases the number of incorrect "experts reports". The situation corrupts the circumstances of occupational health and safety in the Hamburg harbour. Standards for the application of adequate measurement techniques and qualified training of users must be established.

Jan de Jong

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The changing health risk of workers

A lot of work is outsourced by Western companies to developing economies. These companies work in the home countries according to the state of the art and health standards. A lot of chemicals are banned or restricted in use in Western countries. The responsible people do know, in spite of a good code of conduct, that the standards in the developing economies cannot meet the state of the art practice in the West. They are aware of the consequences on the health and safety of the people who have to work according to these conditions. At least 1.1 million people die every year in Asia because of bad working conditions; this means that many more become seriously ill or are badly injured.

In Korea a company was convicted for the death of 25 people because of exposure to a solvent like 1.2 dichlorethan and benzene after long-term high-level exposure, amongst them several under the age of 25. In containers from this same company were several incidents reported from people getting serious complaints after entering the container in a Dutch logistics company. The same two solvents were reported several times after measuring gasses in these containers. This could very well mean that people all over the world are at risk of becoming ill because of bad working conditions during the production processes in the new economies.

Unprotected exposure to chemicals should be considered as a crime against humanity. The strong on life and dead competition between companies and the way down to find production at the lowest costs, makes this economy like a war. So it is time that we held Chief Executive Officers (CEO's) all over the world responsible for bad working conditions and exposure to chemicals in factories owned by them or producing for them and bring them to court as economic war criminals.

PROCEDURES AND DIAGNOSTICS FOR PRESUMED INTOXICATION

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Experiences of port health inspectors on board: safe use of pesticides on ships (MSC.1/Circ. 1358) based on the SOLAS Regulation VI/4

Today the Hamburg Port Health Centre is part of the Institute for Occupational and Maritime Medicine. The institute is a service agency of the Ministry of Health and Consumer Protection in Hamburg and is affiliated with the University Medical School. Since 1961 the PHA has also been responsible for medical supervision at Hamburg Airport. The International Health Regulations were revised and entered into force on 15 June 2007.

Their stated purpose is "to prevent, protect against, control, and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade."

One of the main tasks of enforcement is the inspection of ships for the issuing of ship sanitation certificates. Ship Sanitation Certificates are valid for a maximum of 6 months. If the ship is free of infection and contamination, including vectors and reservoirs, the Port Health Authority will issue a Ship Sanitation Control Exemption Certificate. When evidence is found, control measures are required and the authority issues a Ship Sanitation Control Certificate.

For prevention, ships should have an Integrated Pest Management Plan for passive surveillance, and maintain a monitoring log. Recommendations on the safe use of pesticides in ships have been compiled by the Sub-Committee on Dangerous Goods of the International Maritime Organization (IMO). MSC.1/ /Circ. 1358 is a guide for shipmasters with a view to the safety of personnel and the avoidance of excessive residues of toxic agents in human and animal food. The master has to consider different national regulations for transport by sea. (import, export, flag state).

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Recognising fumigant intoxication in modern times

Headaches, concentration and memory disorders, dizziness and nausea, skin irritation, respiratory symptoms, and muscle cramps are symptoms of acute or chronic intoxication. Specific questions for typical exposure conditions (e.g. opening and unloading of import containers, unpacking of imported goods, or direct loading or venting of containers) give a hint to fumigant or chemical residues in imported goods. The severity of the disease depends on duration of exposure, concentration, distribution and release of the fumigant, the kinetics of the substance, the individual susceptibility of the person, and simultaneous exposure to multiple toxins. Besides the physical examination, blood tests on residues of poisons, pulmonary function tests, especially tests on newly acquired non-specific hypersensitivity of the airways, and neuropsychological tests can confirm the diagnosis. Persons who handle and deal with imported goods should be aware of the typical symptoms of intoxication due to fumigants and should know about drop-in centres for appropriate medical care.

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FROM SYMPTOMS OF INTOXICATION TO IDENTIFICATION OF NOXIOUS AGENTS (MONITORING METHODS)

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Exposure to fumigants in a container atmosphere can be associated with increased health risks for those entering such special workplaces. Pesticides used as fumigants are known to be toxic to humans, and most of the fumigants used are colourless and odourless, thus often escaping subjective detection. Frequently they are quickly absorbed (lung, partially skin) and the patients may show no symptoms for 1–3 days.

The aim of our study was to evaluate the possible health risks due to toxic chemical residues in container units for seafarers, dock workers, container unloaders/transport/warehouse/storage room workers, controlling bodies (inspecting bodies, customs, water police, etc.), and bystanders. We have asked who is at risk, what is the anticipated hazard, and how can we mitigate intoxications. A further aim was to develop diagnostic and preventive analytical methods.

Since 2006, we have performed air measurements of closed container units in Rotterdam and Hamburg harbour areas. Until now c. 4000 container units were measured for fumigant residues (the study is still ongoing to screen also for the adopted methyl bromide alternatives). Since uptake via the lungs and individual metabolic differences are not considered by ambient air analysis, the measurements of air contamination may not be sufficient to determine exposure. Parallel biomonitoring analyses of blood and urine samples from exposed workers show the presence of not only fumigants and their metabolites in the body fluids, but frequently also indications for co-exposure to toxic industrial chemicals (i.e. solvents). Such combined exposures may cause effects not observed individually, leaving biomonitoring as the method of choice for risk assessment and diagnosis.

Conclusions: Risk mitigation strategies should be based on the physicochemical properties of the fumigants and toxicological knowledge, not only on air measurements.

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