RISKS AND COUNTERMEASURES FOR JAPAN NUCLEAR CONCERN
RECOMMENDATIONS FOR SEAFARERS

2nd Edition

if further information on nuclear concern health risks is required, feel free to contact CIRM via e-mail at the dedicated helpline box
nuclearconcern@cirm.it

from the Healthy Ship Team
for your Safety and Well Being

1 September 2011

Information contained in this paper were derived from World Health Organization (WHO) web site (http://www.who.int/en/), from institutional Japanese WEB sites dedicated to the concern and from the Japanese Embassy in Rome. Information contained in this paper were implemented thanks to the contribution of Mario Pillon, EngD, Radioprotection expert, of ENEA, **Italian National agency for new technologies, Energy and sustainable economic development**

1. Contamination risk

Radiation-related health consequences will depend on exposure, which depends on several things, including: the amount and type of radiation released from the reactor; weather conditions, such as wind and rain; a person's proximity to the plant; and the amount of time spent in irradiated areas.

Risk of radioactive contamination may derive from:

- Contaminated food. However, contaminated food would have to be consumed over prolonged periods to represent a risk to human health. The presence of radioactivity in some vegetables and milk has been confirmed and some of the initial food monitoring results show radioactive iodine detected in concentrations above Japanese regulatory limits. Radioactive caesium has also been detected.

Natural radiations and radiation doses

- Any subject is exposed to natural radiation (also known as background radiation) on a daily basis. Natural radiation comes from space (i.e. cosmic rays) as well as from naturally-occurring radioactive materials found in the soil, water and air. The most common man-made sources of ionizing radiation are X-ray machines and other medical devices.
- Radiation doses can be expressed in Sievert (Sv) units. On average, a person is exposed to approximately 3.0 milli Sieverts (mSv)/year, of which 80% (2.4 mSv) is due to naturally-occurring sources (i.e., background radiation), 19.6 % (almost 0.6 mSv) is due to the medical use of radiation and the remaining 0.4% (around 0.01 mSv) is due to other sources of human-made radiation.

2. Radiation exposure caused by nuclear power plant accident

- In the event a nuclear power plant does not function properly, individuals, land, and structures in the vicinity of the plant could be exposed to a mixture of radioactive products generated inside the reactor, also known as "nuclear fission products". The main radionuclides representing health risk are radioactive caesium and radioactive iodine.
- Members of the public may be exposed directly to radionuclides, either in the air or if food and water become contaminated by these materials.
- Rescuers, first responders, and nuclear power plant workers may be exposed to radioactive materials and higher radiation doses inside or around the power plant due to their professional activities.

3. Current situation in Japan

At the present the situation is carefully controlled and radioactivity levels for air and seawater in port areas are measured daily. Based on these measurements the results of which for the past week are detailed below, the estimated average radiation exposure/year in the port of Onhahama area is for air of 0.96 mSv and undetectable for seawater. As according to the WHO, there are no risks under an exposure to an approximate 3.0mSv/year on average, radioactivity levels detected should be considered within a range of safety for health.

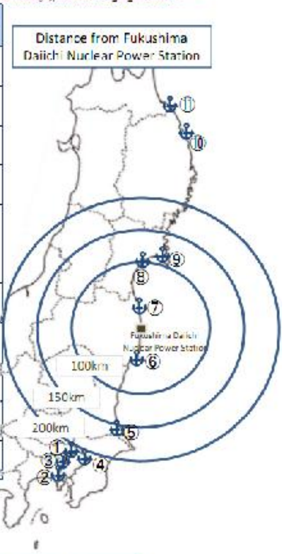
Measurement of Radiation Dose for Air in the Ports

国土交通省

(the Pacific side of Northeast Japan)

http://www.mlit.go.jp/kowan/kowan_fr1_000041.html

		Measurement points	8/29	8/30	8/31	Annual exposure calculation
①	Port of Tokyo	Oi Wharf	0.06 μSv/h	0.07 μSv/h	0.06 μSv/h = 0.00006 mSv/h	0.53 mSv
②	Port of Yokohama	Honmoku Wharf (BC gate)	0.10 μSv/h	0.07 μSv/h	0.08 μSv/h = 0.00008 mSv/h	0.70 mSv
③	Port of Kawasaki	Kawasaki Municipal Research Institute for Environmental Protection <4km from the port>	0.04 μSv/h (AM8:00)	0.04 μSv/h (AM8:00)	0.04 μSv/h (AM8:00) = 0.00004 mSv/h	0.35 mSv
④	Port of Chiba	Chiba Prefectural Environmental Research Center <9km from the port>	0.04 μSv/h (AM8:00)	0.04 μSv/h (AM8:00)	0.04 μSv/h (AM8:00) = 0.00004 mSv/h	0.35 mSv
⑤	Port of Kashima	Bureau of Port of Kashima	0.09 μSv/h (AM8:00)	0.10 μSv/h (AM8:00)	0.09 μSv/h (AM8:00) = 0.00009 mSv/h	0.79 mSv
⑥	Port of Onahama	Fujiwara Wharf	0.10 μSv/h (AM)	0.11 μSv/h (AM)	- μSv/h (AM) = mSv/h	0.96 mSv
⑦	Port of Souma	No.2 Wharf	0.17 μSv/h (AM)	0.17 μSv/h (AM)	- μSv/h (AM) = - mSv/h	1.49 mSv
⑧	Port of Sendai-shiogama	Takasago Container Terminal	- μSv/h	0.04 μSv/h	- μSv/h = - mSv/h	0.35 mSv
⑨	Port of Ishinomaki	Nakajima Wharf	- μSv/h	0.05 μSv/h	- μSv/h = mSv/h	0.44 mSv
⑩	Port of Kuji	Research Institute for Environmental Sciences and Public Health	0.02 μSv/h (AM)	0.02 μSv/h (AM)	0.02 μSv/h (AM) = 0.00002 mSv/h	0.18 mSv
⑪	Port of Hachinohe	Hachinohe City office <4km from the port>	0.03 μSv/h (AM)	0.03 μSv/h (AM)	0.03 μSv/h (AM) = 0.00003 mSv/h	0.26 mSv



①Source: Bureau of Port and Harbor Tokyo Metropolitan Government <http://tokyoport-measurement.jp/>
②Source: Yokohama Port Public Corporation <http://www.ypdc.or.jp/radiation/yokohama/>
③Source: Kawasaki City <http://www.city.kawasaki.jp/e-news/info3718/index.html>
④Source: Chiba Prefecture <http://www.pref.chiba.lg.jp/taiki/h23touhoku/houshasen/index-radiation.html>
⑤Source: Ibaraki Prefecture <http://www.pref.ibaraki.jp/important/20110311eq/index.html>
⑥⑦Source: Fukushima Prefecture <http://wwwcms.pref.fukushima.jp/pcp_portal/PortalServlet;jsessionid=0D95E72E7571D9FD999752E003A0EC417?DISPLAY_ID=DIRECT&NEXT_DISPLAY_ID=U000004&CONTENTS_ID=10877>
⑧⑨Source: Miyagi Prefecture <http://www.pref.miyagi.jp/kouwan/kouwan/houyaread.html>
⑩Source: Iwate Prefecture <http://www.pref.iwate.jp/view.rbz?cd=32086>
⑪Source: Aomori Prefecture <http://www.aomori-portal.com/>

1) 1 Gray/hour (Gy/hr) ≒ 1 Sievert/hour (Sv/hr).
2) 1 mili-Sievert (mSv) = 1000 micro-Sievert (μSv)
1 micro-Sievert (μSv) =1000 nano-Sievert (nSv)
3) "Annual exposure calculation" is the estimation under the condition that the hourly radiation dose measurement at the measurement point is accumulated 24 hours throughout the year
4) The figure in parenthesis below the measured value indicates the measurement time

According to the Ministry of Education, Culture, Sports, Science and Technology, examples of exposure level of radiation in daily life is as below.
- Chest X-ray (once) 0.05 mSv
- 1 roundtrip between Tokyo and New York by air 0.2 mSv
- Stomach X-ray (once) 0.6 mSv
According to the WHO, a person is exposed to approximately 3.0mSv/year on average.

Measurement of Radioactivity for Seawater in the Ports

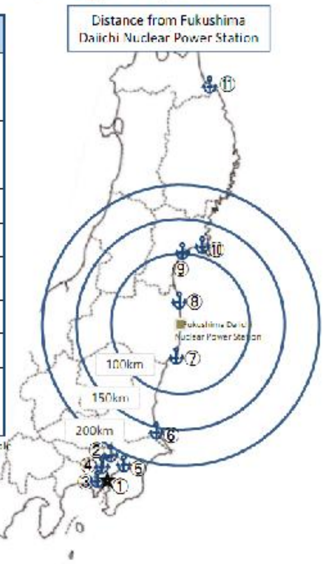
国土交通省

(the Pacific side of Northeast Japan)

http://www.mlit.go.jp/kowan/kowan_fr1_000041.html

		Measurement Points	Date	Iodine I-131	Cesium Cs-134	Cesium Cs-137
①	Tokyo bay	Uraga Channel	8/31	ND (less than 5Bq/kg)	ND (less than 5Bq/kg)	ND (less than 5Bq/kg)
②	Port of Tokyo	Mid point between Oi Terminal and Aomi Terminal	8/31	ND	ND	ND
③	Port of Yokohama	Yokohama Passage/ Tsurumi Passage	8/22	ND (less than 20Bq/kg)	ND (less than 20Bq/kg)	ND (less than 20Bq/kg)
④	Port of Kawasaki	Kawasaki Passage	8/25	ND	ND	ND
⑤	Port of Chiba	Chiba Passage	8/22	ND	ND	ND
⑥	Port of Kashima	3km off the coast of Hirai	8/26～27	ND	ND	ND
⑦	Port of Onahama	1) No.4 Wharf 2) Otsurugi Wharf	8/25	1) ND 2) ND	ND ND	ND ND
⑧	Port of Souma	No.2 Wharf	8/25	ND	ND	LTD
⑨	Port of Sendaishiogama	Takasago Container Terminal	8/18	ND	ND	ND
⑩	Port of Ishinomaki	Nakajima Wharf	8/18	ND	ND	ND
⑪	Port of Hachinohe	Hattaro Area (in the port)	8/25	ND (less than 1.8Bq/l)	ND (less than 1.1Bq/kg)	ND (less than 1.0Bq/l)

ND=Not Detected, LTD=Less Than Detectable



①Source: Kanto Regional Development Bureau, MLIT <http://www.pa.ktr.mlit.go.jp/index.html>
②Source: Bureau of Port and Harbor, Tokyo Metropolitan Government <http://tokyoport-measurement.jp/>
③Source: Yokohama Port Public Corporation <http://www.ypdc.or.jp/radiation/yokohama/>
④Source: Kawasaki City <http://www.city.kawasaki.jp/e-news/info3898/index.html>
⑤Source: Chiba Prefecture <http://www.pref.chiba.lg.jp/kouwan/houshasen/h23sokuteikekka.html>
⑥Source: Tokyo Electric Power Company <http://www.tepco.co.jp/ibaraki/monitor/index-j.html>
⑦⑧Source: Fukushima Prefecture <http://wwwcms.pref.fukushima.jp/pcp_portal/PortalServlet;jsessionid=0D95E72E7571D9FD999752E003A0EC417?DISPLAY_ID=DIRECT&NEXT_DISPLAY_ID=U000004&CONTENTS_ID=10877>
⑨⑩Source: Miyagi Prefecture <http://www.pref.miyagi.jp/kouwan/kouwan/houyaread.html>
⑪Source: Aomori Prefecture <http://www.pref.aomori.lg.jp/soshiki/kendo/kowan/houaya.html>

1) Sample is collected from surface of the sea
2) 'Not Detected', 'Less than Detectable' mean the value below detection limit.
3) The figure in parenthesis below 'ND(Not Detected)' indicates detection limit level.

【Reference】
Barometer of the intake limitation for food material that is defined by Nuclear Safety Committee Japan is shown as follows;
-Radioactive Iodine in drinking water; under 300Bq (becquerel) /1kg water
-Radioactive Cesium in drinking water; under 200Bq (becquerel) /1kg water
Bq (becquerel) is defined as the activity of a quantity of radioactive material.

Food and beverages marketed in Japan including the Onahama area are under continuous control and are healthy and safe.

4. Travel advice

- Even at times closer to the event, international health authorities did not recommend general restrictions on travel to Japan. Japanese authorities did a very attentive control and therefore it is advisable to follow their suggestions.
  At the moment, based on the above data on air and seawater radioactivity levels, allowed areas should be considered safe.

- Travellers in Japan should monitor local media, follow the advice and instructions issued by local authorities, and register their travel and location details with their respective embassy or consulate.

- Information on the status of the nuclear facilities in Fukushima can be found on Japan's Nuclear and Industrial Safety Agency (NISA) website and on the International Atomic Energy Agency (IAEA) website.

- Travellers returning from Japan who have come from the 20 km evacuation zone surrounding the Fukushima Daiichi nuclear power plant and who have undergone proper screening and decontamination procedures, and travellers from all other areas, do not pose a radioactive health risk to others and do not require screening.

5. Health effects

- If the dose of radiation exceeds a certain threshold level, it can produce acute effects, including skin redness, hair loss, radiation burns, and acute radiation syndrome (ARS).

- In a nuclear power plant accident, the general population is not likely to be exposed to doses high enough to cause such effects.

- Exposure to high doses of radiation can increase the risk of cancer.

- The risk of thyroid cancer following radiation exposure is higher in children and young adults.

- Health effects can only occur if someone is exposed to radiation, thus the main protective action someone can take is to prevent exposure. Those closest to the radiation are at greatest risk of exposure and the greater the distance away, the lower the risk. This is why, when a nuclear accident occurs, the recommended public health actions involve evacuation and sheltering of those near the site.

6. Personal protective measures and food/water safety

- The decision to take potassium iodide should be based on information provided by national health authorities who will be in the best position to determine if this step is warranted. **Potassium iodide is not recommended to be taken by an autonomous decision of someone.**

- Measurements of radionuclide concentrations in food are now taking place and are being released by the Japanese authorities.

- Consuming food contaminated with radioactive material will increase the amount of radioactivity a person is exposed to and could increase the health risks associated with exposure to radiation. The exact effect will depend on which radionuclides have been ingested and the amount. Foods can become contaminated with radioactive materials when they are released as the result of a nuclear or radiological emergency. In these

circumstances, radioactive material falling from the air or carried in rain water or snow, can deposit on the surface of foods like fruits and vegetables or animal feed. However, this does not seem to be the case, as **food and beverages marketed in Japan including the Onahama area are under continuous control and are healthy and safe.**

- **Radioactivity cannot contaminate food that is packaged; for example, tinned or plastic-wrapped food is protected from radioactivity as long as the food is sealed.**

- Drinking tap water in Japan poses no immediate health risk. Currently, radioactive iodine is the most common detected contaminant; the standard for adults is 300 Becquerels per litre in drinking-water. In the very unlikely scenario that drinking-water was contaminated and consumed for an entire year at this level, the additional radiation exposure from this water would be equivalent to natural background radiation during one year.

- Standard water treatment procedures may remove significant amounts of radioactive contaminants. Other options to reduce concentrations of radiation contaminants include controlled dilution of contaminated water with non-contaminated water.

- Boiling water will not remove radioactive iodine.

7. Specific recommendations for seafarers from the Healthy Ship Team

If ships are transiting areas exposed to nuclear contamination, the general measures listed below will help to protect crew members.

- Being at sea on a moving platform has benefits including being encased by a metal box. The lower you are in the ship the safer you are..... below the waterline is the safest although this is not always possible.

- Before entering a predicted 'fallout area' a few precautions can be taken.
  - Brief the team.
  - Turn off ventilation systems if at all possible to avoid potential of dust ingress.
  - If unable try only to have ventilation in machinery spaces and provide dust masks to exposed personnel.
  - If possible move equipment inside the ship as it is easier to decontaminate although the risk is low.
  - Potatoes and vegetables which are often stored on deck should be put within the ship.
  - If possible the upper deck should be kept wet as this will allow the dust to wash over the side. If this is not possible wash the decks as this will remove the majority of the contamination. Try and do this just ahead of entering the cloud.
  - If you can top-up fresh water tanks ahead of entering the contaminated zone. Ration water and top-up once you are clear of the cloud. If you have spare containers fill them early to provide additional water.

- On entering the cloud.
  - Avoid going outside especially if it is raining.
  - Keep upper deck and bridge doors closed.
  - When cleaning the upper deck personnel should wear waterproof clothing so that it too can be washed off before entering the ship. This kit needs to be taken off and left near the upper deck access. Regular washing will help keep contamination to a minimum.

- Exposing personnel should be avoided but if unavoidable personnel should wear full foul weather kit – hoods up and dust masks if available.

- Ships sailing in areas under radioactive cloud **should replace all filters of air conditioning systems and/or ventilation as soon as the vessel comes out from the potentially contaminated area**. For doing so it is important that ships with a destination close to the nuclear concern area have an extra supply of filters of air. New filters should be properly stored and open from original containers only before use. Used filters should be placed in closed plastic bags and sealed with tape. These bags should be put in a warehouse far from people, animals and food. The same is recommended for clothes of people who entered the area of radioactive cloud. On the arrival to the destination port, bags with potentially contaminated materials must be delivered to authorities in charge of radioactivity control for checking levels of radiation or of radioactivity present there.