Briefing


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ACOEM International Section[1] | International SOS Briefing

# Dealing with the Japan Disaster: Earthquake, Tsunami, and Nuclear Risk

**June 30, 2011**

American College of Occupational and Environmental Medicine

International SOS

[1]Although this webinar has been co-sponsored by ACOEM's International Section, the viewpoints expressed by the moderator and panelists are not necessarily those of ACOEM.

# Dealing with the Japan Disaster: Earthquake, Tsunami, and Nuclear Risk

The earthquake and subsequent tsunami that struck the northeast coast of Honshu, Japan on March 11, 2011 presented many challenges for multinational and Japan-based organizations. This briefing, based on the questions and answers from the webinar, “Dealing with the Japan Disaster: Earthquake, Tsunami, and Nuclear Risk,” hosted by the International Section of the American College of Occupational and Environmental Medicine (ACOEM) and International SOS, addresses the occupational and environmental health aspects of the Japan earthquake, tsunami, and nuclear disaster as well as the key communication strategies for affected employees and their families.

## Overview of Panel Questions

**Question 1 from Leslie Yee to Makiko Yui:**
Can you provide a timeline and an overview on the recent Japan disaster?

**Makiko Yui, M.D., M.P.H.**
Coordinating Doctor, International SOS

- At 2:46 p.m. on March 11, an earthquake struck the northeast coast of Honshu, Japan. The earthquake was followed by a massive tsunami that left more than 15,000 people dead, 8,000 missing and 5,000 injured.
- There was significant disruption to air, rail, road and sea transportation.
- Hospitals and medical facilities were damaged. Oil and gas pipe- lines were ruptured, causing fires. Telecommunications were disrupted. Initially there were food and water shortages due to contamination.
- The damage was not just felt in the affected area. Over 4 million homes in and around Tokyo were initially without power. Several power plants in Japan were also affected.
- The damage done to the Fukushima Daiichi nuclear power plant created cooling problems, especially from March 12 to15, when there were several explosions and fires. Elevated radiation levels were measured in and around the area.
- The Japanese government established an evacuation zone of 20 kilometers from the power plant. The risk of exposure per individual in this area is expected to be above 20 milliSeverts (mSv) over the next year. Those in the area of 20 to 30 kilometers were advised to shelter in place. Children, pregnant women, people who require nursing care and those who were hospitalized were advised not to enter this area. Educational institutions were closed within this evacuation zone.

**Question 2 from Leslie Yee to Koji Wada:**
Having myself dealt with the 1995 Kobe earthquake, 1999 Izmit earthquake in Turkey, and 2004 Asia tsunami, I know how devastating and rapidly evolving these situations can be. What has been the impact of the earthquake and tsunami on the Japan population? What is the status of recovery efforts?

**Koji Wada, M.D., M.Sc.,**
Junior Associate Professor, Department of Public Health,
Kitasato University School of Medicine

- More than 120,000 people were evacuated from the affected area when their homes were damaged.
- Many factories were also destroyed, forcing operations to stop and significantly impacting the economy. Employment is a top priority.
- In some areas, the debris has been cleared and rebuilding has begun. However, people who live along the coastal area that sustained the most damage are still working to remove debris.
- Several teams measured asbestos particles in the air and in damaged buildings. Crews that are removing debris are taking occupational health precautions, wearing protective masks to avoid inhailing the asbestos. Heat stroke has also become an issue.

**Question 3 from Leslie Yee to Thomas McKone:**
What are the radiation risks posed specifically by the Fukushima nuclear accident, as well as by nuclear plant accidents in general?

**Thomas McKone, Ph.D.**
University of California Berkeley and Lawrence Berkeley National Laboratory

- Scientists have been studying radiation health effects since 1895 when x-rays were discovered. Radiation can not only cause direct damage to DNA, but can also cause the formation of reactive compounds.
- A standard measurement of radiation absorbed by the human body is milliSieverts. Background exposure varies between 1 and 6 mSv. A lethal dose of radiation is approximately 4,000 mSv. There have been no fatalities at Fukushima. Fifty mSv is the international standard for workers annually. The threshold just before seeing direct evidence of health effects is 100 mSv. At Fukushima, five percent of the radioactivity in the three cores was released, half each in the air and water. In contrast, 95 percent was released at Chernobyl.
- The populations in Japan were well protected and evacuated quickly. In addition, actions taken at Fukushima were significant as the Japanese government quickly stopped the consumption of food and water from the affected area.

**Leslie Yee's comment:** The restrictions on local food and water consumption was particularly important. That, of course, was one of the key missed opportunities in the immediate management of the Chernobyl disaster.

**Question 4 from Leslie Yee to James Seward:**
Would you comment on the population protective measures that were taken and should have been taken for the radiation risks of the Fukushima nuclear accident? Any comments on potassium iodide prophylaxis?

**James Seward, M.D.**
Medical Director, Lawrence Livermore National Laboratory

- Contamination occurs through external particles settling on people outside, and internally through breathing or ingesting food and water. Immediate food and water restrictions were key.
- In Fukushima, the exposure limit will yield about 3 mSv per year. While this is below the threshold, this dose could still cause health problems over time.
- Measures were immediately taken to evacuate residents within the 20 kilometer area. Those initially asked to shelter in place between 20 and 30 kilometers have since been evacuated.
- People moving in and out of the affected zone are checked for contamination and protective equipment is worn.
- Evacuation measures varied from different countries.There are two fundamental reasons for this:
    - Different criteria for action being used based on different administrative standards.
    - Different assumptions about the severity as well as different risk modeling, including duration of exposure.
- One thing that was not taken into account was prevailing winds. The initial evacuation zones for both the United States and Japan were concentric and should have been more egg shaped.
- Following the event, the Japanese government distributed potassium iodide to those in the affected zone. Potassium iodide is used to prevent the absorption of radiation in the thyroid. The most vulnerable people are those in young age groups. One concern is that its use can have side effects. At Chernobyl, however, few side effects were seen and appeared be relatively safe.

**Question 5 from Leslie Yee to Makiko Yui:**
What's the current situation in Japan?

**Makiko Yui, M.D., M.P.H.**
Coordinating Doctor, International SOS

- Japan is still experiencing aftershocks. As of June 8, there had been three earthquakes that registered more than 7.0-magnitude and more than 500 with a magnitude of more than 5.0.
- The environment, as well as food and water, continue to be monitored daily.

- Seawater is also monitored daily.
    - http://www.mext.go.jp/english/incident/1304192.htm
    - Some seafood is contaminated at levels above the regulatory limits set by the Japanese government, and control measures are in place to prevent its distribution. Test results for all seafood can be found here: http://www.jfa.maff.go.jp/e/inspection/index.html
- As of May 10, all water restrictions have been lifted. Daily readings can be found at: http://www.mext.go.jp/english/incident/1304083.htm
- The topsoil in inhabited areas where levels are unacceptably high has been removed.
- The air is now at stable low levels in most areas and will continue to improve over time. However, as of June 5, Miyagi, Fukushima and Ibaraki continue to report levels above the background level. Readings can be found at: http://www.mext.go.jp/english/incident/1304080.htm
- There have been no immediate health risks recorded to date.

**Question 6 from Leslie Yee to Larry Sebring:**
Since International SOS deals with a large number of corporate customers, what concerns have you seen from multinational corporations as well as Japan-based corporations?

**Larry Sebring, M.D.**
Medical Advisor, International SOS

- Loss of communications capability was an issue.
    - Cell phones were down or spotty for 48 to 72 hours following the disaster. Employers struggled to reach employees and their families.
- Public transportation was shut down and stranded many people in and out of Tokyo.
    - There is a daily commuter population of 10 million people that flow in and out of Tokyo. With transportation down, offices were seeking hotels for their staff, immediately overwhelming the supply.
- Food, water, flashlights were in short supply.
    - Store shelves nearly emptied within two hours after the large aftershock.
- Status of employees in the affected area was hard to gauge.
    - Information was not available due to communications and infrastructure damage.
- After four days, venting of the containment unit and more information on the status of reactors was still being evaluated.
    - Organizations wondered if they should evacuate their employees within Japan (Osaka) or out of the country as Business Continuity Plans were reviewed.
- Rolling power outages affected transportation.
- Daily updates were delivered on the transportation status.
    - Roadways and trains, especially the Shinkansen and Narita Express.
    - Updates on airport status and ticket availability or delays.
- How reliable and accurate was the information coming from the Japanese government?
- Opinions differed regarding the need for evacuation and the safety of travel to Japan from different Departments of State (France, USA, UK).
- There were requests for stockpiles of Iodine Prophylaxis.
- There were requests for counseling for post-traumatic stress disorder (PTSD) for expatriates and national employees (mainly from multinational companies).
- There were requests for Geiger counters and protective gear.
- Instructions for decontamination areas and procedures were presented.
- Food and water safety was a concern.
- Instructions in case of high levels of exposure due to plume from escaped gas were needed.
- Testing of industrial materials and products coming from the site was needed.
- When can we move our staff back to Tokyo? Is it safe? When will it be safe?

**Question 7 from Leslie Yee to Baruch Fischhoff:**
Given the general agreement that the radiation risk communications for the Fukushima accident were mishandled, what are the general principles of risk communications that ought to be observed in managing these types of disasters?

**Baruch Fischhoff, Ph.D.**
Howard Heinz Professor, Carnegie Mellon University
Chairman, U.S. FDA's Risk Communications Advisory Committee

- Identify people who may need information and determine what decisions they will need to make. Find out what their current beliefs are as well as their knowledge base. Draft a communication plan and make sure time is spent evaluating and testing the plan with the people who may face those situations. Improve these communications over time.
- Once plans are established, put them in the hands of people who can disseminate the information in the event of a crisis.
- Plans require using scientific expertise about radiation and health effects, coupled with people who understand behavior and are able to create and evaluate communications. If no testing is done, people are relying on the intuition of those who are handling the communications. They may not understand their audience, particularly when they are diverse and not in direct contact.
- Often, communications are done well when people have the advantage of dealing with disaster professionals or have access to experts like those at International SOS. Those without that expertise are often left adrift, with no authoritative sources of information and no tested messages.
- There are two speculations of why people do not have plans in place:
  - Psychological: Many people exaggerate how well they communicate and think they understand their audience.
  - Lack of leadership: They view communication plans as an after thought rather than a strategic aspect of their operation.
- Risk communication plans are necessary before and after a disaster strikes.

**Question 8 from Leslie Yee to Robert Catlin:**
Given your experience in dealing with the Three Mile Island, Chernobyl, and other nuclear incidents, would you comment on any key insights from these earlier disasters that should have been applied in managing the Fukushima nuclear accident?

**Robert Catlin, C.H.P., L.M.P.**
Co-author, U.S. Department of Energy's Report, "Health and Environmental Consequences of the Chernobyl Nuclear Power Plant Accident" (DOE/ER-0332)

- "Major Disaster Manager Syndrome" encompasses the stages managers typically go through during the first day of a disaster:
  - **Stage 1:** Manager freezes and cannot react.
  - **Stage 2:** Manager thinks that nothing went wrong.
  - **Stage 3:** Something went wrong, but the manager thinks it can easily be fixed internally without any outside assistance.
  - **Stage 4:** Stress builds up because something went wrong, but the manager still feels he or she can address it.
  - **Stage 5:** Approaching disaster, government officials and the general public know what is happening, but the manager is unable to communicate with others.
- The reactors varied at each location:
  - Three Mile Island: Pressurized water facility.
  - Chernobyl: RBMK water coolant which was highly unsafe and unstable at low power. The reactor had no containment structure.
  - Fukushima Daiichi: Boiling water reactor.
- Three Mile Island, March 1979
  - There was significant loss of coolant due to a failure of the feed water pumps, leading to automatic reactor shutdown and drop in pressure. Operator error in valve closure led to failure of emergency feedwater system backup. Pressure drop caused false indication of water in pressurizer although water-free voids had occurred in the system. Water addition was stopped, uncovering top of reactor and causing fuel melting. Fortunately, the melting did not go through the containment structure.

- Chernobyl, April 1986
  - There was an uncontrolled power excursion caused by a low power test during a period of reactor instability. The control rods took twice as long to insert, and their graphite tips increased reactivity on insertion. Steam explosions in the core ignited the graphite block moderator, resulting in the dispersion of radioactive particles and chunks of burning graphite into the air.
  - The fires burned for 10 days. Some 1,900 petabecquerels (PBq) of noble gases and radioactive particulates were released to the atmosphere. An initial cadre of 240,000 workers was called in to help, including staff, army, local police, prisoners, and firemen. Dosimeters, protective clothing, and masks were in short supply. Shielded vehicles and rest stations were used in heavily affected areas.
  - More than 100,000 people were initially evacuated. Later, an additional 40,000 persons out to 100 kilometers from the plant were evacuated. Another 20,000 persons were evacuated from hot spots. In Kiev, 2.4 million people were exposed to 1 to 2 mSv of radiation but were not evacuated.

**Question 9 from Leslie Yee to Thomas McKone:**
Would you comment on the recent IAEA (International Atomic Energy Agency) initiative to improve nuclear safety?

**Thomas McKone, Ph.D.**
University of California Berkeley and Lawrence Berkeley National Laboratory

- The IAEA is trying to be proactive in the lessons learned from Fukushima and apply them to nuclear power plants around the world.
- There are six reactors at Fukushima Daiichi and three were not operating at the time of the earthquake. Following the earthquake, all shut down and went into safe mode. They did not fail until the tsunami hit and a blackout occurred.
- **Lesson one:** Have we done a good job looking at natural disasters, tsunamis, tornadoes, etc., and how they can affect a nuclear power plant?
- **Lesson two:** The batteries at Fukushima were designed to last for three days but started to fail after 20 hours. Why did the batteries not work as designed?
- **Lesson three:** A look at the decision making process revealed flawed decisions about venting gases. The use of sea water for cooling was key, even though it destroyed the reactors.
- It will take a long time to determine all the lessons learned from this disaster. The IAEA is taking initiatives to put this information together and put it into the system to ensure people do not overreact but instead take the proper actions.

**Closing comment from Leslie Yee:** Although we don't have time during this webinar to explore this topic further, I'll close by noting that this discussion clearly underscores the importance of thorough Business Continuity Planning (BCP). Worst-case scenarios tend to occur much more frequently than they ought to, so organizations have a responsibility to conduct detailed BCP planning -- not only to protect their expatriates, local employees, and critical assets, but also to protect their essential business operations from such disruptions. This includes, of course, developing contingency plans for all aspects of their supply chains, including their critical raw material supply operations, order fulfillment, and other customer interactions. This will generally involve analyzing not only your own internal operations but also those of your critical suppliers, distributors, customers, and strategic alliance partners.

## Questions and Answers from Attendees

1. Are there any specific recommendations for those persons required to work within the US State Department 50 mile evacuation/shelter zone?

- We recommend that people not remain within 50 miles of the Daiichi power plant. Many international governments continue to advise their citizens to evacuate the area within 50 miles (80 kilometers) of the plant. They advise that using transport through the area is low risk to health and safety.
- The risk to health outside the Japanese government's designated exclusion zones cannot be quantified. The World Health Organization advises: "Radiation-related health consequences will depend on exposure, which is dependant 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."

2. Is there an increased risk for mosquito-borne illnesses due to natural disasters in Japan? Should we be extra cautious about vaccinations for humanitarian aid workers?

- As far as we know, there are no warnings announced of the risk of mosquito-borne illness increasing mainly due to geo-meteorological reasons. The areas are located in the northern part of Japan.
- The Infectious Disease Surveillance Center (IDSC) recommends volunteer workers undergo these vaccinations in advance of their on-site activities. (http://idsc.nih.go.jp/earthquake2011/IDSC/20110317volunteer.html)
    - 2010/11 Influenza (strongly recommended)
    - Measles (strongly recommended)
    - Hepatitis A (moderately recommended)
    - Tetanus (strongly recommended, especially for those to be exposed to hazards)
    - Varicella plus Mumps (recommended)
- Relief workers may be exposed to bloodborne risks, so Hepatitis B vaccination should be considered. Since we are within Japan's transmission season for Japanese encephalitis virus (May to October), JE virus vaccination should also be considered. JE virus vaccination is customarily only indicated in rural areas of Japan, but infrastructure in disaster zones may be sufficiently disrupted to pose similar risks.

3. Any consensus on criteria for JE vaccination; overview of all recommended travel vaccines.

- According to the Infectious Disease Surveillance Center in Japan, there are only a few Japanese Encephalitis (JE) cases reported each year and they are found in the east and southern part of the country: Kyusyuu, Shikoku, Chugoku, Kinki, Chubu and Kanto where Tokyo is located. (http://idsc.nih.go.jp/disease/JEncephalitis/QAJE02/fig07.gif)
- International SOS recommends the Japanese Encephalitis vaccination if spending time in rural areas, especially if:
    - Travel is during peak transmission periods, generally from:
        - May to November in tropical areas (wet season)
        - July to October in temperate areas
    - Travel is for 30 or more days per year.
    - Travel involves extensive outdoor, evening and nighttime exposure in rural areas (e.g. bicycling, camping, working outdoors, or sleeping in unscreened structures without bednets), especially if spending time near pig farms or rice paddies. These activities may cause high risk, even if the trip is brief.

4. What are the current risks to travelers & expatriates given invalid information provided by the Japanese government, re release vs safety zone?

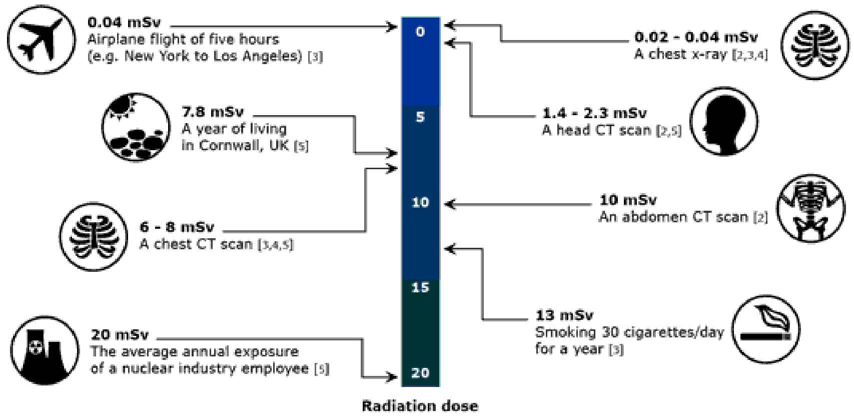
- The situation is dynamic and unprecedented. We advise everyone to monitor developments, and act on the best information available at the time.

5. Did any companies evacuate local nationals from Japan after the earthquake/tsunami?

- Some companies elected to move nationals to Hong Kong and Singapore temporarily as part of business continuity planning during the first weeks after the disaster, when the radiation threat was not yet well defined.

6. What are the radiation exposure levels that should prevent entry to areas for a few hours, a work day, or residents?

- Recommendations on radiation exposure levels are cautious and variable.
- The International Commission on Radiological Protection (ICRP) sets limits on what is considered acceptable for radiation exposure for the public above the natural background, including the radiation which people are exposed to for medical purposes (x-rays, CT scans etc). For the general public, the limit is set at 1 mSv per year. The limit for occupational exposure is much higher, up to 20 mSv averaged over a year.
- See Appendix A for additional information provided by Robert Catlin.




(http://www.internationalsos.com/japancrisis/default.cfm?content_id=257&language_id=ENG)

References:

1. Conversion units from: Armed Forces Radiobiology Research Institute (AFRRI) Pocket Guide.
2. X-ray doses from RADIATION AND YOUR PATIENT: A GUIDE FOR MEDICAL PRACTITIONERS (ICRP)
3. Idaho Department of Environmental Quality Radiation doses and limits.
4. Japanese Ministry of Education, Culture, Sports Science and Technology "Radiation in daily life."
5. Health Protection Agency (HPA UK) "Dose Comparisons for ionising radiation".

7. What is the current risk of Japanese industrial goods produced outside the 100 km perimeter around Fukushima Daichii Nuclear plant to be radioactively contaminated? Is this contamination measured/monitored by authorities, and if so, where can results of this monitoring be consulted?

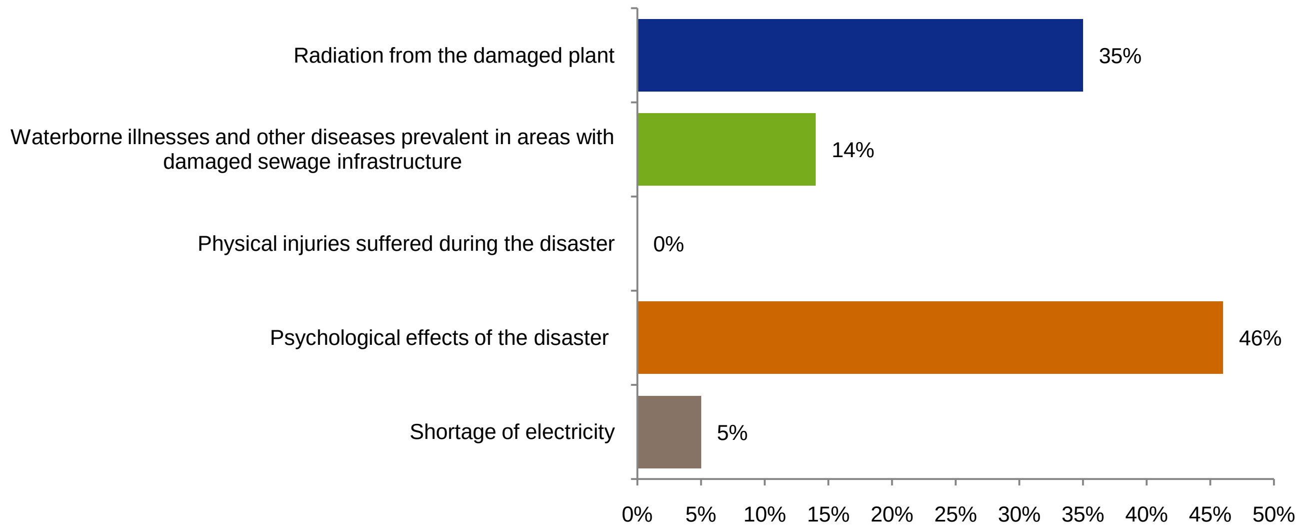
- Authorities continue to monitor radiation levels in the environment, as well as in food and drinking water. Regular updates are published by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). (http://www.mext.go.jp/english/incident/1303962.htm)

8. What should my organization do about screening of passengers who are coming from Japan?

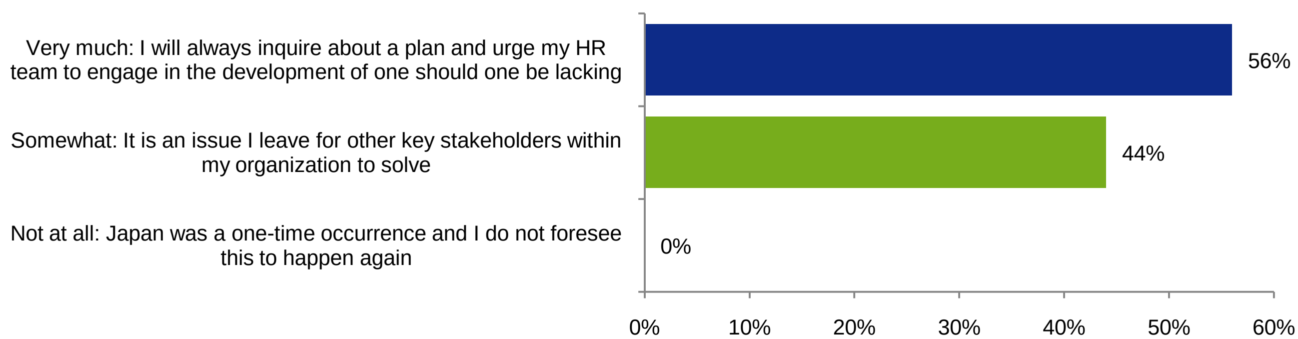
- Outside of the evacuation zone, no special screening is needed for passengers coming from Japan.

## Webinar Poll Results

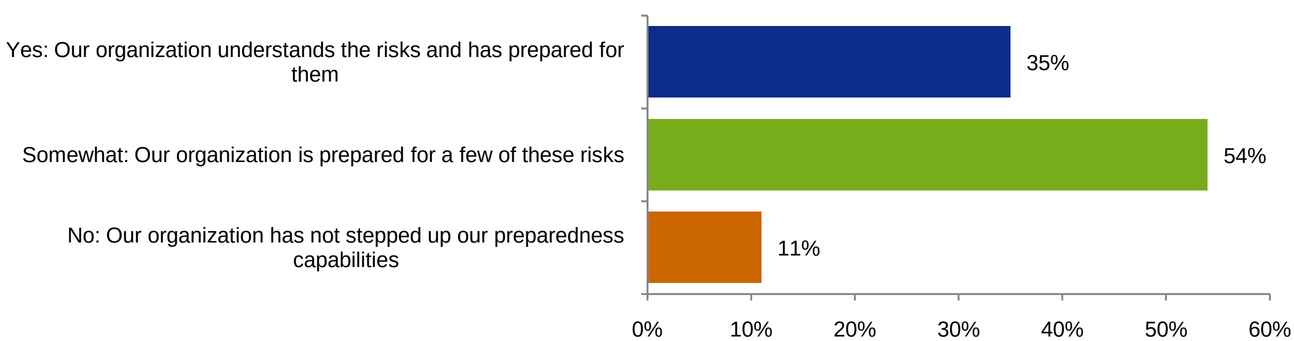
1. What do you feel continues to be the greatest risk facing your employees or members in and around Japan at this point in time?



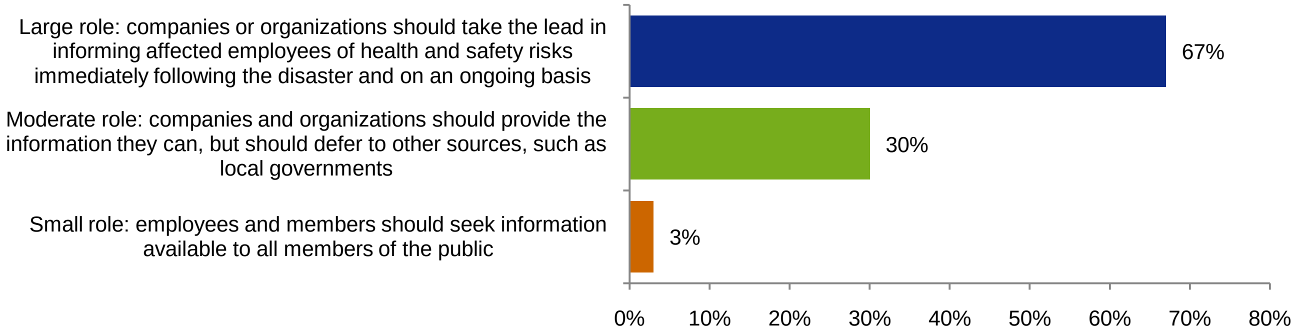

2. Has your decision making process changed as it relates to the importance of inquiring/requiring a disaster response plan as a result of the Japan disaster?



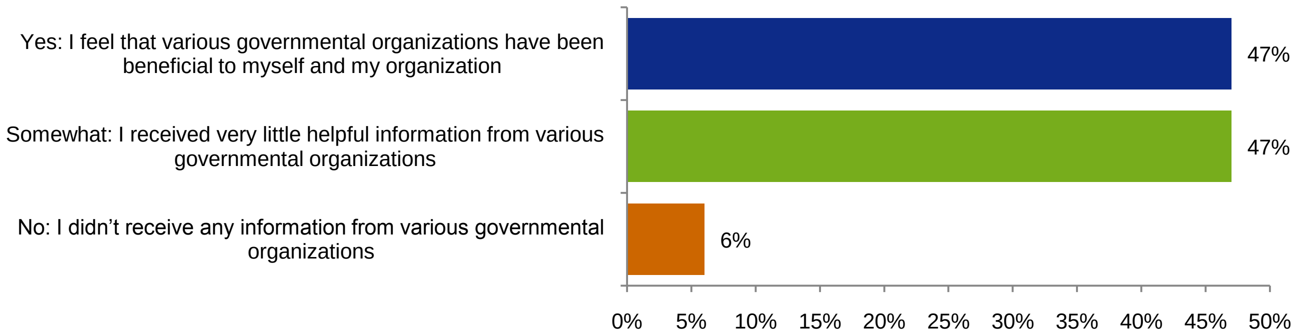

3. Do you feel your organization is better prepared to mitigate these risks today since the earthquake hit?



4. What role does a company or organization have in keeping employees or members informed of risks or hazards that may affect them following a disaster like that in Japan?




5. Do you feel that you were supported by the international community's response to the disaster in Japan?




## Overview of Moderator, Panelists and Host

**Leslie M. Yee, M.D., M.P.H., FACPM, FACP, FACOEM,** President, Skylark Health Strategies, Ltd. (www.skylarkhealth.com), and Chairman, ACOEM International Section

Dr. Yee is President of Skylark Health Strategies, Ltd., which provides consulting services to Fortune 500 corporations in Health & Productivity Management, International Health, New Business Development, Occupational Medicine, and Product Stewardship. Until 2009, he served for almost 15 years as Corporate Medical Director for the Procter & Gamble Company, a multinational manufacturing company with over $80 billion in sales and over 138,000 employees in over 80 countries. Dr. Yee has worked for over 30 years in medical management and has had work assignments and business travel to over 30 countries, including 20 cities in BRIC countries (Brazil, Russia, India, and China), as well as serving for 2 years in Okinawa, Japan.

**Robert Catlin, C.H.P., L.M.P.,** Co-author, U.S. Department of Energy's Report, "Healthy and Environmental Consequences of the Chernobyl Nuclear Power Plant Accident" (DOE/ER-0332)

Robert Catlin retired from the University of Texas Health Science Center in Houston, Texas, where he served as Executive Director of the Clinical and Laboratory Safety Department of the Positron Diagnostic and Research Center, and as Adjunct Associate Professor of the School of Public Health, from 1990 to 1995. He was a member of the U.S. Department of Energy's Committee for Assessing Chernobyl Health Effects, the USSR Academy of Medicine Scientific Conference on Medical Aspects of Chernobyl in Kiev, and the USA-USSR Committee on Civilian Nuclear Reactor Health and Safety in Chernobyl.

**Baruch Fischhoff, Ph.D.,** Howard Heinz Professor, Carnegie Mellon University and Chairman, U.S. FDA's Risk Communications Advisory Committee

Baruch Fischhoff, Ph.D., is a Howard Heinz University Professor, in the Departments of Social and Decision Sciences and of Engineering and Public Policy at Carnegie Mellon University, where he heads the Decision Sciences major. Dr. Bischhoff received his Ph.D. in psychology from the Hebrew University of Jerusalem. He is a member of the Institute of Medicine of the National Academies of Sciences. He chairs the Food and Drug Administration Risk Communication Advisory Committee and the National Research Council Committee on Behavioral and Social Science Research to Improve Intelligence Analysis for National Security.

**Thomas McKone, Ph.D.,** University of California Berkeley and Lawrence Berkeley National Laboratory

Thomas E. McKone, is a senior staff scientist at the Lawrence Berkeley National Laboratory (LBNL) and a Professor of Environmental Health Sciences at the University of California Berkeley School of Public Health. His research focuses on the development, use and evaluation of models and data for human health and ecological risk assessments and on the health and environmental impacts of energy, industrial, and agricultural systems. Dr. McKone has consulted with the International Atomic Energy Agency, the United Nations Environment Program and the World Health Organization. He is a fellow of the Society for Risk Analysis and a former president of the International Society of Exposure Science (ISES). Dr. McKone earned his Ph.D. in nuclear engineering from the University of California, Los Angeles.

**Larry Sebring, M.D.,** Medical Advisor, International SOS

Dr. Larry Sebring joined International SOS in 2002 and has since performed emergency medical evacuations. Dr. Sebring has worked in International SOS clinics and acted as a Coordinating Physician for medical cases in Indonesia, Singapore, Malaysia, Thailand, Cambodia, Laos, China and Japan. Dr. Sebring was working in the International SOS office in Tokyo at the time of the March 11 earthquake. Prior to his career at International SOS, he worked in level one trauma centers in Los Angeles. Dr. Sebring is an American Physician and a graduate of the UCLA Emergency Medicine Program.

**James Seward, M.D.,** Medical Director, Lawrence Livermore National Laboratory

Dr. James Seward is Medical Director at Lawrence Livermore National Laboratory. He holds academic appointments as Clinical Professor of Medicine at UCSF and Clinical Professor of Public Health at UC Berkeley. He teaches in occupational medicine and preventive medicine at the UC Berkeley School of Public Health and serves as Chair of the UCSF Occupational Medicine Residency Advisory Committee. He is Co-Director of the UCSF-UCB Joint Residency Program in Preventive Medicine and Public Health and is a member of the UCSF Global Health Sciences Faculty.

**Koji Wada, M.D., M.Sc.,** Junior Associate Professor, Department of Public Health, Kitasato University School of Medicine

Dr. Koji Wada is a Junior Assistant Professor in the Department of Public Health at Kitasato University. He previously served as a World Health Organization (WHO) consultant in Vietnam, a member of the International Labor Organization (ILO) mission to Thailand for assessing occupational health services, and occupational health physician for the Ebara Corporation and for the Matsushita Center for the Science of Industrial Hygiene.

**Makiko Yui, M.D., M.P.H.,** Coordinating Doctor, International SOS

Dr. Makiko Yui joined International SOS in 2009 to offer a full range of medical assistance to foreign nationals based in Japan as well as Japanese citizens staying abroad. In 2004, Dr. Yui became a certified specialist in Obstetrics and Gynecology and engaged in a broad spectrum of OBGYN practices, i.e. complicated obstetrical emergencies and gynecological oncology (surgical intervention, conservative management with chemotherapy and radiation therapy). Dr. Yui worked at the Japanese Red Cross Medical Center (JRCMC) specializing in Obstetrics and Gynecology and contributed to the medical humanitarian activities. Dr. Yui dedicated herself to the international medical humanitarian activities of the Red Cross in conflict areas and disaster affected areas. These areas included Afghanistan, Iran, Sri Lanka, Indonesia, Philippines, and Kenya.

**Myles Druckman, M.D.,** Vice President, Medical Services, Americas Region, International SOS

Myles Druckman, M.D. is Vice President, Medical Services for International SOS, directing the Medical Consulting Services division in the Americas. In this role, Dr. Druckman leads the development of customized corporate health solutions for multinational organizations, as well as the implementation and evaluation of the programs to ensure they meet the clients' needs. Considered a leading disease outbreak and pandemic expert, Dr. Druckman has served as a resource for international and national media such as *CBS Evening News, CNN*, *CNBC, Forbes* and *Consumer Reports* on topics such as the global management of emerging diseases, pandemic preparedness, and medical crisis management. In addition, Dr. Druckman lectures widely and publishes articles on international healthcare issues.

## About American College of Occupational and Environmental Medicine (ACOEM)

The American College of Occupational and Environmental Medicine (ACOEM) represents more than 4,500 physicians and other health care professionals specializing in the field of occupational and environmental medicine (OEM). Founded in 1916, ACOEM is the nation's largest medical society dedicated to promoting the health of workers through preventive medicine, clinical care, research, and education.

Although this webinar has been co-sponsored by ACOEM's International Section, the viewpoints expressed by the moderator and panelists are not necessarily those of ACOEM. For more information about the American College of Occupational and Environmental Medicine, contact http://www.acoem.org.

## About International SOS

International SOS (http://www.internationalsos.com) is the world's leading international healthcare, medical and security assistance, and concierge services company. Operating in over 70 countries, International SOS provides integrated medical, clinical, security, and customer care solutions to organizations with international operations. A global team of over 8,000 employees led by 970 full-time physicians and 200 security specialists provides services including planning, preventative programs, in-country expertise and emergency response to 66 percent of the Fortune Global 500 companies.

**International SOS would like to express sincere condolences to all the victims and their families.**


The International SOS Japan Crisis website (http://www.internationalsos.com/Japancrisis) was created shortly after the tsunami and nuclear disaster for members. This site was maintained 24/7 by a team of medical and security experts.

## Appendix A
**Provided by: Robert Catlin**

Response for Radiation Worker:
To answer appropriately, the status of the person desiring entry needs to be identified. Is this individual an adult radiation worker, and is the situation involved one of routine operations status or, rather, an emergency one? What is the nature of the exposure environment to be entered, and are there other eminent hazards associated with the radiation environment involved, such as chemical or physical hazards? Is the radiation field of high or low level, and is it uniform or spotty? Has the worker already accumulated a high burden of exposure, or, conversely, little? Are the risks to be encountered solely those from external radiation, or are there inhalation and/or contamination problems involved in the entry? Is the present radiation field likely to remain constant or change markedly while entry is being made? For what purpose is this entry to be made, e.g., routine work; surveillance; risk definition; emergency operations; equipment recovery; acute risk reduction; action to protect public; or volunteer (avert major nuclear escalation; lifesaving; or prevention of serious injuries)?

For perspective, TEPCO limits for radiation worker doses may be contrasted with Chernobyl experience (see CAREC Report (4 August 1986) to Office of Health and Environmental Research, USDOE; and USDOE Report DOE/ER-0332 (June 1987)):

TEPCO Radiation Dose Limits for Workers:

| | |
|---|---|
| Normal operations radiation dose limit: | 1 mSv/y |
| Nuclear Emergency radiation dose limit: | 5 mSv/y |
| Nuclear Emergency upper dose limit: | 250 mSv/y |
| Natural radiation background: | ~2.4 mSv/y (range 1 to 10 mSv/y) |

On June 14, 2011, TEPCO withdrew a worker exposed to more than 100 mSv internal radiation.

6 Sv – risk of death within days or weeks
1 Sv – risk of cancer later in life (5 in 100)
100 mSv – risk of cancer later in life (5 in 1,000)

Chernobyl Worker Radiation Dose Experience:

| Acute Radiation Sickness | Deaths | Survived | Dose Range |
|---|---|---|---|
| Initial Responders: | 21 | 1 | 6-16 Gy |
| | 7 | 16 | 4-6 Gy |
| | 1 | 52 | 2-4 Gy |
| | 0 | 105 | 0.8-2 Gy |
| Total | 29 | 174 | |

| Other Radiation Workers: | Number | Dose Level | Dose Range |
|---|---|---|---|
| Liquidators: | 240,000 | High | > 100 mSv / 20y |
| Liquidators: | 360,000 | Low | < 100 mSv/ 20y |
| Natural Background: | | | 48 mSv / 20y |

The purpose of the data listed above is to show that knowledge of the projected exposure environment is necessary to determine how much additional radiation exposure may be tolerated in terms of the risk to health of the worker. TEPCO has reported high radiation exposure areas, but the actual radiation field levels and their locations have not been identified. Further, it is possible that such fields will change over time as recovery and stabilization operations take place.

Response for Member of General Public:
Again, it is necessary to examine the status of the member of the general public, whether a single individual, a small group of people, a regional group, or a significant portion of the population. Is the individual or group thereof residing within a locale to which protective actions such as sheltering, evacuation, or other controls have been applied? Does the radiation exposure risk from entry arise from external fields of penetrating radiation, from airborne radioactivity, from possible intake of contaminated foodstuffs or water, or from likely contamination of the self and others by bodily contact? What are the risk tradeoffs for sheltering *vs* evacuations for the general public? How are these modified by the changing radiation risk status over time?

For example, after the initial explosion at Chernobyl, the radioactive residues and charcoal moderator blocks burned for the next 6 days. During that time, the wind distribution of the plume rotated geographically through 360 degrees. Citizens at Pripyat, the closest town to the reactor, were not informed of the accident immediately. Only after a 36 hour delay was evacuation ordered. Families were moved directly though the ground level plume, resulting in exposures that could have been prevented by proper planning. A broader evacuation of 116,000 persons was started on May 5, ten days after the initial event. The following table shows the various evacuations made, and the estimated dose ranges for each group (note that some dose estimates are given in *absorbed* dose in Grays, rather than in *effective* dose equivalents in Sieverts).

Initial Actions – Chernobyl/Kiev Environs:

| Number of Persons | Actions | Estimated Range of Radiation Dose ($1^{st}$ y) |
|---|---|---|
| ~100,000 | Evacuated within 30km (Chernobyl) | 0.05 to ~0.5 Gy |
| 40,000 | Additional evacuated (out to 100km) | 0.6 mSv |
| 20,000 | Later evacuated (hot spots) | Several mGy |
| 2,400,000* | Exposed (Kiev area) | 1 to 2 mSv |

*Includes 40,000 persons evacuated, listed above. (from CAREC Report, 4 Aug. 1986, Table 6)

The relocation criterion for areas affected by Chernobyl releases was set at 350 mSv/lifetime. The average personal exposure in Belarus, where no evacuations were made, was 31 mSv.

At the TMI event, that began on Mar. 30, 1979, the Governor ordered a pre-cautionary evacuation of pre-school children and declared pregnant women within a 5 mile radius. Most returned by April 4th. The average dose to persons within a 16 km radius of the TMI accident was 0.08 mSv during the accident. The average dose to 2 million people was about 0.01 mSv (1 mrem). Natural radiation background was about 2.4 mSv /y (range 1-10 mSv /y). Radioactive xenon gases and particulates were released from the reactor systems at Fukushima Daiichi following the earthquake and tsunami on Mar. 11, 2011. Further releases were aided by hydrogen explosions at unit 1 on Mar. 12, at unit 3 on Mar. 14, and at units 2 and 4 on March 15. Radioactive contamination was also found in ground water, sea water near the facility, foods, and land areas. A series of evacuation orders were issued to protect the local populations, starting as follows:

1. Evacuation order for people living within 3 km (1.9 mi) of plant.
2. Order expanded to 10 km (6.2 mi) radius.
3. Air traffic restricted to 10 km (6.2 mi) radius.
4. Evacuation order expanded to 20 km (12 mi) radius on Mar. 12.
5. Evacuation ***advisory*** issued to 30 km (19 mi) radius on Mar. 15.
6. Air traffic no-fly zone issued to 30 km (19 mi) radius on Mar. 15.

The United States also issued a restricted access advisory for non-essential U.S. persons to stay outside a 50 mile (80 km) of the plant.

The estimated size of the Japanese populations associated with these different evacuation radii are as follows:

20 km evacuation radius – 77,000 citizens
30 km evacuation radius – 139,000 citizens
50 mi US advisory – ~1,000,000 citizens

Airborne surveillance data indicate that the radioactive debris releases from Fukushiima Daiichi are deposited in a non-uniform manner and may result in local hot-spots. Further analyses of the radioactive contributions to exposure are needed to determine whether the current use of radius-defined evacuation areas is sufficient, or whether zones within these areas need to be relaxed or made more stringent. Such situations occurred in the Chernobyl experience, where some restrictions were relieved or additional delayed evacuations were needed to reduce radiation doses to individuals. The extent to which the earthquakes and tsunamis in Japan were factored into decisions that established the evacuation perimeters is not known.