IAEA MINISTERIAL CONFERENCE

Director general to set out post-Fukushima action plan

Following the Fukushima Daiichi accident, the IAEA reacted quickly to lead the international response, calling almost immediately for a high-level global conference on nuclear safety.

The damaged reactor buildings at Fukushima Daiichi (Photo: Reuters/DigitalGlobe/Handout)

SPEAKING ON THE last day of the IAEA Ministerial Conference on Nuclear Safety, held June 20–24 in Vienna, Yukiya Amano, director general of the International Atomic Energy Agency, said that the meeting had achieved its main goal, "which was to pave the way for an enhanced post-Fukushima global nuclear safety framework." Amano's next task is to set out an action plan to implement the recommendations of the conference's working sessions in response to events at Fukushima Daiichi, taking into account the guidance for action given by government ministers at the meeting. He is to submit his plan to the IAEA Board of Governors and the General Conference in September.

Immediately realizing the potential impact on the global nuclear community of the events that were unfolding at Fukushima Daiichi, Amano had called for this conference on March 30, less than three weeks after the earthquake and tsunami struck on March 11. His overall objective was to identify and to draw on the lessons from the accident in order to strengthen nuclear safety throughout the world. The conference provided government ministers and senior officials a relatively thorough, albeit preliminary, assessment of the accident to date and an opportunity to discuss broader issues relating to nuclear safety and the role that the IAEA should play.

The request for the director general to draft a post-Fukushima action plan came in the Ministerial Declaration, which was adopted at the end of the first day of the meeting. The declaration calls for improvements in nuclear safety, as well as action on other issues addressed at the conference, and demands that Japan provide the IAEA with a comprehensive and fully transparent assessment of the Fukushima Daiichi accident to help all countries understand what happened so that they can take appropriate measures. According to the IAEA, the action plan will take into account the lessons learned from the accident and will reflect other findings and recommendations of the conference, which also examined emergency preparedness and response and the international legal framework for nuclear safety.

Amano

At the opening of the meeting, Amano said that the conference "is crucial for the future of nuclear power. It is imperative that the most stringent safety measures are implemented everywhere." He put forward his own proposals for improving global nuclear safety in light of the Fukushima Daiichi accident. These proposals, which were consistent with the recommendations that came out of the working sessions, included strengthening nuclear safety standards; systematically reviewing the safety of all nuclear power plants to enhance the effectiveness of national nuclear regulatory bodies and ensure their independence; strengthening the global emergency preparedness and response system; and expanding the IAEA's role in receiving and disseminating information.

On the final day of the conference, Amano said that the aims of the ministerial declaration "must be translated into action—and will be." The declaration, he said, "expresses the firm commitment of IAEA member states . . . that these measures are actually implemented." He added, "Collectively, our member states have expressed their sense of urgency, as well as their determination that the lessons of Fukushima Daiichi will be learned and that the appropriate action will be taken."

Continued

By the meeting's end, Amano was already responding to the recommendations of the working sessions. He asked that the IAEA's Commission on Safety Standards begin reviewing safety standards on the basis of the views expressed by member states during the conference. He also asked that the INES Advisory Committee consider ways of making the International Nuclear and Radiological Event Scale more effective as a communication and information tool. "We will also press ahead with detailed proposals in other areas for which we have direct responsibility, such as implementing an expanded program of expert peer reviews."

Amano said that he is pleased that member states recognize the central role of the IAEA and that there is an acceptance, if not yet an agreement, that a significant enhancement of the agency's nuclear safety budget is needed. And judging by discussions he has had with ministers, he said, it will be forthcoming.

Finally, Amano said that the primary goal is simple: to make nuclear power plants as safe as humanly possible, as quickly as possible. However, he added, "It is also important to rebuild long-term public confidence in the safety of nuclear power. For that, tangible outcomes are needed, and we must maintain our sense of urgency. . . . I am confident that as a result of this conference, measurable and lasting improvements will be made in the safety of all nuclear power plants."

As with other IAEA meetings, the conference consisted of daily plenary sessions that provided an opportunity for governments to explain how their countries have been affected by and are responding to the events in Japan and to put forward their own views on the consequences. There were also three working sessions that allowed senior technical officials and experts in nuclear safety to discuss the accident and to draw lessons and recommend actions. Summaries of the working sessions, including recommendations, were presented at the closing plenary session on June 24.

Working Session #1

Lessons learned and actions to be taken

The first working session, "Preliminary Assessment of the Accident and Actions for Safety Improvements," began with a presentation of the results of the IAEA's first fact-finding mission to Japan by Mike Weightman, the mission's team leader and Britain's chief nuclear inspector, who also chaired the session.

The IAEA's most important activities include the development of international safety standards, which have been adopted by most countries engaged in nuclear technology, and the provision of expert peer review services, such as the Integrated Regulatory Review Service, Operational Safety Reviews, and Emergency Preparedness Reviews. This session called for the IAEA to strengthen international safety standards in all areas related to design requirements, with particular emphasis on defense-in-depth, low-probability beyond–design basis accidents (singly and in combination), and severe accident management for single-unit and, more particularly, multiunit sites, including an extended loss of ultimate heat sink and essential supplies, hydrogen management, post-accident monitoring, and safety of spent fuel storage.

Other topics discussed included the use of hardened on-site emergency response centers and the availability and capability of site staff to work under severe accident conditions.

The participants emphasized the importance for countries with nuclear programs to systematically review the safety of their nuclear plants. In the wake of the accident, countries have been implementing national stress tests—safety assessments to determine how reactors would behave if challenged by extreme environmental conditions. These reviews assess safety margins and design basis assumptions, taking into account low-probability extreme events previously not included in original design and engineering considerations. It was suggested in this session that the IAEA coordinate an effort to develop an international methodology for performing these reviews.

The session's summary document also put forward various ways of expanding the IAEA's review services. One proposal was that the IAEA organize peer reviews of the national reviews, which would make them more credible and add to public confidence in nuclear plant safety. Another proposal was that the use of the IAEA's safety review services be made mandatory, although there is resistance to this by some countries. Another suggestion was to establish a new service to provide peer reviews of plant designs, with a recommendation that the results of the peer reviews be publicly available.

Receiving and disseminating information

Another of the agency's major roles is collecting and disseminating information that has been authenticated and validated. For the Fukushima Daiichi accident, the IAEA quickly became the international point of contact for information. The working session participants called on the agency to continue this role and to extend it by collecting the results of all relevant analyses of the accident and the lessons learned from it. It was also suggested that the IAEA expand its role in this area to include an analysis of the information received and even to predict how systems, structures, and components will behave during accidents.

This session also identified the sharing of operational experience as a vital tool for learning lessons from accidents and asked that the IAEA further consolidate operator and regulatory experience. In this regard, the IAEA and the World Association of Nuclear Operators should establish a mechanism to improve their cooperation in sharing experience and, in particular, to learn lessons from the Fukushima Daiichi accident.

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The IAEA, among others, had found that for the Fukushima Daiichi accident, the INES did not provide to the public an adequate appreciation of the event. The session's summary report suggests that improvements are needed to make the INES more effective from a communications point of view. The summary report also suggests that the IAEA's practice of undertaking fact-finding missions be "institutionalized" in the case of nuclear accidents. The criteria for invoking such missions could be linked to the INES.

Working Session #2

Emergency preparedness and response

The second working session, on measures to strengthen emergency preparedness and response, was chaired by Alumanda de la Rosa, director of the Philippine Nuclear Research Institute. This session examined the initial response to the accident, identified some lessons learned, and considered the way forward in dealing with major nuclear accidents.

The session recommended that the IAEA's role in the area of radiation emergencies be broadened to enable it to conduct analyses of emergency conditions and their progression, possible scenarios for emergency development, and associated radiological impact and response actions, and that the agency share these analyses with member states. The session summary also calls for undertaking Emergency Preparedness Reviews at more plants to appraise

emergency arrangements and capabilities to ensure their continuous improvement.

While the IAEA Safety Standards on preparedness and response to severe reactor emergencies were judged adequate even after the Fukushima Daiichi accident, the standards are expected to be enhanced as a deeper understanding of this accident develops. The session summary also suggests that additional guidance on taking protective and other actions following a release of radioactivity be developed by the agency.

The summary document also notes that there is a growing number of real-time online radiation monitoring systems in operation or being developed worldwide that could be useful in emergency situations. It suggests that by integrating these systems, a global radiation monitoring platform could be created that is able to display real-time data on radioactive releases.

It would also be helpful, according to the summary document, for standardized and reliable methodologies to be put in place in all member states to estimate accident source terms, to analyze and evaluate radiological monitoring data, and to assess radiological impacts to the population in affected areas via all exposure pathways.

At the national level, the summary says, the universal implementation of the IAEA Safety Standards on emergency preparedness and response would improve capabilities, facilitate communication to the public during an emergency, and contribute to harmonizing national criteria for protective and other measures. The session also recommended that the capabilities and arrangements of national authorities to communicate risk to the public be strengthened. The summary suggests that states may wish to consider establishing national rapid response teams that could be made available internationally.

Working Session #3

The global nuclear safety framework

The impact of the accident on the "global nuclear safety framework" was considered in the third working session, which was chaired by Richard Meserve, chair of the International Nuclear Safety Group and a former chairman of the U.S. Nuclear Regulatory Commission.

Meserve's summary of the session explained that the international nuclear safety framework encompasses a variety of organizations that reinforce efforts to secure safety, with the primary responsibility resting with plant operators and national regulators. These organizations are linked to each other by a cluster of conventions and other arrangements to achieve common safety objectives. Within this framework, the IAEA's activities, most notably in setting standards and conducting peer reviews, ensure the agency a central role.

Convention on Nuclear Safety

The Convention on Nuclear Safety forms an important part of the global nuclear safety framework. The summary document suggests that in the wake of the Fukushima Daiichi accident, the convention's effectiveness should be reviewed in order to ensure that all safety issues are fully considered. A possible amendment to the convention proposed by session participants is to incorporate stronger requirements for regulatory independence, which is believed to be a fundamental requirement for improving nuclear safety. Regulatory systems need to operate in an environment without political influence and undue financial constraints, the summary document says, and regulators should be empowered to make timely safety decisions. Other suggestions for enhancing the convention were to strengthen the requirements for transparency, emergency preparedness, and peer review.

Safety standards

IAEA Safety Standards represent a common reference for nuclear safety. According to the agency, however, not all states apply them, and those that do may not always implement them fully. The summary report says that it is important that all countries

make their national safety standards consistent with those of the IAEA.

As the details of the Fukushima Daiichi accident become clearer, the IAEA should review and update its safety standards to incorporate the lessons learned, the summary says. Special attention needs to be paid to those standards pertaining to multiple severe hazards, such as tsunamis and earthquakes, and their impact on single-unit and multiunit sites. The standards that deal with preparedness for prolonged power blackouts and with the cooling of reactors and spent fuel storage facilities under severe accident conditions should also be reviewed, the summary notes.

The agency should consider the implications of the accident in its peer reviews and should ensure that the lessons learned and the resulting good practices are widely shared.

International peer reviews

Besides providing recommendations to improve safety, IAEA peer reviews serve to exert peer pressure to ensure that countries with nuclear installations recognize their safety responsibility and are able and committed to meet IAEA Safety Standards. According to the session summary, these reviews should be reinforced to ensure that there is continuous improvement of safety and regulation. It adds that the agency should consider the implications of the Fukushima Daiichi accident in its peer reviews and should also ensure that the lessons learned from the accident and the resulting good practices developed by member states are widely shared.

There are concerns that not enough states are taking advantage of the IAEA's review services, which are currently being carried out on a voluntary basis. Moreover, there are instances where reviews have been carried out with no follow-up to monitor the implementation of recommendations. Nevertheless, the agency has said that because of peer pressure, it expects that more countries will be asking for reviews and making a commitment to follow the advice given.

A proposal was made that peer review services be accorded a greater profile to enhance public confidence in the national and international arrangements for safety. In this regard, the schedule of planned peer review missions and any follow-up missions should be published along with the mission results. Those that have had peer reviews could be identified, along with those that have yet to participate.

There was also a suggestion that the IAEA develop a peer review service similar to the stress tests that many countries are conducting in response to concerns raised by the Fukushima Daiichi accident. This new service would look particularly at safety margins against extreme natural hazards, such as earthquakes, tsunamis, and floods, and on the regulatory implications of the Fukushima accident. Such assessments could be carried out within the next 12 to 18 months. The lessons learned, including an assessment of the regulatory responses to the Fukushima accident, should also be incorporated into the other review services.

Another suggestion was that the IAEA, with some reinforcement of its present capabilities, could conduct international safety reviews of one nuclear power plant in 10 over a period of three years. This would serve to assure the public of the overall level of safety at the world's plants, since reviewing all 440 operating nuclear reactors around the world in a short period of time is not realistic.

Other recommendations that will enhance safety and public confidence made during the sessions include:

Transparency—The Fukushima Daiichi accident has understandably shaken public confidence in the safety of nuclear activities. These concerns should be openly acknowledged and honestly confronted. Transparency in dealing with safety-related issues is an important component in building public confidence.

Newcomer countries—Countries embarking on nuclear power programs need to participate fully in the global nuclear safety framework, including signing on to international legal instruments, applying IAEA Safety Standards, and making use of the IAEA peer review services. These activities will contribute to building the necessary national infrastructure, including an emergency preparedness and response program that is essential for safety. They must also demonstrate the capability to manage severe accidents before the startup of their first nuclear installation.

Research—The Fukushima Daiichi accident will provide the opportunity for safety research on fuel performance and accident progression, among other matters. More generally, the report stresses that scientific knowledge of nuclear technology—notably, the integrity and behavior of systems, structures, and components, including fuel elements—will be vital in responding to an emergency. Countries are encouraged to utilize research and development more effectively in these areas and in those of nuclear safety and emergency preparedness and response.—*Dick Kovan*

REPORTS

Fukushima Daiichi accident offers lessons for all

Two key reports on the accident at Japan's Fukushima Daiichi nuclear power station caused by the earthquake and tsunami of March 11 identify a series of lessons for Japan specifically and for the global nuclear community as well. The reports—one by the Japanese government and the other by the international fact-finding mission organized by the International Atomic Energy Agency—were presented at the IAEA Ministerial Conference on Nuclear Safety, held June 20–24 in Vienna.

The IAEA mission—which was made up of experts from Argentina, China, France, Hungary, India, Indonesia, Russia, South Korea, Spain, Turkey, the United Kingdom, and the United States—considered the Fukushima disaster an event apart from other major nuclear accidents. Its report argues that the 15 conclusions and 16 lessons learned during the mission will help the international nuclear community "take advantage of the unique opportunity created by the Fukushima accident" to improve nuclear safety worldwide.

The Japanese report also states that Fukushima differed from earlier major reactor accidents, such as those at Three Mile Island and Chernobyl, because the Fukushima accident was a case of a natural disaster that caused a "knot of accidents" involving multiple reactors at the same time. It also stood apart in terms of emergency response activities, which "had to be performed in a situation where the earthquake and tsunami had destroyed the social infrastructure such as electricity supply, communication, and transportation systems across a wide area in the vicinity." In addition, the occurrence of aftershocks frequently impeded accident response activities.

Mission report

The IAEA's international fact-finding mission to Fukushima Daiichi took place between May 24 and June 2. An important observation of the mission is that the IAEA Fundamental Safety Principles (<http://www-pub.iaea.org/MTCD/publications/PDF/Pub1273_web.pdf>) are shown to provide a "robust basis in relation to the cir-

cumstances of the Fukushima accident and cover all the areas of lessons learned from the accident." The mission report goes so far as to declare that given the extreme circumstances of the accident, its local management was "conducted in the best way possible." Furthermore, it also notes that the accident managers followed Fundamental Principle 3, "Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks."

The first lesson in the mission report is that considering external natural hazards, the design and siting of nuclear plants should include sufficient protection against infrequent and complex combinations of external events; plant layout should be based on maintaining a "dry site concept"; common cause failure should be particularly considered; changes in external hazards or the understanding of them should be periodically reviewed; and an active tsunami warning system should be established.

For severe accident situations—such as a total loss of off-site power or the loss of all heat sinks or engineered safety systems—simple alternative sources for these functions should be provided. These should be located at a safe place, and plant operators should be trained to use them.

Nuclear sites should have seismically robust and suitably shielded, ventilated, and well-equipped buildings to house emergency response centers that are large enough and sufficiently provisioned to maintain the welfare and radiological protection of the workers needed to manage the accident. Severe accident management guidelines and associated procedures should take into account the potential unavailability of instruments, lighting, and power.

The risk and implications of hydrogen explosions should be revisited and necessary mitigating systems implemented. In relation to preventing the loss of safety functionality, the robustness of defense-in-depth against common cause failure should be based on providing adequate diversity, as well as redundancy and physical separation, for essential safety functions.

The report states that "greater consideration should be given to providing hardened systems, communications, and sources of monitoring equipment for providing essential information for on-site and off-site responses, especially for severe accidents."

The use of long-term sheltering is not an effective approach and has been abandoned, the mission report notes. Concepts of "deliberate evacuation" and "evacuation-prepared area" have been introduced for effective long-term countermeasures using the guidelines of the International Commission on Radiological Protection and the IAEA.

The mission report recommends that the international nuclear community take advantage of the information from the accident to improve and refine existing methods and models to determine the source term involved in a nuclear accident and to refine emergency planning arrangements. Another lesson is that "large-scale radiation protection for workers on sites under severe accident conditions can be effective if appropriately organized and with well-led and suitably trained staff."

Nuclear regulatory systems should ensure that regulatory independence and clarity of roles are preserved in all circumstances.

Fukushima experiences could also be applied to improve current exercises and drills for on-site workers and external responders in order to establish effective on-site radiological protection in severe accident conditions. And finally, the accident underlines that nuclear regulatory systems should ensure that regulatory independence and clarity of roles are preserved in all circumstances, in line with IAEA safety standards.

Report from Japan

According to the government report on the lessons learned so far, those specific to Japan and those relevant to other nuclear sites fall into five categories: coping with a severe accident; adequacy of early response; adequacy of emergency response to the nuclear element in the accident; robustness of the safety infrastructure established at nuclear power stations; and lessons learned from reviewing the thoroughness of the plant safety culture.

The 12 000-word report elaborates on each category in some detail. Category 1, for example, describes eight lessons learned regarding the need to strengthen preventive measures against a severe accident. The first lesson is that Japan needs to strengthen defenses against earthquakes and tsunamis specifically, although the report does note that the March 11 earthquake was extremely massive and was caused by "plurally linked" active seismic centers.

"As a result, at the Fukushima Daiichi nuclear power station, the acceleration response spectra of seismic ground motion observed on the basemat exceeded the acceleration response spectra of the design basis seismic ground motion," the report says. "Although damage to the external power supply was caused by the earthquake, no damage caused by the earthquake to systems, equipment, or devices important for nuclear reactor safety . . . has been confirmed. However, further investigation should be conducted, as the details regarding this situation remain unknown."

The report notes that the tsunami waves that hit the plant were 14–15-m high, substantially exceeding the height assumed in the design. "The tsunami severely damaged seawater pumps [and other equipment], causing the failure to secure the emergency diesel power supply and reactor cooling function." Furthermore, flooding from a tsunami was not assumed. In terms of the design, the recurrence of large-scale earthquakes is "appropriately considered," but the design to protect against tsunamis has been "based on tsunami folklore," according to the report.

The report commits authorities in the future to fully consider a plant's ability to cope with a number of linked seismic centers, as well as to strengthen the seismic quake resistance of external power supplies. Regarding tsunamis, from the viewpoint of preventing a severe accident, the authorities will assume "appropriate frequency and adequate height of tsunamis" to ensure safety. A design will then be undertaken to provide protection against such an event. Recognizing the risk of a tsunami exceeding the ones allowed for in the design, however, further defense-in-depth measures are to be implemented to ensure that important safety functions are available to manage the flooding and huge destructive power of the tsunami waves.

The other seven lessons learned under the first category include remedial measures under the following headings:

- Ensure power supplies.
- Ensure robust cooling functions of reactors and primary containment vessels (PCV).
- Ensure robust cooling functions of spent fuel pools.
- Thorough accident management measures.
- Response to issues concerning sites with more than one reactor.
- Consideration of plant arrangement in the basic design.
- Ensuring the water tightness of essential equipment facilities.

Ensure power supplies

A major cause of the accident, the report notes, was the failure to secure power supply at the plant. Power sources were not diversified, and some important electrical equipment, such as switchboards, was not

built to withstand severe environments such as flooding. Another deficiency was that the life of emergency batteries was short compared with the time required to restore AC power supply. In fact, there was no clear idea of how long it would take to recover external power supply.

In the future, according to the report, Japan has a goal of ensuring that power is secured for a much longer time, even under severe emergency conditions, through the diversification of power supply sources. These would include air-cooled diesel generators and gas turbine generators, as well as the deployment of power-supply vehicles, the installation of switchboards and other equipment that can tolerate environmental extremes, the provision of generators for battery charging, and other measures.

Japan has a goal of ensuring that power is secured for a much longer time through the diversification of power supply sources.

Ensure robust cooling functions of reactors and PCVs

The final heat sink for the reactor was lost due to the failure of the seawater pumps. Although reactor cooling by water injection was activated, core damage could not be prevented due to a cluster of failures involving, for example, the loss of power and PCV cooling functions, as well as other difficulties. The report says that robust alternative cooling for the reactors and PCVs would be secured by providing additional final heat sinks, along with a diversified water injection capability, and by introducing air-cooling systems and other means of removing heat.

Ensure robust cooling functions of spent fuel pools

The loss of power supply also meant that the normal means of cooling the spent fuel pools was lost, requiring the external injection of water to maintain cooling of the fuel. The risk of a major accident at a spent fuel pool had hitherto been deemed small compared with that of a reactor core event, and alternative means of cooling had not been considered. In the future, "Japan will secure robust cooling measures by introducing alternative cooling . . . such as a natural circulation cooling system or an air-cooling system, as well as alternative water injection [capability] in order to maintain the cooling of spent fuel pools, even in case of the loss of power supplies."

Thorough accident management measures

Although some accident management measures had previously been implemented at Fukushima, during the actual event, some did not function or turned out to be inadequate. Also, in Japan, operators basically regard accident management measures as voluntary, not legal requirements. Furthermore, the accident management guideline has not been reviewed since it was developed in 1992. Japan has now undertaken to "change the accident management measures from voluntary safety efforts by operators to legal requirements." New accident management measures will be developed to prevent severe accidents. This will involve a review of design requirements utilizing a probabilistic safety assessment approach.

Response to issues concerning sites with more than one reactor

The report notes that the March 11 accident affected more than one reactor at the same time, and the resources needed for accident response had to be dispersed. In the future, measures will be taken to ensure that emergency operations at one reactor can be conducted independently of those at other reactors if there is more than one reactor at the site. "Also," the report says, "Japan will assure the engineering independence of each reactor to prevent an accident at one reactor from affecting nearby reactors."

Measures will be taken to ensure that emergency operations at one reactor can be conducted independently of those at other reactors.

Consideration of plant arrangement in basic design

There were difficulties in responding to the accident due to the design and layout of the station. For example, with the spent fuel storage pools located relatively high up in the reactor buildings, contaminated water uncontained in these buildings could not be prevented from eventually flowing into the turbine buildings. In the future, Japan will improve the arrangement of facilities and buildings at the stage of basic design to further ensure adequate cooling and to prevent the spread of damage during an accident. For existing facilities, additional measures will be taken to provide an equivalent capability.

Ensuring the water tightness of essential equipment facilities

One of the main impacts of the tsunami was the flooding and consequent unavailability of essential equipment, including seawater pumps, emergency diesel generators, and switchboards, which made it difficult to provide cooling to the reactor and other critical facilities. In the future, Japan will ensure that important safety functions are maintained even in the case of tsunamis greater than the design basis or of extreme flooding of plants located near rivers. The water tightness of important facilities will be ensured by various measures, such as installing watertight doors capable of withstanding the destructive power of tsunamis and floods, blocking possible flooding routes at the plant, and installing drainage pumps.

The report similarly describes the lessons learned so far in each of the following four categories: enhancement of response measures against severe accidents; enhancement of nuclear emergency responses; reinforcement of safety infrastructure; and instillation of a safety culture.

For example, the report explains that the eight lessons in category 1 are learned from reviewing the sufficiency of preventive measures against a severe accident, the seven in category 2 from reviewing the adequacy of the responses to this severe accident, the seven in category 3 from reviewing the adequacy of the emergency responses to the nuclear disaster, and the five in category 4 from reviewing the robustness of the safety infrastructure established at nuclear power stations.

Category 5 consists of a single lesson, which recommends that safety culture be thoroughly instilled at every nuclear energy facility. The report urges organizations and individuals with responsibility for securing safety to look at every item of information to determine whether it indicates a vulnerability at the plant. The report states that Japan will establish a safety culture by going back to the basics, pursuing defense-in-depth, and continually looking for weaknesses in the area of safety and also for areas that are in need of improvement.—*Gamini Seneviratne*