Now I'd like to introduce Dr. Saegusa. For more than 30 years Dr. Toshiari Saegusa has been engaged in research and development matters regarding the transport and storage of radioactive materials including spent fuel at Japan's Central Research Institute of Electric Power Industry or CRIEPI. He served as the chair of the working group on transport of radioactive materials for the Japanese government and is now a chair of the subcommittee on spent nuclear fuel storage of the Code Committee of the Japanese Society of Mechanical Engineers.

Dr. Saegusa also works with the International Atomic Energy Agency in the field of transport and storage. He has participated in IAEA conferences, technical meetings and consultant meetings. Please give a warm welcome to Dr. Toshiari Saegusa.

Toshiari Saegusa.
Thank you, Scott. Good morning, audience. Thank you for coming to this plenary. Today I'm going to make a presentation on behalf of Tokyo Electric Power Company. TEPCO. TEPCO apologizes for the Fukushima accident and also TEPCO is grateful to the overseas countries with the support to the restoration of Fukushima.

The presentation covers the current roadmap of spent fuel management and report of investigation, maintenance, dry casks at the Fukushima Daiichi nuclear power station that was attacked by earthquake and tsunami.

This is a message from TEPCO. The starting point is devitalization of Fukushima. They are determined to fulfill all of their responsibilities for the nuclear power accident and achieve the revitalization of Fukushima which is essential to TEPCO's reform and restoration efforts and so on.

I think I'll first introduce you to the video tour of the Fukushima accident which includes an overview of the March 11 accident and status of units one to four and a fresh fuel inspection at unit four, and the common pool and the casks storage area. This is a video of the situation. It starts in a few seconds.

[video plays]

So then I will introduce you to mid and long term roadmap toward decommissioning of Fukushima with respect to spent nuclear fuel. This is a plan for removing the fuel and the fuel debris from each unit. To reduce risks, removal of the fuel from the spent fuel pool and removal of the fuel debris will be carried out at the earliest possible time. For fuel removal the initial target was December 2013, this year. And for unit four the plan was accelerated and it will commence

in November this year. And for fuel debris removal for units one and two, it will commence the first half of fiscal year 2020. Again, it is 1.5 years earlier than initially planned.

The targets under the initial roadmap is as follows: December 2011 the roadmap was established at the time therefore to stabilize nuclear power plants were made and core shutdown achieved, and significantly reduced radiation releases. And until this year, phase one is a period up to the commencement of the removal of the fuel from the spent fuel pool and will be carried out within two years. And until December 21, which is phase two, is a period up to the commencement of the removal of the fuel debris and so on.

TEPCO made … plans under the revised water map. This is an example for unit two. Plan one is when the existing reactor building can be decontaminated and the fuel handling machine can be restored. They will start the fuel debris removal first half of fiscal year 2020. So depending on the situation of the reactor buildings, they have … plans such as round three when the reactor building lacks sufficient seismic resistance. It was necessary to construct the separate container and commencement of the fuel debris removal will start first half of fiscal year 2024.

This slide shows the fuel removal work processes. In order to remove the fuel from the spent fuel pool, rubble in the upper level of the reactor building needs to be removed and this process has been completed for unit four and is ongoing on unit three. And the cover or container for the entire reactor building is to be constructed and the fuel handling equipment is to be installed. It's now under construction for unit four.

Thirdly, the fuel stored in the common pool is to be moved to the temporary cask custody area to make vacancy in the common pool for the fuel removed from the spent fuel pool. And the soundness of the fuel from the common pool is confirmed and installed in the transport container and is shipped. Transportation of the fuel removed from unit four is scheduled to commence this November.

This slide illustrates the fuel removal work process. The fuel will be taken out from the spent fuel pool at the reactor building and taken to the common pool nearby. Afterwards spent fuel after confirmation of the integrity goes to temporary cask custody area at the same site of Fukushima.

This slide explains the work processes to the removal of the fuel debris at units one, two and three. The most rubble method of shred debris removal is to remove the fuel debris and keeping them covered with water in terms of reducing the risk of radiation exposure during work processes.

Accordingly, the fuel debris will be examined and the primary containment vessel, PCV, will be examined and repaired for filling the PCV with water. And the furthermore research and development is necessary for removal and storage of fuel debris. This slide illustrates the process.

The left on here shows the last picture of the process from repairing the bottom of the RCD, water flow will have stopped here to fill the bottom of the vessel with water. And after filling the water the fuel debris will be taken out from the top.

Now I'm going to present the report of investigation of maintenance results of the dry casks at Fukushima which were attacked by earthquake and tsunami.

Nine dry casks had been stored in the cask custody area in the premises before the earthquake. The cask custody area is placed just in front of the sea and the vast amount of seawater, sand and debris flew into the building when the earthquake occurred. Even a small automobile came into the building. It had been judged from the external appearance, results of measurements, temperature and dosage that the safety performance of the dry casks was maintained. It was planned to inspect the casks in the common pool and replace necessary parts and then store them in the new reconstructed

temporary cask custody area. After two years from the accident, they inspected.

This is the outline of the investigation results. Nine dry casks have been investigated and the absence of problems with safety function and spent fuel integrity was confirmed. After the investigation and replacement of the necessary parts all the casks have been transported and stored at the temporary cask custody area. That work commenced in March of this year and they finished May of this year.

This is a bird's eye view of the dry storage casks at the Fukushima. The cask was placed horizontally and the original design was TN-24 and it carries installed 37 BWR spent fuel by medium type. And 52 BWR spent fuel by large lab cask. It is primary lead and secondary lead for monitoring the containment function of the cask. This is a cross section of the latest structure of the cask.

At the primary lead and the secondary lead placed on the cask body, there are metal casks covered by aluminum plate. And here is our pressure measurement gauge on the secondary lead and measuring the pressure between the primary lead and the secondary lead by those two transduces. And when the tsunami came, the seawater into it came to this space between cask body and the … elite.

This slide indicates how transfer the dry storage casks and in this case were carried out. This is a storage building and the storage building was damaged to some extent so they repaired the handling equipment and took out the casks to a common pool nearby. At the common pool they investigated the integrity of the seal performance and the spent fuel integrity and so on. And afterwards the casks were rolled to the temporary cask custody area.

This last slide described the investigation method of the nine casks. The first cask of the nine casks, the primary lid of the cask was removed in the common pool and external appearance observation of the basket and three fuel assemblies were performed as a representative of nine casks. The other eight casks were investigated as follows: only if there was leak from the primary lid or if Krypton gas was detected, the primary lid was to be removed in the pool. But no problem was found so that all investigations were performed in the air.

This last slide, investigation of the eight casks in the common pool if necessary. The process from one to four is a process to be carried out outside the pool. Step three is just removal of the secondary lid and step four is check air tightness and the primary lid and the gas sampling inside the cask, and the helium injection if the primary lid is not open. But if Krypton 85 was detected, those casks would have to be raised in the water pool and the primary lid will be opened and the

spent fuel shall be inspected. But those are not the case. So eight casks were inspected outside the pool and they replaced the secondary lid with new metal gasket and a vacuum drying and so on.

So this is the result of the investigation with respect to containment. The leakage rate of the primary and the secondary was less than the criteria which is 10^{-6} of this unit. And the pressure between the lids was more than the criteria, that is .29 MPa abs. External appearance of the flange surface of the cask body of the first cask, no abnormalities such as flaws and cracks and so on. The external appearance of the metal gaskets of the primary and the secondary lids of the casks, no abnormalities such as flaws and cracks and so on. The metal gasket of the secondary lid was corroded at the outer circumference by the seawater intrusion. But there was no penetration and the cask cavity was separated from external environment. From those results it was confirmed there was no problem to the containing function of the casks.

This slide shows external appearance of the first cask flange surface. No abnormalities such as flaws and cracks on the flange surfaces.

Next are the investigation results of the casks with respect to sub-criticality function and the spent fuel integrity. The result of the external appearance observation of the basket of the first cask shows no abnormalities such as

deformation, damage and so on in the basket. And the result of external appearance observation of the spent fuel assembly of the first cask shows no abnormalities such as deformation, damage and so on to three representative samples of spent fuel assemblies. And the result of internal gas sampling from the dry storage cask shows no significant change in the monitoring of Krypton gas and the stored fuel claddings were sound. And the result of neutron dosimetric measurement shows little difference in the neutron dosimetric value between before and after the results. It was confirmed that no problem to sub-criticality function and spent fuel integrity.

This slide shows external appearance of the basket from the top of the cask. This slide shows the external appearance of the spent fuel assemblies. Top of the spent fuel assembly and the middle and the bottom of the assemblies. And they observed there was crud flaking partially from the surface of one of the three assemblies which does not affect fuel integrity. So from those results they confirmed no abnormalities such as deformation, damage and so on in the three spent fuel assemblies of the first cask.

This is another result on casks with respect to heat removal and shielding function. They have been measuring the surface temperature of the casks. On the left hand side of this table shows the results of surface temperature of the casks. Nine casks, nine different temperatures. And much less on the design

criterion. And the right hand side of this table shows dose equivalent rate values at the surface of the cask at one meter from the cask and shows much less … from the design criterion for the shielding.

In addition, they investigated the surface of the flange again to see any corrosion. This is the result of penetrant testing of the flange surfaces. They observed some whitening partially on the surface of the flange. It's barely seen but. Penetrant testing has been performed because of the concern of fluoroscopic cracking but the result showed no indication of the flange surface.

This is the outline of the temporary cask custody area. They will store 50 casks and 15 cask space is reserved for the future. Each cask is covered with a concrete module like this, and base structure was improved and the baseplate was installed. The cask support structure was installed as in the existing cask custody area and are tied down with fixed bolts. And a gantry train would handle those casks.

In summary of the inspection, TEPCO has performed the investigation on those casks that were suffered from the earthquake and tsunami. And the investigation performed in terms of containment function, sub-criticality function, heat removal function, shielding function and spent fuel integrity. As for all nine casks absence of problems with all safety functions and spent fuel integrity was

confirmed. The nine dry casks are now at the newly constructed temporary cask custody area and will be stored until further notice.

I made part of this presentation at an IAEA meeting on storage and transport and answered some questions. So I will be glad to introduce what are those questions.

Question number one was how long are the casks being stored at Fukushima? Those were 18 years. They started storage in 1995.

The second question was how long were the casks immersed in the seawater tsunami? It was seemingly less than one hour.

The third question was how were the casks investigated other than visual inspection? As explained earlier, Krypton gas detection was performed to investigate if there was any damage to the spent fuel.

The next question was how were the casks cleaned after the tsunami? The casks were cleaned by water and dried from the external surface only. The seawater might remain between the lid and the cask body. That's why after the tsunami accident two years they inspected the casks at the common pool.

The fifth question was were the casks removed by force of the tsunami? I said no. The casks were fixed on the transport dolly on the floor by bolts.

The next question was what external force acted on the storage casks? They said there was a demonstration to show the robustness of the casks. And I said no significant force acted on the casks, just scratches on the cask surface.

Finally, is that the TEPCO strategy to store spent fuel by dry casks? Currently TEPCO is planning to remove the spent fuel in the reactor pool units one through four but they do not have enough storage space in the common pool before they move the spent fuel from the common pool to a temporary dry cask storage facility in order to make enough space for spent fuel in the reactor pool units one through four.

So that completes my presentation. Thank you for your attention.

Scott Moore.
Thank you very much, Dr. Saegusa. Do we have any questions from the floor?

Question.

Doug Ammerman from Sandia National Laboratories. Toshiari, was there a seismic monitor at the power plant so you know what the ground motion was at the site?

Toshiari Saegusa.
Yes, they reported ground motion values at their website. I don't have those numbers at this moment, but yes they had.

Scott Moore.
Any more questions? Dr. Saegusa, the eight or nine casks that you mentioned, how will they continue to be used? Will they be kept in the interim storage facility that you talked about or will they be moved?

Toshiari Saegusa.
Those casks were investigated at the common pool and they replaced some components such as metal gaskets of the secondary lids. And the first lid of the first cask was, the middle gasket of the primary lid was replaced for the first cask. And in addition they replaced pressure gauge of each cask because the tsunami destroyed, damaged connection cable to the pressure gauge. I think also they were measuring the cask surface temperature so they put a new thermal couple to measure the cask temperature. I think those are the

replacements for the casks and they continue to use the same cask at the different places, at the higher level from the sea level at the same site.

Scott Moore.

Thank you very much. I want to remind everyone that Charles Pennington is our technical keynote speaker, to be introduced by David Miller. Pennington will talk at 1:00 p.m. here about advancing U.S. public acceptance of spent fuel storage and transports, proposed outreach services for ionizing radiation education support. So please join us at 1:00 p.m. right here. And see the posters.

I'd like to thank our presenters today for the plenary presentations and I'd also like to thank the AV staff in the back of the room who are helping us make the visuals and audios very clear. Thanks to them. This concludes Wednesday's plenary session, have a great lunch and even better afternoon. Thank you.