



Japan Nuclear power plants map, with Fukushima I nuclear accidents.

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100kW," said Ino. "They do not want to decommission Takahama. These two stations are equally dangerous, but the decision is made based on economic rather than safety reasons."

Today, there are approximately 430 nuclear power units in operation in the world. When a nuclear reactor operates for one year, it is called one reactor-year. The global nuclear plant operation amounts to 16,000 reactor-years so far.

"During this period, there have been five major accidents, namely Three Mile in 1979, Chernobyl in 1986, Fukushima Daiichi, Daini and Daisan in 2011. That means a big accident once in every 3,200 reactor-years. If we divide this with 430 units, we have a possibility to have a major accident every 7.4 reactor-years."

In spite of all this, a power company announced that a severe accident that lets out radioactive substances on a large scale happens only once in a million years. Ino said: "Recently, Kagoshima District Court overruled the petition to prohibit the operation resumption of Sendai Nuclear Power Plant of Kyushu Power Company. The judge certified that level of accident rate as well. That means the nuclear power community's message of 'an accident happens almost never' is very well disseminated."

In August, Sendai Nuclear Power Plant was the first plant to resume operation after the new regulation standard was put in place by the METI (Ministry of Economics, Trade and Industry). "Though the government and the electric power companies boast that it is 'the world's strictest safety standard,' it is in fact much more lax than those in the U.S. and Europe," says Ino.

The most serious deficiency of the new regulation standard is, according to Ino, the fact that they deleted the location site evaluation guideline. The old standard strictly regulated the radiation exposure level of the inhabitants of the surrounding areas. The new one deleted that part, he claims.

"It is because they cannot find any location, even a less-populated area, that meets the standard if they deal with the possibility of an accident as grave as Fukushima," claims Ino. "The new standard also inherits the conventional design criteria which assumes only a malfunction of a single machine. However, we have a significant chance of a simultaneous malfunction of a number of machines caused by earthquakes and tsunami. If it happens, it would be extremely difficult to implement the three principles of a nuclear reactor shutdown; namely shutdown, cooldown and contain. Therefore, I would say this new regulatory standard is set rather to reopen the nuclear power plants which already exist, than to enforce the safety measures."

At a review meeting of the Nuclear Regulatory

Commission in August 2013, members discussed a case based on the assumption that "the coolant is lost due to major damage in the pipework," "the emergency reactor core cooling system does not function because electricity both from the grid and from emergency generators is knocked out," and "containment vessel spray does not work." The director of the Genkai Nuclear Power Plant said, "In such a situation, we currently have no measure to prevent reactor core damage."

As for the Sendai Nuclear Power Plant, because there are several caldera volcanoes nearby that have a history of large-scale eruptions, it runs a risk of being affected by volcano eruptions. The plant is located, according to the Nankai Trough earthquakes plan, in the area of "over intensity 5." In addition, both Sendai and Takahama have adopted Pressurized Water Reactor (PWR) made by Mitsubishi. Fukushima used the Boiling Water Reactor (BWR), and nitrogen was filled up inside the containment vessel to prevent hydrogen explosion, which resulted in no explosion in the containment vessel. On the other hand, the PWR containment vessel is filled with air, not nitrogen. If hydrogen, generated by a serious accident, explodes inside a containment vessel, there is a possibility that the containment vessel is destroyed. "The ideal measure is to decommission the reactor. But the realistic measures we can take right away are: to fill the containment vessel with nitrogen, to install a core catcher to receive the melted reactor core, to conduct an assessment, not only by a power company alone but also a cross-check assessment by independent organizations," adds Ino.

In the 2030s energy target ratio, set by METI, nuclear power represents 20 to 22 percent. "This figure is feasible only by restarting a number of old nuclear power plants," says Ino. "I think for future energy policy we should establish such a system that citizens can reach a public consensus through discussions based on accurate information, including power companies' opinions as well as critical opinions."

"In face of the government's attitude that takes the operation resumptions for granted, if citizens give up, nobody can stop this trend. Citizens' movements can influence the courts. As scientists, our role is to offer scientific information about what can happen and to validate irresponsible explanations given by government and power companies. It is up to citizens whether to take it seriously or not. The last resort to stop the real danger is, I believe, in the power of citizens."

Courtesy of INSP News Service www.INSP.ngo/ / Big issue Japan

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A.W.: Does that mean if you're looking at a 30-year-old person in this cohort, at the cellular level they are closer to 45, for instance?

G.M.: We don't know yet exactly what that means. Other studies show that they have higher blood pressure, they seem to have higher body mass and more fat. It seems like they are farther down the road toward eventual health problems than their peers. We know that a lot of the problems people eventually have with diabetes and heart disease don't start in middle age. They start in childhood and adolescence, and they progress at a slow pace. With strivers, these problem seems to be starting faster.

A.W.: Is it normal to have such a disparity between biological and chronological aging? What is the relationship between the two?

G.M.: They are highly related. The distance between them tell us something about how much stress people are under and what underlying health risks there are. For example, if you look at cancer cells from a 20 year old, those cells look like they are 50 or 60. If you look at liver cells from someone who is obese, (those cells) look about five years older than someone who is not obese. What we know is that agitation from chronological age ... is a risk factor (for) already having health problems, or that you will have them in the future.

A.W.: Suppose you sat one of these high-achieving people down and you told them their health is poor because they've worked so hard to have a good career and a stable life. Do you think that is something they would realize about themselves?

G.M.: That's a good question. We don't know the answer yet.

A.W.: You've said repeatedly during this interview that this

area of research is new. What are the questions you now have?

G.M.: This is very early stage work and raises more questions than answers. The next steps are figuring out some of the most pressing questions about how generalizable (the findings are). Is it something about the kids we're studying, or more broadly applicable to other kids, other places, other classes? That's the main thing we want to know right now.

There is still uncertainty about what this means for actual health problems or mortality. What does it mean for long-term disease? Everything we studied so far is a biomarker - a precursor of disease. It doesn't mean you have the health problems. Finding out whether these kids are the ones who go on to have heart attacks and strokes is 40 years down the line. We can't get answers immediately like we could if we were studying fruit flies or bacteria. If you want to do studies with kids, you have to follow them for decades and decades.

This interview has been edited for length and clarity.



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