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Fukushima leaks: Japan pledges \$470m for 'ice wall'

Japan is to invest hundreds of millions of dollars into building a frozen wall around the Fukushima nuclear plant to stop leaks of radioactive water.

Government spokesman Yoshihide Suga said an estimated 47bn yen (\$473m, £304m) would be allocated.

The leaks were getting worse and the government "felt it was essential to become involved to the greatest extent possible", Mr Suga said.

The plant was crippled by the 2011 earthquake and tsunami.

The disaster knocked out cooling systems to the reactors, three of which melted down.

Water is now being pumped in to cool the reactors, but storing the resultant large quantities of radioactive water has proved a challenge for plant operator Tokyo Electric Power Company (Tepco).

'Closely watching'

Under the government plan, a wall of frozen earth will be created around the reactors using pipes filled with coolant to prevent groundwater coming into contact with contaminated water being used to cool fuel rods.

Water treatment systems will also be upgraded to tackle the build-up of contaminated water, officials said.

The damage to the plant has necessitated the constant pumping of water to cool the reactors - a process which creates an extra 400 tonnes of contaminated water every day.

That water is being stored in temporary tanks at the site. Last month Tepco said that 300 tonnes of highly radioactive water had leaked from one of the tanks, in the most serious incident to date.

2 September 2013 Last updated at 17:02 GMT

Fukushima nuclear plant still 'unstable', regulator says



Contaminated water may have to be filtered and dumped in the ocean, officials say

The crisis at Japan's Fukushima nuclear plant "has not ended", the country's nuclear watchdog has warned, saying the situation there is "unstable".

Watchdog chief Shunichi Tanaka also accused the plant's operator of careless management during the crisis.

He added that it may not be possible to avoid dumping some contaminated water into the ocean.

The comments come a day before the Japanese government is due to unveil plans to resume the clean-up operation.

Mr Tanaka's comments come after Fukushima's operator, the Tokyo Electric Power Company (Tepco), said radiation levels near one tank were 18 times higher than previously thought.

However, Mr Tanaka said that reports that this level of radiation could be lethal to workers after four hours of exposure were exaggerated.

"Supposing the figure of 1,800 millisieverts per hour is correct, it is beta radiation. It will not penetrate as long as there is a 5-10 millimetre-thick plastic shield or you wear leather shoes," he said.

'Dumping' option raised



News of the leaks have fuelled anti-nuclear protests in Japan in recent weeks

The damage to the plant from the 2011 tsunami has necessitated the constant pumping of water to cool the reactors. The process creates an extra 400 tonnes of contaminated water every day.

It was revealed last month that some of that water was leaking from storage tanks at the site.

On Monday, Tepco said a patrol of workers had found a new area of high radiation near the tanks, Reuters reports.

Mr Tanaka told reporters that the only long-term solution to the problem of contaminated water was to filter it and that it might "not be possible to avoid dumping it in to the sea".

That will be extremely unpopular with local fishermen and possibly with Japan's neighbours, the BBC's Rupert Wingfield-Hayes reports from Tokyo.

The plant was crippled by the 2011 earthquake and tsunami and the plant has since been hit by a series of water leaks and power failures.

The tsunami knocked out cooling systems to the reactors, three of which melted down.

The latest leak is believed to be the fourth major leak from storage tanks at Fukushima since 2011 and the worst so far in terms of volume.

Experts have said the scale of water leakage may be worse than officials have admitted.

1 September 2013 Last updated at 09:09 GMT

Fukushima radiation levels '18 times higher' than thought



Japanese Economy Minister Toshimitsu Motegi inspected the site on Monday

Radiation levels around Japan's Fukushima nuclear plant are 18 times higher than previously thought, Japanese authorities have warned.

Last week the plant's operator reported radioactive water had leaked from a storage tank into the ground.

It now says readings taken near the leaking tank on Saturday showed radiation was high

enough to prove lethal within four hours of exposure.

The plant was crippled by the 2011 earthquake and tsunami.

The Tokyo Electric Power Company (Tepco) had originally said the radiation emitted by the leaking water was around 100 millisieverts an hour.

However, the company said the equipment used to make that recording could only read measurements of up to 100 millisieverts.

The new recording, using a more sensitive device, showed a level of 1,800 millisieverts an hour.

The new reading will have direct implications for radiation doses received by workers who spent several days trying to stop the leak last week, the BBC's Rupert Wingfield-Hayes reports from Tokyo.

In addition, Tepco says it has discovered a leak on another pipe emitting radiation levels of 230 millisieverts an hour.

The plant has seen a series of water leaks and power failures.

The 2011 tsunami knocked out cooling systems to the reactors, three of which melted down.

The damage from the tsunami has necessitated the constant pumping of water to cool the reactors.

This is believed to be the fourth major leak from storage tanks at Fukushima since 2011 and the worst so far in terms of volume.

After the latest leak, Japan's nuclear-energy watchdog raised the incident level from one to three on the international scale measuring the severity of atomic accidents, which has a maximum of seven.

Experts have said the scale of water leakage may be worse than officials have admitted.

Leak discovered at Fukushima nuclear plant



Should Fukushima's radioactive water be dumped at sea?

- 18:20 23 August 2013 by [Andy Coghlan](#)
- For similar stories, visit the [The Nuclear Age](#) Topic Guide

JAPAN'S beleaguered Fukushima Daiichi nuclear facility made headlines again this week, when some 305 tonnes of radioactive water leaked from a storage tank at the complex. This prompted Japan's Nuclear Regulation Authority to upgrade the situation from 1 to 3 – a "serious accident" on the 8-point International Nuclear Event Scale.

The crisis reopened questions about how to deal with the flood of radioactive water accumulating at [Fukushima](#). There is a radical option: to filter out as much radioactive material as possible, dilute what's left, [and dump it in the Pacific](#).

This idea was [put forward in April by a delegation from the International Atomic Energy Agency](#) (IAEA) after a visit to the site. But the Japanese government and local fishermen are opposed, [fearing the waste would destroy their fisheries](#). A look at the numbers suggests that such fears lack firm justification.

For now, it is unclear whether any water from last week's leak actually reached the Pacific. The Tokyo Electric Power Company (Tepeco), which owns the plant, recorded high levels of radioactivity in a drainage ditch that runs to the sea from the tank, but could not detect anything

in the seawater itself.

Other parts of Fukushima are certainly leaking. From samples of seawater, [Jota Kanda](#) of Tokyo University of Marine Science and Technology estimated last year that about [0.3 terabecquerels \(TBq\) of radioactive material are leaking into the sea each month](#).

Ken Buesseler of the Woods Hole Oceanographic Institution in Massachusetts says the Kanda estimate is probably the best he is aware of, and closely matches figures released on 21 August by Tepco, of 0.1 to 0.6 TBq per month for caesium-137 and 0.1 to 0.3 for strontium.

He points out that the north Pacific contains an estimated 100,000 TBq of caesium-137 from H-bomb testing in the 1960s, so the fallout from Fukushima is adding only a fraction of that. Total discharges from the Sellafield nuclear plant in the UK released 39,000 TBq over 40 years, he says.

Buesseler says that during his own sampling survey in waters 30 to 600 kilometres from Fukushima in June 2011, three months after the meltdown, the highest levels he found were 3 Bq of caesium-137 per litre of seawater. By comparison, the natural weathering of rocks results in about 10 Bq of radioactive potassium-40 making it into each litre of seawater.

On an international level, even if all the waste from Fukushima was dumped neat into the Pacific, dilution would eliminate any radiation risks to distant countries like the US, says Simon Boxall of the National Oceanography Centre in Southampton, UK.

The ocean would be the safest place for the waste water, says Geraldine Thomas, who runs the Chernobyl Tissue Bank at Imperial College London. "But to make that politically acceptable they have to talk to the local population. They have to make people understand that low levels of radiation don't matter because we're all exposed to it all the time."

In other words, it is more of a communication problem than a public health problem. "None of this is going to do anything health wise," she says. "Fukushima is nothing compared to Chernobyl."

Additional reporting by Rob Gilhooly in Tokyo, Japan, and Rowan Hooper

Ice walls, wells and filters

The contaminated water problem at Fukushima comes from the mountains. Every day, 400 tonnes of groundwater flows down from peaks overlooking the complex, invades the stricken reactor halls and is contaminated. At present, the Tokyo Electric Power Company (Tepco), which runs the plant, redirects the water over the reactor cores to keep them cool. After filtering to remove radioactive caesium, the water is stored in tanks. Huge volumes are being placed in 1060 tanks, each holding up to 1000 tonnes.

Tepco has drilled wells in the mountains to pump out and divert groundwater before it reaches Fukushima. It is even considering creating an "ice wall" around the complex by freezing water in soil.

More prosaically, in March, the company installed new filtering equipment. The advanced liquid processing system (ALPS) filters out caesium and 60 other isotopes. The IAEA says such filtering offers the best hope for cleaning water to a standard fit for dumping at sea. The

tanks would then be used for more concentrated waste.

But Tepco halted tests on ALPS this month after corrosion holes developed in an associated tank. It says tests won't resume until December.

"Anything they can do to remove the more dangerous compounds and dilute the others is almost the only solution," says Ken Buesseler of Woods Hole Oceanographic Institution in Massachusetts.

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Fukushima leak is 'much worse than we were led to believe'

By Matt McGrath Environment correspondent, BBC News



Faulty seals on the storage tanks at Fukushima are said to be the source of the most recent leak

A nuclear expert has told the BBC that he believes the current water leaks at Fukushima are much worse than the authorities have stated.

Mycele Schneider is an independent consultant who has previously advised the French and German governments.

He says water is leaking out all over the site and there are no accurate figures for radiation levels.

Meanwhile the chairman of Japan's nuclear authority said that he feared there would be further leaks.

The ongoing problems at the Fukushima plant increased in recent days when the Tokyo Electric Power Company (Tepco) admitted that around 300 tonnes of highly radioactive water had

leaked from a storage tank on the site.

Moment of crisis

The Japanese nuclear energy watchdog raised the incident level from one to three on the international scale that measures the severity of atomic accidents.

"It is leaking out from the basements, it is leaking out from the cracks all over the place"

Mycle Schneider Nuclear consultant

This was an acknowledgement that the power station was in its greatest crisis since the reactors melted down after the tsunami in 2011.

But some nuclear experts are concerned that the problem is a good deal worse than either Tepco or the Japanese government are willing to admit.

They are worried about the enormous quantities of water, used to cool the reactor cores, which are now being stored on site.

Some 1,000 tanks have been built to hold the water. But these are believed to be at around 85% of their capacity and every day an extra 400 tonnes of water are being added.

"The quantities of water they are dealing with are absolutely gigantic," said Mycle Schneider, who has consulted widely for a variety of organisations and countries on nuclear issues.

"What is the worse is the water leakage everywhere else - not just from the tanks. It is leaking out from the basements, it is leaking out from the cracks all over the place. Nobody can measure that.

Increase in radioactive water stored at Fukushima



Satellite images show how the number of water storage tanks has increased in the past two years. The tanks store contaminated water that has been used to cool the reactors.

"It is much worse than we have been led to believe, much worse," said Mr Schneider, who is lead author for the World Nuclear Industry status reports.

At news conference, the head of Japan's nuclear regulation authority Shunichi Tanaka appeared to give credence to Mr Schneider's concerns, saying that he feared there would be further leaks.

"We should assume that what has happened once could happen again, and prepare for more. We are in a situation where there is no time to waste," he told reporters.

The lack of clarity about the water situation and the continued attempts by Tepco to deny that water was leaking into the sea has irritated many researchers.

Dr Ken Buesseler is a senior scientist at Woods Hole Oceanographic Institution who has examined the waters around Fukushima.

"It is not over yet by a long shot, Chernobyl was in many ways a one week fire-explosive event, nothing with the potential of this right on the ocean."

"We've been saying since 2011 that the reactor site is still leaking whether that's the buildings and the ground water or these new tank releases. There's no way to really contain all of this

radioactive water on site."

"Once it gets into the ground water, like a river flowing to the sea, you can't really stop a ground water flow. You can pump out water, but how many tanks can you keep putting on site?"

Several scientists also raised concerns about the vulnerability of the huge amount of stored water on site to another earthquake.

New health concerns

The storage problems are compounded by the ingress of ground water, running down from the surrounding hills. It mixes with radioactive water leaking out of the basements of the reactors and then some of it leaches into the sea, despite the best efforts of Tepco to stem the flow.

Some of the radioactive elements like caesium that are contained in the water can be filtered by the earth. Others are managing to get through and this worries watching experts.

"Our biggest concern right now is if some of the other isotopes such as strontium 90 which tend to be more mobile, get through these sediments in the ground water," said Dr Buessler.

"They are entering the oceans at levels that then will accumulate in seafood and will cause new health concerns."

There are also worries about the spent nuclear fuel rods that are being cooled and stored in water pools on site. Mycle Schneider says these contain far more radioactive caesium than was emitted during the explosion at Chernobyl.

"There is absolutely no guarantee that there isn't a crack in the walls of the spent fuel pools. If salt water gets in, the steel bars would be corroded. It would basically explode the walls, and you cannot see that; you can't get close enough to the pools," he said.

The "worsening situation" at Fukushima has prompted a former Japanese ambassador to Switzerland to call for the withdrawal of Tokyo's Olympic bid.

In a letter to the UN secretary general, Mitsuhei Murata says the official radiation figures published by Tepco cannot be trusted. He says he is extremely worried about the lack of a sense of crisis in Japan and abroad.

This view is shared by Mycle Schneider, who is calling for an international taskforce for Fukushima.

"The Japanese have a problem asking for help. It is a big mistake; they badly need it."

21 August 2013 Last updated at 05:04 GMT

Fukushima plant: Nuclear agency seeks leak alert level upgrade



Workers discovered the water was leaking from a tank on Monday

Japan's nuclear agency wants to raise the severity level of a radioactive water leak at the Fukushima plant from one to three on an international scale.

Highly radioactive water was found to be leaking from a storage tank into the ground at the plant on Monday.

It was first classified as a level one incident on the International Nuclear and Radiological Event Scale (Ines).

But Japan's Nuclear Regulation Authority proposes elevating it to level three on the seven-point scale.

This week is the first time that Japan has declared an event on the Ines scale since the 2011 earthquake and tsunami.

The move was announced in a document on the agency's website and was to be formally approved at a meeting, a spokesman told Reuters news agency.

Japanese reports said it was a provisional move that had to be confirmed with the IAEA, the UN's nuclear agency.

'Five-year dose'

The March 2011 tsunami knocked out cooling systems to the reactors at the plant, three of which melted down.

Water is now being pumped in to cool the reactors but this means that a large amount of contaminated water has to be stored on site.

There have been leaks of water in the past but this one is being seen as the most serious to date, because of the volume - 300 tonnes of radioactive water, according to plant operator Tokyo Electric Power Company (Tepco) - and high levels of radioactivity in the water.

A puddle of the contaminated water was emitting 100 millisieverts an hour of radiation, Kyodo news agency said earlier this week.

Masayuki Ono, general manager of Tepco, told Reuters news agency: "One hundred

millisieverts per hour is equivalent to the limit for accumulated exposure over five years for nuclear workers; so it can be said that we found a radiation level strong enough to give someone a five-year dose of radiation within one hour."

[Under the Ines](#), events have seven categories starting with Level 0 ("without safety significance") and Levels 1-3 denoting "incidents" while Levels 4-7 denote "accidents".

Leak discovered at Fukushima nuclear plant



20 August 2013 Last updated at 07:52 GMT

Fukushima nuclear plant: Radioactive water leak found



The tsunami knocked out cooling systems to the reactors at Fukushima

Radioactive water has leaked from a storage tank into the ground at Japan's Fukushima plant, its operator says.

Tokyo Electric Power Company (Tepco) said the leak of at least 300 tonnes of the highly radioactive water was discovered on Monday.

The plant, crippled by the earthquake and tsunami in 2011, has seen a series of water leaks and power failures.

The tsunami knocked out cooling systems to the reactors, three of which melted down.

An employee discovered the leak on Monday morning, Tepco said in a statement.

Officials described the leak as a level-one incident - the lowest level - on the International Nuclear and Radiological Event Scale (Ines), which measures nuclear events.

This is the first time that Japan has declared such an event since the 2011 earthquake and tsunami, however.

[Under the Ines](#), events have seven levels starting with Level 0 ("without safety significance"), and Levels 1-3 denoting "incidents" and Levels 4-7 denoting "accidents".

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More monitoring

A Tepco official told a press conference on Tuesday that the water probably leaked from a tank after escaping a concrete barrier.

Workers were pumping out the puddle and the remaining water in the tank and would be transferring it to other containers, Kyodo added.

Water is being pumped into the reactors, after cooling systems were knocked out by the tsunami.

Hundreds of tanks were built to store the contaminated water. Some of them had experienced similar leaks since 2012, but not on this scale, a Tepco official said.

Tepco had been instructed to retrieve contaminated soil and to strengthen monitoring of the surrounding environment, a regulatory official told Agence-France Presse news agency.

No major changes in radiation levels outside the plant had been observed so far, the official added.

The incident comes days after Tepco admitted that as much as 300 tonnes of contaminated

water a day was leaking from the damaged reactor buildings to the sea.

19 June 2013 Last updated at 09:32 GMT

Fukushima nuclear plant: Toxic isotope found in groundwater



Radioactive water was found to be leaking from a storage tank at the plant last month

High levels of a toxic radioactive isotope have been found in groundwater at Japan's Fukushima nuclear plant, its operator says.

Tokyo Electric Power Company (Tepco) said tests showed Strontium-90 was present at 30 times the legal rate.

The radioactive isotope tritium has also been detected at elevated levels.

The plant, crippled by the 2011 earthquake and tsunami, has recently seen a series of water leaks and power failures.

The tsunami knocked out cooling systems to the reactors, which melted down.

Water is now being pumped in to the reactors to cool them but this has left Tepco with the problem of how to safely store the contaminated water.

There have been several reports of leaks from storage tanks or pipes.

Analysis [Matt McGrath](#) Environment correspondent, BBC News
Detecting increasing levels of the highly radioactive substance Strontium-90 indicates that Tepco is still struggling to contain the Fukushima reactors.

Water continues to be a massive problem as the company is running out of storage space for the large amounts of the liquid they use every day as to cool the plant.

On top of that around 400 tonnes of groundwater flow into the reactor buildings every day. They have even dug up 12 relief wells near the site in an effort to halt the ingress.

As to the high levels of Strontium-90 detected, it has a half life of 29 years. This means that in humans it can continue to irradiate them for many years. It can be ingested from food or water and tends to concentrate in the bones and is believed to cause cancer there.

In animal studies, exposure to Strontium-90 also caused harmful reproductive effects. These effects happened when animals were exposed to doses more than a million times higher than typical exposure levels for humans.

- [Read more from Matt](#)

Sea samples

Strontium-90 is formed as a by-product of nuclear fission. Tests showed that levels of strontium in groundwater at the Fukushima plant had increased 100-fold since the end of last year, Toshihiko Fukuda, a Tepco official, told media.

Mr Fukuda said Tepco believed the elevated levels originated from a leak of contaminated water in April 2011 from one of the reactors.

"As it's near where the leak from reactor number two happened and taking into account the situation at the time, we believe that water left over from that time is the highest possibility," he said.

Tritium, used in glow-in-the-dark watches, was found at eight times the allowable level.

Mr Fukuda said that samples from the sea showed no rise in either substance and the company believed the groundwater was being contained by concrete foundations.

"When we look at the impact that is having on the ocean, the levels seem to be within past trends and so we don't believe it's having an effect."

But the discovery is another setback for Tepco's plan to pump groundwater from the plant into the sea, correspondents say.

Nuclear chemist Michiaki Furukawa told Reuters news agency that Tepco should not release contaminated water into the ocean.

"They have to keep it somewhere so that it can't escape outside the plant," he said. "Tepco needs to carry out more regular testing in specific areas and disclose everything they find."

The Fukushima power plant has faced a series of problems this year. Early this month, radioactive water was found leaking from a storage tank.

The plant also suffered three power failures in five weeks earlier this year. A leak of radioactive water from one of the plant's underground storage pools was also detected in April.