Fukushima: Sick Workers and Cracked Vessels. What's true?

Posted by **EBEN HARRELL** Friday, March 25, 2011 at 2:01 pm

6 Comments • Related Topics: beta ray, Chernobyl, Fukushima, gamma radiation, meltdown, MOX fuel, plutonium, uranium

Each day at the stricken Fukushima power plant seems to bring a new piece of troubling news—today, reports surfaced that three workers at the Fukushima plant had been hospitalized after radiation levels reported at the plant spiked to "10,000 times above normal." There were also reports that the No. 3 reactor vessel had been damaged, which if true would result in a serious leak of radiation at the only reactor at the site that contains the especially-toxic MOX fuel.

But like so much at Fukushima, reliable information is difficult to come by (more on that later). So consider this a summary of what we know for sure.

• According to the IAEA, the three hospitalized workers were laying cable for the Unit 3 reactor when radioactivity was discovered on their feet and legs. An IAEA release states that the workers "were washed in the attempt to remove radioactivity, but since there was a possibility of Beta-ray burning of the skin, [the workers] were taken to the Fukushima University Hospital for examination and then transferred to Japan's National Institute of Radiological Sciences for further examination. They are expected to be monitored for around four days. It is thought that the workers ignored their dosimeters' alarm believing it to be to be false and continued working with their feet in contaminated water."

• Press reports suggested that the hospitalized workers had been exposed to doses 10,000 times above normal. But the only reliable information on the dosage received by the workers comes from a TEPCO press release, which states that the trio suffered radiation exposure between 170 millisieverts and 180 millisieverts. That is not nearly enough to burn the skin or cause any symptoms of radiation poisoning, and it's well below "10,000 times above normal."

• The discrepancy is likely the result of confusion over what type of radiation the workers received, says Dr. Barry Rosenstein, a professor of radiation oncology at the Mount Sinai Medical Center in New York. The 170-180 millisievert figure probably refers to the full-body "gamma' radiation--probably from cesium-137 or iodine-131. Gamma rays can penetrate the skin and cause damage to internal organs. But beta particles—another source of radioactive decay—don't typically penetrate far into the body (for the scientifically minded, this is because they are charged electrons that have a mass and so are more easily stopped by atoms in the skin rather than the photons of gamma radiation). "It's possible that an individual can receive very high dosage [from beta rays] to the skin and the internal organs will not be irradiated," Rosenstein says.

• A dose of beta rays greater than 2,000 millisievert can damage the skin much the same way as ultraviolet radiation from the sun can cause a sunburn. And it's likely it is this dosage that reports of "10,000 times greater than normal radiation level" refers to, although again no firm figures have been released. In any case, burns from beta rays, like sun burns, usually clear up without any complications, Dr Rosenstein says. At Chernobyl, some emergency workers died from extensive burns, although reports of the burns to the Fukushima workers suggest the injuries are not nearly as serious.

• The Bulletin of Atomic Scientists reported that the three hospitalized workers were the first radiation-exposure injuries at Fukushima, contradicting earlier reports suggesting some workers showed symptoms of radiation sickness. The IAEA seemed to confirm this, stating that the number of workers at the Fukushima Daiichi nuclear power plant found to have

received more than 100 millisieverts of radiation dose totaled 17 including the three contract workers. Again, 100 millisieverts is not nearly a high enough dosage to cause acute radiation sickness--that requires a dose of at least 1,000 milliesierverts. However, it does exceed the recommended safety level for nuclear power plant workers, which is normally set at 50 millisieverts. The daily limit for the emergency workers has now been set to 250 millisieverts. Such a dose will not make the workers ill, but it may increase their chance of developing cancer by a little less than 1%.

• In a related development, Hidehiko Nishiyama, deputy director-general of the Japan Nuclear and Industrial Safety Agency, said at a news conference that a reactor vessel of the No. 3 unit may have been damaged. That raises the possibility that radiation from the MOX fuel in the reactor — a combination of uranium and plutonium — could be released. The three workers who suffered skin burns were working on the No. 3 reactor, which is one of the clues that the vessel may have been damaged. (However, their burns could also have come from radioactive seepage from vents or valves.) It's simply not known if the No. 3 reactor vessel has been compromised.

• MOX fuel is more dangerous than normal uranium fuel because it contains plutonium, which heats up more than uranium and can thus cause hot spots during a "loss of coolant incident" (see this earlier post by Jeffrey Kluger). Plutonium also makes control rods and boron less effective in slowing down a nuclear reaction--two crucial elements in the emergency shut-down of a reactor during a "criticality incident." It also releases more harmful radiation than pure uranium fuel in the case of a meltdown. For these reasons, nuclear safety campaigners in Japan succeeded in limiting the amount of plutonium in Japan's MOX to 6 percent (In France, by comparison, plutonium makes up 30 percent of MOX fuel). That certainly seems like a good thing now.

• Is the crisis at Fukushima over? Some experts believe that the main challenge now will be the hugely expensive clean-up operation of contaminated land, water and agriculture in the surrounding area. Such a clean-up can be done, but it's hugely expensive, and government officials may decide to abandon certain swathes of the surrounding area instead. But other experts say the crisis remains serious, and could escalate, especially given the unpredictability of the build-up of salt from the use of seawater as a coolant. And as an indication that the crisis remains serious, the Japanese government said it would now assist people who want to leave the area from 12 to 19 miles outside the crippled plant and said they were now encouraging "voluntary evacuation" from the area. Although it's possible that the move was the result not of safety concerns but of the fact that those within 12-19 miles had been ordered to remain indoors, making them virtual prisoners.

• Many outside experts have begun openly criticizing both TEPCO and the Japenese government for the lack of transparency and reliable information about the Fukushima crisis. It's an admittedly frenzied and difficult time for TEPCO and Japanese nuclear safety officials, but it's also difficult to disagree with the sentiment of Najmedin Meshkati, a USC engineering professor who has advised U.S. agencies on nuclear safety issues; he told the LA Times, "Information sharing has not been in the culture of Tepco or the Japanese government. This issue is larger than one utility and one country. It is an international crisis."

Comments (6)
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1
This is the end of the fairy tale of "cheap and safe" nuclear energy.
You might also be interested in how to treat radioactively contaminated drinking water - the next big thing in Japan and adjacent countries:
http://crisismaven.wordpress.com/2011/03/22/dangers-properties-possible-uses-and-methods-of-purification-of-radioactively-contaminated-drinking-water-e-g-in-japan/
A Japanese translation seems underway, see comment by Takuya there. Maybe someone wants to help with other languages?
crisismaven
March 25, 2011

at 2:09 pm
Log in to Reply
2
If the japanese govt could give up trying to control the news and provide greater transparency, it could help people make more safe choices.
outboundadvent…
March 25, 2011
at 7:42 pm
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3
No wonder you are confused. Your facts are not correct. You state:
"Press reports suggested that the hospitalized workers had been exposed to doses 10,000 times above normal. But the only reliable information on the dosage received by the workers comes from a TEPCO press release, which states that the trio suffered radiation exposure between 170 millisieverts and 180 millisieverts."
No. I was watching NHK World when the information came out. I wrote it down. But I have to say I just about fell out of my chair when I wrote down the numbers.
The radiation in the water that the workers were exposed to was 3.9 MILLION Bq/cc. It was then stated in the news conference that this is 10,000 times the amount of radiation that would be in water in a reactor that is working normally. This is a very important point. It clearly shows that this water that had leaked out of the reactor had been exposed directly to the reactor fuel, which could only have happened if some of the fuel rods melted and the protective coating oxidized off. Otherwise it could not have been so highly irradiated. The estimated radiation exposure was 173-180 millisieverts between the three men. The surface of the water measured 400 millisieverts.
BTW you are confusing two types of measurements. A radiation dose (rads, etc) is a different measurement than a level of radiation that you might be exposed to (sieverts, curies, rems, etc). Sometimes it is difficult to determine what dose a person received from their exposure.
At the hospital, after decontamination, the workers were still radioactive, and that measurement was around 150 millisieverts.
Two of the workers had shorter boots. They stepped in about 15 cm (about 5 in) of water and the water seeped into their boots. The third worker had higher boots his skin was not exposed directly to the extremely radioactive water, as the feet of the other two were.
The most recent report is that the feet of the two men were exposed to 2-6 sieverts. This is usually a fatal amount of radiation exposure if it is full body exposure, so the fact it was only their feet that were exposed likely makes a huge difference. It will take a couple weeks for some symptoms to appear.
Look, I don't mean to sound too harsh, but if you are going to be writing for Time you have a responsibility to check your facts and present accurate information. A lot of people read Time and expect a certain standard of reporting. To be fair I did see many other incorrect statements in the press regarding this. But if they had only gone to the horse's mouth so to speak and watched the news conference on NHK there would have been no way to misconstrue the information.
squeaksqueak
March 25, 2011
at 9:58 pm
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4
A further explanation of a small point. The 173-180 millisieverts exposure the three men had was 173 for one, 179 for another, and 180 for the third. This is the exposure they had from the radiation in the air in that room. This would have been shown on each person's meter.
Two of the men had additional radiation exposure from the water that leaked into their boots.
squeaksqueak
March 25, 2011
at 10:43 pm
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5
I am bombarded by myriads of information and reports about the Fukushima nuke reactors crisis since it started. More so in the past week when the media had been trying to exaggerate, the authorities attempting to understate, and the scientists over-simplifying the complicated situation for public consumption or justifying what they did.
Where have validity, reliability and transparency gone?
Most people are still relentlessly serving their own vested interests and hidden agenda. Utterly nauseating.
(vzc1943, btt1943)
tanboontee
March 25, 2011
at 10:48 pm
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6
Soon at a theatre, pardon, nuclear power station near you: You may also be interested in how to treat their radioactively contaminated drinking water:
http://crisismaven.wordpress.com/2011/03/22/dangers-properties-possible-uses-and-methods-of-purification-of-radioactively-contaminated-drinking-water-e-g-in-japan/
Maybe someone wants to help with Japanese and other languages?
crisismaven
March 26, 2011
at 9:10 am
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C.R. "KIT" BRAMBLETT, a West Texas prosecutor who says his recommended plea deal for the country artist, who was charged with marijuana possession last November, would consist of his singing in court, a $100 fine and court costs

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