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JAPAN'S 'THROWAWAY' NUCLEAR WORKERS

The March 11 earthquake and tsunami revealed the heroism of Japanese workers at the crippled Fukushima nuclear plant. But it also exposed something else -- a legacy of lax safety standards for nuclear workers.

By **KEVIN KROLICKI & CHISA FUJIOKA**,
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A DECADE and a half before it blew apart in a hydrogen blast that punctuated the worst nuclear accident since Chernobyl, the No. 3 reactor at the Fukushima nuclear power plant

was the scene of an earlier safety crisis.

Then, as now, a small army of transient workers was put to work to try to stem the damage at the oldest nuclear reactor run by Japan's largest utility.

At the time, workers were racing to finish an unprecedented repair to address a dangerous defect: cracks

in the drum-like steel assembly known as the "shroud" surrounding the radioactive core of the reactor.

But in 1997, the effort to save the 21-year-old reactor from being scrapped at a large loss to its operator, Tokyo Electric, also included a quiet effort to skirt Japan's safety rules: foreign workers





REST FROM A RISKY JOB: Workers engaged in operations to stabilize the crippled Fukushima Daiichi Nuclear Power plant take a rest on the floor of a gymnasium inside the grounds of the Fukushima Daini Nuclear Power Plant, about 10km away from the crippled Daiichi plant in Fukushima prefecture, northern Japan, in this photo taken May 7, 2011. **REUTERS/Takeshi Tanigawa**

were brought in for the most dangerous jobs, a manager of the project said.

"It's not well known, but I know what happened," Kazunori Fujii, who managed part of the shroud replacement in 1997, told Reuters. "What we did would not have been allowed under Japanese safety standards."

The previously undisclosed hiring of welders from the United States and Southeast Asia underscores the way Tokyo Electric, a powerful monopoly with deep political connections in Japan, outsourced its riskiest work and developed a lax safety culture in the years leading to the Fukushima disaster, experts say.

A 9.0 earthquake on March 11 triggered a 15-metre tsunami that smashed into the seaside Fukushima Daiichi plant and set off a series of events that caused its reactors to start melting down.

Hydrogen explosions scattered debris across the complex and sent up a plume of radioactive steam that forced the evacuation of more than 80,000 residents near the plant, about 240 km (150 miles) northeast of Tokyo. Enough radioactive water to fill 40 Olympic swimming pools has also been collected at the plant and threatens to leak into the groundwater.

The repeated failures that have dogged

Tokyo Electric in the three months the Fukushima plant has been in crisis have undercut confidence in the response to the disaster and dismayed outside experts, given corporate Japan's reputation for relentless organization.

BEHIND THE HEROISM IS A LEGACY OF JAPANESE NUCLEAR WORKERS FACING HAZARDS WITH LITTLE OVERSIGHT

Hastily hired workers were sent into the plant without radiation meters. Two splashed into radioactive water wearing street shoes because rubber boots were not available. Even now, few have been given training on radiation risks that meets international standards, according to their accounts and the evaluation of experts.

The workers who stayed on to try to stabilize the plant in the darkest hours after March 11 were lauded as the "Fukushima

50" for their selflessness. But behind the heroism is a legacy of Japanese nuclear workers facing hazards with little oversight, according to interviews with more than two dozen current and former nuclear workers, doctors and others.

Since the start of the nuclear boom in the 1970s, Japan's utilities have relied on temporary workers for maintenance and plant repair jobs, the experts said. They were often paid in cash with little training and no follow-up health screening.

This practice has eroded the ability of nuclear plant operators to manage the massive risks workers now face and prompted calls for the Japanese government to take over the Fukushima clean-up effort.

Although almost 9,000 workers have been involved in work around the mangled reactors, Tokyo Electric did not have a Japan-made robot capable of monitoring

COVER PICTURE: International Atomic Energy Agency (IAEA) fact-finding team leader Mike Weightman examines Reactor Unit 3 at the Fukushima Daiichi Nuclear Power Plant May 27, 2011 to assess tsunami damage and study nuclear safety lessons that could be learned from the accident.

radiation inside the reactors until this week. That job was left to workers, reflecting the industry's reliance on cheap labor, critics say. "I can only think that to the power companies, contract workers are just disposable pieces of equipment," said Kunio Horie, who worked at nuclear plants, including Fukushima Daiichi, in the late 1970s and wrote about his experience in a book "Nuclear Gypsy".

Tokyo Electric said this week it cannot find 69 of the more than 3,600 workers who were brought in to Fukushima just after the disaster because their names were never recorded. Others were identified by Tepco in accident reports only by initials: "A-san" or "B-san."

Makoto Akashi, executive director at the National Institute of Radiological Sciences near Tokyo, said he was shocked to learn Tokyo Electric had not screened some of the earliest workers for radiation inside their bodies until June while others had to share monitors to measure external radiation.

That means health risks for workers - and future costs - will be difficult to estimate.

"We have to admit that we didn't have an adequate system for checking radiation exposure," said Goshi Hosono, an official appointed by Prime Minister Naoto Kan to coordinate the response to the crisis.

BROAD ROAD TO DESTRUCTION

Fujii, who devoted his career to building Japanese nuclear power plants as a manager with IHI Corporation, was troubled by what he saw at Fukushima in 1997.

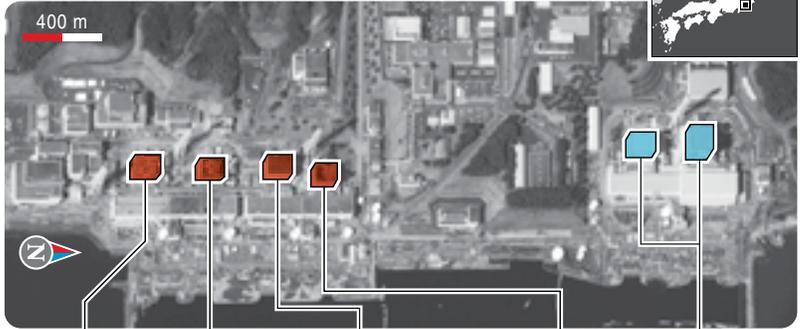
Now 72, he remembers falling for "the romance of nuclear power" as a student at Tokyo's Rikkyo University in the 1960s. "The idea that you could take a substance small enough to fit into a tea cup and produce almost infinite power seemed almost like a dream" he said.

He had asked to oversee part of the job at Fukushima as the last big assignment of his career. He threw himself into the work, heading into the reactor for inspections. "I had a sense of mission," he said.

As he watched a group of Americans at work in the reactor one day, Fujii jotted down a Bible verse in his diary that captured his angst: "Wide is the gate and broad is the road that leads to destruction and many enter through it."

The basis for nuclear safety regulation is the assumption that cancers, including leukemia, can be caused years later by exposure to relatively small amounts of radiation, far below the level that would cause immediate sickness. In normal operations, international nuclear workers

FUKUSHIMA DAIICHI NUCLEAR PLANT



Reactor 4	Reactor 3	Reactor 2	Reactor 1	Reactor 5 & 6
784-MW	784-MW	784-MW	460-MW	784 & 1,100-MW
Mar. 12 Sat.			Explosion and radiation leak confirmed	
Mar. 13 Sun.	Seawater pumped		Seawater pumped	
Mar. 14 Mon.	Blast destroys concrete building	Seawater pumped		
Mar. 15 Tue. Explosion and fire. Radiation becomes unsafe		Explosion reported. Fuel rods exposed for a time		
Mar. 16 Wed. On fire again				Seawater pumped
Mar. 17 Thu. Army helicopters spray seawater on the reactors				
Mar. 18 Fri. Smoke seen rising from reactors				
Mar. 20 Sun		Power cables connected		Cold shutdown
Mar. 21 Mon	Smoke/steam rising from reactors			
Power cables attached, system tests			Power cables attached, system tests	
Mar. 23 Wed	Black smoke seen rising from reactor		Reactor's core temperature rose to 380-390°C	
Mar. 24 Thu	Three workers hospitalised after stepping in radioactive water			
Mar. 26 Sat	Engineers struggle to manage disposal of contaminated water and find source of leak in the plants			
Mar. 27 Sun		Radiation levels spike		
Mar. 29 Tue Traces of plutonium, believed to have originated from reactor 3, are found in soil at five places. TEPCO* says it's not at harmful levels				
Apr. 2 Sat		Cracks found in nearby pit, highly radioactive water discharged into the sea		Low-level radioactive water discharged into the sea
Apr. 5 Tue Low-level radioactive water discharged into the sea		Radioactive water leak into the sea plugged	Nitrogen infusion started	
Apr. 6 Wed				
Apr. 12 Tue Fire seen near the plant early in the day but was later put out				

* Tokyo Electric Power Company

Satellite photo: GeoEye/Reuters MW: Megawatt



are limited to an average exposure of 20 millisieverts per year, about 10 times natural background radiation levels.

At Fukushima in 1997, Japanese safety rules were applied in a way that set very low radiation exposure limits on a daily basis, Fujii said. That was a prudent step, safety experts say, but it severely limited what Japanese workers could do on a single shift and increased costs.

The workaround was to bring in foreign workers who would absorb a full-year's allowable dose of radiation of between 20 millisieverts and 25 millisieverts in just a few days.

"We brought in workers from Southeast Asia and Saudi Arabia who had experience building oil tankers. They took a heavier dose of radiation than Japanese workers could have," said Fujii, adding that American workers were also hired.

Tokyo Electric would admit five years later it had hid evidence of the extent of the defect in the shroud from regulators. That may have added to the pressure to finish the job quickly. When new cracks were found, they were fixed without a report to regulators, according to disclosures made in 2002

It is not clear if the radiation doses for the foreign workers were recorded on an individual basis or if they have faced any health problems. Tepco said it had no access to the worker records kept by its subcontractors. IHI said it had no record of the hiring of the foreign workers. Toshiba, another major contractor, also said it could not confirm that foreign workers were hired.

Hosono, the government official overseeing the response to the disaster, said he was not aware of foreign workers being brought in to do repair work in the past and they would not be sent in now.

Now retired outside Tokyo, Fujii said he has come to see nuclear power as an "imperfect technology."

"This is an unfortunate thing to say, but the nuclear industry has long relied on people at the lowest level of Japanese society," he said.

PAY-BY-THE-DAY

Since the late 1960s, the Kamagasaki neighborhood of Osaka has been a dumping ground for men battling drug and alcohol addiction, ex-convicts, and men looking for a construction job with few questions. It has also been a hiring spot for Japan's nuclear industry for decades.

"Kamagasaki is a place that companies have always come for workers that they can use and then throw away," said Hiroshi Inagaki, a labor activist.



TEMPORARY QUARTERS: Bunk beds for workers are seen in a gymnastic hall at Tokyo Electric Power (TEPCO) Co.'s Fukushima Daini Nuclear Power Station in Fukushima prefecture, May 14, 2011. **REUTERS/Tokyo Electric Power Co/Handout/Files**



SHIFT WORK: Workers for Toshiba rest inside the Toshiba Rest Area at Tokyo Electric Power (TEPCO) Co.'s Fukushima Daiichi Nuclear Power Station in Fukushima prefecture, May 15, 2011. **REUTERS/Tokyo Electric Power Co/Handout/Files**

The nearby Lawson's store has a sign on its bathroom door warning that anyone trying to flush a used syringe down the toilet will be prosecuted. Peddlers sell scavenged trash, including used shoes and rice cookers. A pair of yakuza enforcers in black shirts and jeans walks the street to collect loans.

The center of Kamagasaki is an office that connects day laborers with the

small construction firms that roll up before dawn in vans and minibuses.

Within a week after the Fukushima disaster, Tepco had engaged Japan's biggest construction and engineering companies to run the job of trying to bring the plant under control. They in turned hired smaller firms, over 600 of them. That cascade brought the first job offers to Kamagasaki by mid-March.



CRIPPLED PLANT: International Atomic Energy Agency (IAEA) inspection team members watch No.3 reactor at the crippled Tokyo Electric Power Co. Fukushima Daiichi nuclear power plant in Fukushima Prefecture, in this handout photo taken and released by TEPCO on May 27, 2011. **REUTERS/Tokyo Electric Power Co/Handout/Files**

One hiring notice sought a truck driver for Miyagi, one of the prefectures hit hard by the tsunami. But when an Osaka day laborer in his 60s accepted the job, he was sent instead to Fukushima where he was put to work handling water to cool the No. 5 reactor.

The man, who did not want to be identified, was paid the equivalent of about \$300 a day, twice what he was first promised. But he was only issued a radiation meter on his fourth day. Inagaki said the man was seeking a financial settlement from Tokyo Electric. "We think what happened here is illegal," he said.

Nearby, several men waiting to be hired in Kamagasaki said they had experience working at nuclear plants.

A 58-year-old former member of Japan's Self Defense Forces from southern Japan who asked to be identified only by his nickname, Jumbo, said he had worked at Tokyo Electric's Kashiwazaki-Kariwa power plant for a two-month job. He knows others who have gone to Fukushima from

KAMAGASAKI IS A PLACE THAT COMPANIES HAVE ALWAYS COME FOR WORKERS THAT THEY CAN USE AND THEN THROW AWAY

the hiring line at Kamagasaki, he said.

THE ABANDONED SPA

In Iwaki, a town south of the Fukushima plant once known for a splashy Hawaiian-themed resort, the souvenir stands and coffee shops are closed or losing money. The drinking spots known as "snacks"

are starting to come back as workers far from home seek the company of bar girls.

"It's becoming like an army base," said Shukuko Kuzumi, 63, who runs a cake shop across from the main rail station. "There are workers who come here knowing what the work is like, but I think there are many who don't."

Each morning, hired workers pile into buses and beat-up vans and set out from the nearly abandoned resort. More men in the standard-issue white work pajamas pour out of the shipping containers turned into temporary housing at the Hirono highway exit where residents have fled and weeds have overgrown the sidewalks.

They gather at a now abandoned soccer complex where Argentina's soccer team trained during the 2002 World Cup to get briefed on the tasks for the shifts ahead. They then change into the gear many have come to dread: two or three pairs of gloves, full face masks, goggles and white protective



INFLUX OF WORKERS: Sixty-three-year-old Shukuko Kuzumi sits outside her cake shop across from a rail station in Iwaki, about 50 km south of the tsunami-crippled Fukushima Daiichi nuclear power plant in Fukushima Prefecture. Hundreds of workers from the nuclear plant are staying at inns in the town, once known for a splashy Hawaiian-themed resort. Picture taken June 12, 2011. **REUTERS/Issei Kato**

suits. More than a dozen Fukushima workers have collapsed of heat stroke, and the rising heat weighs more heavily on the minds of workers than threat of radiation.

"I don't know how I'm going to make it if it gets much hotter than this," a heavysset, 36-year-old Tokyo man said as he stretched out at Hirono after a day of spraying a green resin around the plant to keep radioactive dust from spreading.

The risks from the radiation hotspots at Fukushima remain considerable. A vent of steam in the No. 1 reactor was found earlier this month to be radioactive enough to kill anyone standing near it for more than an hour.

Tokyo Electric has been given a sanction-free reprimand for its handling of radiation exposure at Fukushima. Nine workers have exceeded the emergency exposure limit of 250 millisieverts. Another 115 have exceeded 100 millisieverts of exposure. The two workers with the highest radiation readings topped 600 millisieverts of exposure.

For context, the largest study of nuclear

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workers to date by the International Agency for Research on Cancer found a risk of roughly two additional fatal cancers for every 100 people exposed to 100 millisieverts of radiation.

But several Fukushima workers say they have been told not to worry about health risks unless they top 100 or near 200 millisieverts of exposure in training by contractors.

Experts say that runs counter to international standards. The International

Atomic Energy Agency requires workers in a nuclear emergency to give "informed consent" to the risks they face and that they understand danger exists at even low doses.

Tokyo Electric spokesman Junichi Matsumoto said the utility could not confirm what kind of training smaller firms were providing. "The subcontractors have a responsibility as well," he said. "I don't know what kind of briefing they are getting."

Kim Kearfott, a nuclear engineer and radiation health expert from the University of Michigan who toured Japan in May, said authorities needed to ensure that safety training was handled independently by outside experts.

"The potential for coercion and undue influence over a day laborer audience is high, especially when the training and consent are administered by those who control hiring and firing of workers," she said.

Tokyo Electric has been challenged before on its training. Mitsuaki Nagao, a plumber who had worked at three plants



WORKERS AT RISK: A thirty-six-year-old electrician from northern Japan, who is working inside the tsunami-crippled Fukushima Daiichi nuclear power plant, stands in a parking lot in Iwaki, about 50km south of the plant in Fukushima prefecture, June 12, 2011. Since the start of the Japanese nuclear boom in the 1970s, Japan's utilities have relied on temporary workers who receive little explanation on the health risks from radiation. The worker declined to give his name and to show his face. **REUTERS/Issei Kato**

including Fukushima, said he was never briefed on radiation dangers, and would routinely use another worker's dosimeter to finish jobs. Some doctors worry that the same under-reporting of radiation could happen at Fukushima as well.

Nagao sued Tokyo Electric when he was diagnosed with multiple myeloma, a type of bone marrow cancer, in 2004. His lawsuit, one of two known worker

cases against a Japanese utility, was rejected by a Tokyo court, which ruled no links had been proven between his radiation and his illness. He died in 2007.

Some doctors are urging Japan's government to set up a system of health monitoring for the thousands of workers streaming through Fukushima. Some also want to see a standard of care guaranteed.

"This is also a problem of economics,"

said Kristin Schrader-Frechette, a Notre Dame University professor and nuclear safety expert. "If Japan wants to know the true costs of nuclear power versus the alternatives, it needs to know what these health care costs are."

(Editing by Bill Tarrant)

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