



Inside Japan's Nuclear Meltdown

WRITTEN, PRODUCED AND DIRECTED

by Dan Edge

March 11, 2011 Day 1

TAKASHI SATO, Former Plant Inspector: [*through interpreter*] On March 11th, there was a relaxed atmosphere at work. I was at my computer, writing reports. Before that day, we'd had a few earthquakes, around magnitude 4. Then, I think it was about 2:46 PM, I felt an incredible rumbling in the earth. It was like nothing I'd ever experienced.

[*Weather camera footage*]

NARRATOR: The earthquake that shook the Fukushima Dai-ichi nuclear power plant was the most powerful to strike Japan since records began. The company that operates the

plant, TEPCO, has forbidden its workers from speaking publicly about what followed.

But one year on, they are starting to tell their stories. Some have asked for their identities to be hidden for fear of being fired.

“ONO”: [*through interpreter*] I saw all the pipes fixed to the wall shifting and ripping off.

TAKASHI SATO: [*through interpreter*] It was getting stronger and stronger. This was no ordinary quake.

“MURAKAMI”: [*through interpreter*] We were all on our knees, holding onto the railings. Then the power was cut.

NARRATOR: The workers stayed calm because they knew Japanese power plants are designed to withstand earthquakes. The reactors automatically shut down within seconds. But the high radioactivity of nuclear fuel rods means they generate intense heat even after a shutdown. So backup generators kicked in to power the cooling systems and stop the fuel rods from melting.

Takashi Sato is a reactor inspector who no longer works at the plant.

TAKASHI SATO: [*through interpreter*] I wasn't worried about the condition of the plant. I had always thought nuclear power was safe. But in the end, the plant wasn't safe, was it.

3:15 PM

NARRATOR: Just up the coast, the fishermen of Fukushima knew what was coming next.

YOSHIO ICHIDA: [*through interpreter*] It's always been said on this shore the tsunami will follow the earthquake. I went straight to the harbor and headed out to sea.

NARRATOR: Yoshio Ichida wanted to save his boat. He was racing straight into the biggest tsunami waves to strike Japan in hundreds of years, hoping to crest them before they broke.

YOSHIO ICHIDA: [*through interpreter*] They were like mountains. We went over three waves that came directly from the east. They were about 15 meters high. It was like this.

NARRATOR: The biggest of the waves was more than 40 feet high and traveling at over 100 miles an hour.

YOSHIO ICHIDA: [*through interpreter*] When I looked back to shore, there was a strange ocean mist. I knew something bad was happening.

NARRATOR: At the nuclear plant, a worker was filming as his co-workers fled to higher ground.

FLEEING WORKER: [*subtitles*] Hurry up! It's coming!

FLEEING WORKER: [*subtitles*] The tsunami is going to catch you!

NARRATOR: At 3:35 PM, the biggest of the waves struck. It was more than twice the height of the plant's seawall.

It's now known that TEPCO had been warned by a government committee of scientists in 2009 that its tsunami defenses were inadequate. The company says it was still reviewing the matter when the disaster happened.

Now the tsunami flooded the nuclear plant.

“MURAKAMI”: [*through interpreter*] The port area was trashed. I felt something incredible had happened.

NARRATOR: This man is a senior nuclear engineer who still works at the plant.

“MURAKAMI”: [*through interpreter*] Cars had been left

everywhere by the wave. Buildings and 5,000-ton fuel tanks were sucked out to sea. I watched them slowly sinking.

NARRATOR: Most of the backup diesel generators needed to power the cooling systems were located in basements. They were destroyed by the tsunami waters, meaning the workers had no way of keeping the nuclear fuel from melting.

TAKASHI SATO: [*through interpreter*] When I heard the diesel generators were lost, I couldn't square that with reality. I was stunned.

NARRATOR: This is the frantically scribbled log the engineers kept on a whiteboard in the control room as the nuclear plant slid towards disaster. "15:42, nuclear emergency declared. 15:50, loss of water level readings. 16:36, emergency core cooling system malfunction. No water can be injected."

TEPCO turned down FRONTLINE's requests for interviews with plant workers, but put forward the managing director of its nuclear division. He acknowledged the company had never imagined that one of their nuclear plants could lose all power.

AKIO KOMORI, Managing Dir., TEPCO Nuclear Division: [*subtitles*] We were entering territory that exceeded what we had ever considered. My gut feeling was that our options for responding were going to be rather limited.

5:00 PM Tokyo

NARRATOR: In the 90 minutes since the tsunami, Japan's government had been scrambling to deal with one of the biggest natural disasters in the country's history. Now the prime minister was informed that the cooling systems had failed at Fukushima.

NAOTO KAN, Prime Minister, 2010-11: [*subtitles*] When I got that news, I truly felt the situation was extremely serious. The earthquake and tsunami had caused massive damage. Now we had a nuclear accident on top of that. I knew if we left

it, it would melt down. I felt a shiver down my spine.

NARRATOR: The prime minister asked to be kept informed of what was happening in Fukushima. But for now, the executives at TEPCO headquarters in Tokyo were in charge of tackling the nuclear emergency.

5:30 PM

NARRATOR: Two hours had now passed since the tsunami. The coastline was devastated. Around 20,000 people were dead or missing.

Norio Kimura, a farmer from Fukushima, lived just two miles from the nuclear plant. He'd been out working when the waves struck. Now he was searching for his family. Survivors were gathering at the local sports center, unaware of the unfolding nuclear crisis.

NORIO KIMURA: [*through interpreter*] Many people had gathered. I was told three of my family were missing. I felt cold, like my blood was being drained.

NARRATOR: Norio's father was missing. So was his wife, and his youngest daughter, Yuna.

NORIO KIMURA: [*through interpreter*] I just couldn't accept that the tsunami might have killed them. I started searching in the rubble, not just around my house but the whole village.

NARRATOR: As night fell, the Japanese government ordered an evacuation of everyone within two miles of Fukushima Dai-ichi. But Norio and others ignored the order and kept searching for their families.

11:30 PM

NARRATOR: Just along the coast, the nuclear plant was still without power. The workers had no functioning instruments to

reveal what was happening inside the reactor cores. They improvised.

TAKASHI SATO: [*through interpreter*] All of us who had a car or a company car were asked to get the batteries to try to restore power.

NARRATOR: The scavenged batteries allowed vital monitoring instruments in the Reactor 1 control room to work again. Just before midnight, the workers restored power to the pressure gauge. The levels caused panic.

MURAKAMI: [*through interpreter*] The pressure was going up and up. Everyone thought, “Isn’t this dangerous? Are we in trouble?”

NARRATOR: The engineers realized the rising heat of the fuel rods in the reactor core was creating massive amounts of radioactive steam and hydrogen. The resulting pressure meant the workers could not get water onto the fuel. Even worse, it meant the containment vessel might explode, a disaster that could leave parts of Japan uninhabitable for decades.

1:00 AM Day 2

NARRATOR: TEPCO now knew they had to release radioactive gases into the atmosphere to prevent the reactor from exploding. But to take such a desperate measure, the company needed the permission of the prime minister himself.

NAOTO KAN: [*subtitles*] I got a report from TEPCO that the pressure was going up. Venting was necessary. What should we do?

NARRATOR: Radiation has long been a sensitive subject in Japan. After the United States dropped atomic bombs on Hiroshima and Nagasaki in 1945, tens of thousands died of radiation sickness and cancers. Yet now Japan’s prime minister felt he had no choice but to authorize the deliberate release of radioactivity.

NAOTO KAN: [*subtitles*] Everyone agreed the venting had to happen. So I said, “I understand. Do it. Let’s do it.”

NARRATOR: But there was something TEPCO wasn’t telling the prime minister. The company had never imagined they might have to vent a reactor without electricity. They didn’t know how to do it.

“MURAKAMI”: [*through interpreter*] The venting valves are driven by motors. So without electricity, they won’t open. It’s possible to open them manually, but really difficult.

NARRATOR: In the darkness of the Reactor 1 control room, the workers pored over blueprints to try to work out how to open the vents. The handwritten plant logs show that radiation levels were now rising.

TAKASHI SATO: [*through interpreter*] To see those kind of numbers would normally be unthinkable. And this isn’t inside the reactor itself, it’s in the office. It was a disaster.

NARRATOR: The engineers suspected something that the prime minister and TEPCO would not acknowledge for months — nuclear meltdown had begun.

“MURAKAMI”: [*through interpreter*] I realized that the fuel had started to melt. We got our masks and put them by our feet so we could escape at any time.

6:00 AM Day 2

NARRATOR: Back in Tokyo, six hours after the order to vent the reactors, there was still no news from the plant. The prime minister began to suspect that TEPCO was hiding the truth. He decided to go to Fukushima Dai-ichi himself. He was later criticized for interfering with the emergency work at the plant, but he says he had to find out what was really going on.

NAOTO KAN: [*subtitles*] Everyone agreed that we should vent. But no one could explain why it wasn’t happening. It

was like a game of telephone with TEPCO headquarters in the middle.

NARRATOR: At Fukushima Dai-ichi, the Prime Minister met directly with the TEPCO engineers. He insisted they vent the reactors

“MURAKAMI”: [*through interpreter*] Kan was very angry. The government had given an order. What was TEPCO doing? But we were trying our best. The valves were hard to open. We were genuinely trying, we just hadn’t managed it.

NARRATOR: The plant manager, Masao Yoshida, was known for being frank. He knew the radiation near the vents was at potentially fatal levels, but he told the prime minister he’d send in a suicide squad if necessary.

NAOTO KAN: [*subtitles*] He said, “I get it.” Then he showed me his plan.

NARRATOR: The prime minister knew his orders might condemn the men who went into the reactor to death, but he felt Japan’s future was at stake.

NAOTO KAN: [*subtitles*] For me, it was a very difficult decision. But I thought it had to be done, and I did it.

NARRATOR: But then TEPCO got some news which meant the venting was delayed yet again. The evacuation of the surrounding villages was not yet complete. If the reactors were vented, local residents could be exposed to dangerous levels of radiation.

Norio Kimura was two miles from the plant, together with his eldest daughter, Mayu. He was still searching for his youngest daughter, his wife, and his father. Now he faced a choice: abandon the search, or risk exposing his surviving daughter to radiation.

NORIO KIMURA: [*through interpreter*] The head of the

village told me that the nuclear plant was in trouble. He persuaded me to leave. He told me the living were more important than the dead. That's when my feelings changed. I had one daughter left. I had to protect her.

NARRATOR: By just after 9:00 o'clock on the morning of March the 12th, the villages around the plant had been evacuated. At last, TEPCO ordered the venting team to go in. The plant logs show the first two volunteers set off at 9:04 AM.

“MURAKAMI”: [*through interpreter*] They knew they'd be exposed to radiation, but they went in.

VOLUNTEER WORKERS: [*subtitles*] The pipes look all right. 50 milli. The radiation is rising!

NARRATOR: This footage was filmed by TEPCO seven months later, when radiation levels remained dangerous. It shows the reactor building where the venting team had to operate.

“MURAKAMI”: [*through interpreter*] It was not a place for humans. The temperature was 100 degrees plus. The surroundings were pitch black, and there was condensation. The radiation was high. I don't think I would have been able to go.

NARRATOR: Each worker was limited to 17 minutes in the reactor building.

VOLUNTEER WORKER: [*subtitles*] 67 milli!

NARRATOR: After nine minutes, the workers found the wheel for opening the vent. They inched it open, then pulled back when time ran out. Four more workers followed, each spending just minutes in the reactors.

“MURAKAMI”: [*through interpreter*] They showed courage. And resolution. Their lives were on the line.

2:00 PM Day 2

NARRATOR: That afternoon, a thin plume of gas signaled that the pressure in the reactor core was falling. The venting team appeared to have saved northeastern Japan from a catastrophic explosion. The Fukushima workers began to think the worst might be over.

TAKASHI SATO: [*through interpreter*] I started to relax. I was hoping the reactor would soon be stable and they would let us leave soon.

NARRATOR: With the venting complete, the workers could focus on getting vitally needed water into the reactor cores. Suddenly, the ground shook.

“MURAKAMI”: [*through interpreter*] I was thrown a foot from my chair. No one knew what it was. Maybe an earthquake?

TAKASHI SATO: [*through interpreter*] The ground was rumbling and shaking like an aftershock. It was like thunder.

“MURAKAMI”: [*through interpreter*] Then Yoshida said, “Did Reactor 1 just explode?” Then we all panicked.

NARRATOR: The engineers feared that the reactor core itself had exploded, scattering radioactive fuel over the plant. In the control center, they watched the radiation levels— and waited to learn if they would survive.

“MURAKAMI”: [*through interpreter*] Many of us thought of running away. But there was no escape. If you actually ran, you would be exposed to radiation.

NARRATOR: After an hour, the radiation levels stabilized. The engineers figured out what had happened. Leaking hydrogen had exploded in the roof of the reactor building, but the reactor core itself was intact.

CHIEF CABINET SECRETARY: [*press conference*]
[*subtitles*] The radiation levels have not changed much since the explosion. Please remain calm.

NARRATOR: In Tokyo, the prime minister's chief cabinet secretary was playing down the crisis.

CHIEF CABINET SECRETARY: [*subtitles*] We see no indications of damage to the containment vessel itself.

NARRATOR: The prime minister and his team were later fiercely criticized for hiding the severity of the disaster from the Japanese people and the world. Behind the scenes, they knew the situation was sliding out of control. The explosion had halted efforts to get water onto the reactor cores. It was now only a matter of time before the fuel would melt through into the open, spewing out much worse levels of radiation.

NAOTO KAN: [*subtitles*] We started to think about how far this accident would spread. I asked people to do a simulation. The worst-case scenario was an evacuation of 120 to 190 miles around the plant. If that happened, Tokyo would grind to a halt. Japan would grind to a halt.

NARRATOR: Already a plume of radiation from the gas released in the explosion was drifting across Japan. The government widened the evacuation zone, ordering everyone within 12 miles of the plant to flee.

Norio Kimura and his surviving daughter were still in that danger zone when they got the news.

NORIO KIMURA: [*through interpreter*] I now thought it was dangerous to stay. Iodine tablets were being handed out in the village. I made my daughter take one. I had to take her somewhere safe. That's all I could think about. We had to get far away from the nuclear plant.

8:00 AM Day 4

NARRATOR: Back at the plant, the situation was about to get even worse. The explosion had already set back efforts to get water into the melting cores of Reactors 1 and 2. Now Reactor 3 was also in meltdown. TEPCO needed help.

A specialist team of soldiers was ordered to the site. Another hydrogen build-up meant the Reactor 3 housing could explode at any moment.

Col. SHINJI IWAKUMA: [*through interpreter*] I was desperately trying to work out how we could get the job done quickly. I was nervous. Although we had trained for it, this was actually our first time in a radioactive area.

NARRATOR: Colonel Shinji Iwakuma and his team wore suits that shielded their bodies from radioactive particles but provided no protection against lethal gamma rays. Their mission was to inject water directly into the core of Reactor 3.

Col. SHINJI IWAKUMA: [*through interpreter*] Just as we were about to get out of the jeep to connect the hose, it exploded. Lumps of concrete came ripping through the roof of the jeep. Radioactive matter was leaking in through the bindings of our masks. Our dosimeter alarms were ringing constantly.

NARRATOR: The soldiers were now surrounded by lethally radioactive debris. They were injured in the blast but managed to flee the scene before anyone received a fatal dose.

Col. SHINJI IWAKUMA: [*through interpreter*] I was desperate to get away from the danger. We were lucky on many levels. We were lucky. Just lucky.

3:00 PM Day 4

NARRATOR: Parts of the nuclear plant were now completely off limits to the workers. Radiation levels near one of the reactor buildings were at 1,000 millisieverts per hour. After an hour of exposure at these levels, radiation sickness sets in. A

few hours would mean death.

TAKASHI SATO: [*through interpreter*] In the control room, people were saying we were finished. They were saying it quietly, but they were saying it. We felt we had to flee. This was the end.

3:00 AM Day 5

NARRATOR: That night in Tokyo, the prime minister was awakened with a disturbing message. He says he was told that TEPCO planned to withdraw their workers from the plant.

NAOTO KAN: [*subtitles*] I thought withdrawal was out of the question. If they withdrew, six reactors and seven fuel pools would be abandoned. Everything would melt down. Radiation tens of times worse than Chernobyl would be scattered.

NARRATOR: At that moment in Fukushima, the plant manager, Masao Yoshida, had gathered all the workers together.

“MURAKAMI”: [*through interpreter*] Yoshida said, “Starting now, we are going to evacuate.” At that point, Yoshida was resigned to his fate. I’m sure he was prepared to die himself, but he couldn’t kill 250 people. So he said, “Just go home. We’ve done this much. We can do no more. Just go home.”

TAKASHI SATO: [*through interpreter*] It’s probably bad to admit it, but I was relieved. I just wanted to get out.

5:30 AM Day 5

NARRATOR: Meanwhile, the prime minister was arriving at TEPCO headquarters in Tokyo, determined to stop total withdrawal. He demanded to speak to TEPCO’s executives. Via a video link, he was watched by the engineers in

Fukushima.

NAOTO KAN: [*subtitles*] I said, “This is a very tough situation. But you cannot abandon the plant. The fate of Japan hangs in the balance. All those over 60 should be prepared to lead the way in a dangerous place. Otherwise, we’re handing Japan over to an invisible enemy. This would affect not just Japan, but the whole world.”

NARRATOR: To this day, there is controversy about what TEPCO intended. The company executives say they never planned to completely abandon the plant.

AKIO KOMORI, Managing Director, TEPCO Nuclear Division: [*subtitles*] We never said that all employees would withdraw. We said we wanted to look into withdrawing. We were considering withdrawing some of the workers.

NARRATOR: That morning, TEPCO evacuated all but a skeleton crew led by plant manager Yoshida. The remaining men were to become known as the Fukushima 50. For now, they were locked down in the central control room.

“MURAKAMI”: [*through interpreter*] The radiation level was ridiculously high. We just didn’t know what to do. The reactors were unmanned. Unmanned.

NARRATOR: Hundreds of workers were on standby a few miles away, ready to lay pipes that could pump water into the reactors. But the radiation levels were now too high for them to approach the plant.

A team of American nuclear specialists, who’d just arrived in Japan, were fearful that TEPCO and the government had run out of ideas.

CHUCK CASTO, Nuclear Regulatory Commission: We were given numbers, very low numbers of people who were on the site, and we knew that that wasn’t sufficient to do what needed to be done at that time.

NARRATOR: That day, frustrated at the lack of information the prime minister was giving them, the Americans decided to fly a surveillance drone over the plant. The data they got was disturbing.

A third hydrogen explosion had exposed pools of discarded radioactive fuel to the atmosphere. These spent fuel rods were still highly radioactive. If the pools boiled dry, they could catch fire, and the contamination could be even worse than from a reactor meltdown.

CHUCK CASTO: We had some pretty clear indication that there was fuel damage occurring in the spent fuel pools from lack of water. And as they were worried about Japanese citizens, we were worried about American citizens. And we thought, to put all this to rest, put water in there.

9:40 AM Day 7

NARRATOR: The Japanese prime minister ordered a desperate tactic, dumping water on the spent fuel pools from the air. The first crew to take off knew that Soviet pilots who'd done this during the Chernobyl nuclear accident had subsequently died of cancer.

1st Lt. YOSHIYUKI YAMAOKA, Helicopter Pilot:
[*through interpreter*] That morning, before I started the engine, I called my wife. She said, "If someone has to do it, then go and do your best. I am praying for you." So she was supportive. She was crying at the time. I almost cried, as well.

NARRATOR: An earlier reconnaissance mission had been abandoned because of high levels of radiation over the reactors. Tungsten plates were now bolted to the helicopter to protect the pilots from gamma rays. The crew knew that they had to drop the water on the move from 300 feet. If they went higher, they'd miss. If they went lower, they could receive dangerous doses of radiation.

1st Lt. YOSHIYUKI YAMAOKA: [*through interpreter*] At

the time, it felt like, “This is it. This is finally it.” Like a tingle down the spine.

NARRATOR: Their target was beneath them.

1st Lt. YOSHIYUKI YAMAOKA: [*through interpreter*] I will never forget what I saw — the bones, the skeleton of the building, the walls were strewn everywhere. Incredible.

NARRATOR: The world watched the mission live via a camera placed 20 miles from the plant.

1st Lt. YOSHIYUKI YAMAOKA: [*through interpreter*] The wind was bending the water, so we sprayed it like this. We could see the steam, so I knew it had gone in. “We did it. We did it. We did it for everyone.” That’s how I felt.

NARRATOR: But on their second mission, they missed. Other helicopters followed, but the wind was too strong for accurate aiming.

The American nuclear team was monitoring the operation.

CHUCK CASTO: We were taking radiation measurements ourselves to see, after the drop, did the radiation level go down. And it didn’t.

NARRATOR: The United States government began to draw up plans to evacuate 90,000 of its citizens from Japan. For now, they advised all Americans to stay at least 50 miles from the plant. The Japanese evacuation zone remained at 12 miles.

U.S. surveillance now suggested that there were flakes of deadly radioactive fuel scattered around the reactors. This meant that anyone who approached the plant would be risking their lives.

11:00 PM Day 8

NARRATOR: Despite the danger, the Japanese government

ordered a team of Tokyo firefighters to get water into the fuel pools by any means. The men had no experience of working in radioactive conditions.

Capt. TOYOHICO TOMIOKA, Tokyo Fire Dept.:

[through interpreter] All of our troops gathered. First, we chose all the over-40s. These were the guys who weren't going to be having any more children.

Capt. OSAMI KAMANAKA, Tokyo Fire Dept.: *[through interpreter]* I didn't speak to my family. I've taught them that at any moment, I might go into these situations.

NARRATOR: One of the firefighters went ahead to plot a route. But the radiation he was exposed to meant he couldn't accompany his men on their mission.

Capt. TOYOHICO TOMIOKA: *[through interpreter]* I was worried about the radiation and the mental welfare of my team. But I had to leave it to them. I waited and prayed.

NARRATOR: The plan was for the firefighters to park a truck by the sea to suck up water, then lay 800 yard of hose and leave it spraying into the fuel pool.

OFFICER: *[subtitles]* Does everyone have their lights ready?

NARRATOR: Unique footage filmed that night from the front line of the nuclear disaster shows the firefighters preparing to approach the reactors.

OFFICER: *[subtitles]* The truck along the seawall will be the one that heads towards the ocean. OK, good luck!

NARRATOR: They gave themselves 60 minutes to complete the mission. Any longer would expose them to excessive radiation.

Capt. OSAMI KAMANAKA: *[through interpreter]* When we arrived at Fukushima Dai-ichi, it was so quiet. No wind, an

eerie silence. The first thing we saw was tsunami debris. The roads were violently twisted. I was worried we wouldn't be able to complete the mission in one hour.

FIREFIGHTER: [*subtitles*] I'm getting 0.4 millisieverts.

FIREFIGHTER: [*subtitles*] OK, 0.4 millisieverts. No problem.

NARRATOR: A radiation-monitoring vehicle set off in front of the firefighters.

FIREFIGHTER: [*subtitles*] OK, we are moving. 0.4 millisieverts.

NARRATOR: Within minutes, the route was blocked by tsunami debris. The firefighters now had to lay the hose by hand, taking radiation readings as they went.

FIRE DEPT. VIDEO: [*subtitles*]

- Move from the middle!
- Watch the manhole!
- Is the manhole on the left?
- Yes, the left!

NARRATOR: The alarms on the dosimeters signaled a dangerous increase in radiation.

FIRE DEPT. VIDEO: [*subtitles*]

- Stop! Almost there!
- The hoses are there!
- Keep to the right!

- No, keep to the left!
- What are you reading?
- I'm getting 70 millisieverts.
- I'm getting 100 millisieverts here!
- 100 millisieverts!
- Everyone not working take cover inside the truck!
- Take a step back! Pull back!
- OK, get away from the building as soon as you can.

NARRATOR: After an hour on site, the hoses were finally connected.

Capt. OSAMI KAMANAKA: [*through interpreter*] I was told on the radio that the water was spraying, so I started to think we had completed our mission. Then I just wanted to get out of there. We ran to the minibus and left.

NARRATOR: As the firefighters withdrew, radiation levels at the plant began to fall. The men started back for Tokyo. Some had still not told their families what they'd been doing.

Capt. OSAMI KAMANAKA: [*through interpreter*] When I got home, I was told off. My wife said, "So where have you been? A phone call would have been nice."

NARRATOR: With radiation levels lower, TEPCO seized their chance. The hundreds of workers who'd been on standby headed into the plant. Their mission was to lay miles of pipes that would channel a constant flow of water into the reactor cores. They had to work fast in case radiation levels spiked again.

"YANAI": [*through interpreter*] At the time, in March, we

didn't wear dosimeters. TEPCO didn't tell us directly where radiation levels were highest.

NARRATOR: TEPCO now says most of their dosimeters were washed away in the tsunami, but that they ensured each group of workers had one.

“YANAI”: [*through interpreter*] It was an emergency operation and we were in a hurry. No one complained. We all understood. Even if it broke the rules, we kept quiet about it.

NARRATOR: When the pipes were laid, a steady flow of water at last started to cool the reactor cores. After days in fear of dying, the workers in the control center began to feel hope.

“MURAKAMI”: [*through interpreter*] People around me, their expressions grew brighter. Angry voices fell silent. The bosses calmed down.

NARRATOR: Weeks of difficult and often perilous work lay ahead, but the most dangerous phase of the crisis was over.

Day 9

NAOTO KAN, Prime Minister, 2010-11: [*subtitles*] Until then, we were pushed and pushed by an invisible enemy. Finally, the system was in order. The turnaround began.

NARRATOR: The prime minister was later forced to resign, accused by his critics of mishandling the crisis.

TEPCO faces having to pay tens of billions of dollars in damages. The company is on the verge of bankruptcy.

The workers who battled to save the plant face an uncertain future. None of them have died from their exposure to radiation, but more than a hundred received doses which increase their risk of developing cancer in the future.

NAOTO KAN: [*subtitles*] After the Second World War,

people in Japan no longer died for their country. In this case, escape was not an option. Fighting was the only way. That it did not get any worse was God's will. That first week, we walked a razor-thin line.

NARRATOR: The radiation released by the Fukushima meltdowns contaminated hundreds of square miles of northeastern Japan. More than 100,000 people fled the fallout.

Norio Kimura moved to the mountains of Hakuba. Only here, on the other side of the country, did he feel his surviving daughter was safe from radiation. In the weeks after the tsunami, the bodies of his wife and father had been recovered. But his youngest daughter, Yuna, was still missing.

Four months after the disaster, Norio is travelling back to Fukushima. An exclusion zone is still in force for 12 miles around the plant. Animals abandoned by their owners have starved to death. Others roam wild. Some of these districts are contaminated so badly that they will be uninhabitable for decades.

Just two miles from the nuclear power plant, the evacuees from Norio's village are holding a ceremony for those who died in the tsunami. For Norio, it's a chance to say farewell to the family he had to leave behind.

NORIO KIMURA: [*through interpreter*] It has been four months since you suddenly disappeared. I have been wondering why this happened. One day, we will return here to live, looking at the sea that took you from us. We do not know when this will be, but we will definitely return. On behalf of the bereaved, Norio Kimura.

