Introduction

It has been five years since the triple disaster brought Fukushima Daiichi to its knees and stunned the world. The first nuclear disaster to play out so publicly in real time, live on worldwide television and social media. It has proven the power of people and the push back from old entrenched systems trying to cling to their position of dominance.

The US State Department had two worries when the nuclear disaster struck. Will it cause a hit to the US stock markets and the emergence of information they could not control.

“Technology/ social media would devolve power from governments and large institutions to individuals and small institutions, enabling almost leaderless political movements.” “Powerful virtual organizations would emerge with globally distributed members and followers instead of paid staff, and a web address instead of a street address.”

While there have been some establishment efforts to astroturf social media and online reporting, it has largely been ineffective. Most of the establishment has fallen back on old tactics of having their narrative reported in the mainstream press. Even that has been somewhat limited as media outlets run the risk of alienating readers if they lose their trust by reporting obviously skewed or inaccurate information.

Countries like the US and Japan have the most to lose if the worldwide public turns away from nuclear power. They have been the largest purveyors of attempts to skew public perceptions about the disaster. Reporting and research from countries more removed from the issue have proven to be valuable allies in discovering the objective facts of the disaster.

In our 5th year report we cover the technical details of the status of each reactor unit and what new knowledge has been discovered this year. We also look at the broader implications for society, the environment and the people.

Unit 1

Unit 1 received considerable attention this year with a number of new efforts. TEPCO has not said why unit 1 has been the recipient of so much of the work but it may be due to relatively low radiation levels in most of the building compared to units 2 and 3.

Unit 1 received the first set of muon scans at the plant. Muon detectors were installed after test runs were done previously at the Tokai research reactor. The detector units can determine the
location of reactor fuel by monitoring muon particles passing through the area. The detectors were installed in February of 2015 as we reported here along with more photos.

The results of the scan were completed in mid-March of 2015 and showed no fuel inside the reactor vessel. The scans also found a scatter pattern of what may have been fuel debris released from the reactor well across the spent fuel pool.

The grainy image below of unit 1’s reactor vessel shows where no fuel was found. This image was provided as a rough indication of where they would have found signatures that indicated reactor fuel. The smaller color image shows the traces of what is assumed to be reactor fuel debris scattered across the refueling floor and spent fuel pool. This is also the location where the reactor well cover can be seen as being dislodged.

We pulled some long term graphs for unit 1 as it has had the most unstable activity. The radiation and temperature graphs did show some trends. Graphs courtesy of Fukuichi-Mods.
The graph above shows readings for the suppression chamber of unit 1. Containment (drywell) radiation sensors provided no data. From early March 2014 to early February 2016 the radiation levels took a steady decline. These sensors are located along the outer walls of the suppression chamber room well above the standing water and are not in the actual torus tube. This diagram and photo below from unit 2 shows the typical location for the suppression chamber radiation sensor.
Temperature readings for containment and the suppression chamber also showed some interesting trends. Both peaks are during the summer, indicating that outside temperatures have an influence on the containment temperatures. The three highest lines on the graph are HVH air supply C, D and E. These are air handling systems within containment. Each has a temperature sensor. This cluster has read warmer since we have been able to track trends.
Hydrogen has been an ongoing problem for the suppression chamber of unit 1. TEPCO suspects at least some of the fuel debris is in the torus tube and may be the cause. Unit 1 also has small amounts of xenon 135 detected from the suppression chamber. Constant nitrogen injection at unit 1 has been conducted in an effort to keep hydrogen levels down. Higher concentrations can become explosive.
UNIT 1 HYDROGEN & NITROGEN

FUKUSHIMA
Fifth Anniversary REPORT

- Unit 1 Suppression Chamber hydrogen (blue & green)
- Hydrogen values grow then drop rapidly
- Nitrogen injected via the reactor vessel
- Unit 1 also has xenon 135 production continuing. Other units do not.

MORE INFORMATION AT SimplyInfo.org
TEPCO began efforts to put a robot into containment in April of 2015. This involved sending in a small shape changing robot to crawl the catwalk grating in containment. The plan involved using two robots, one to do each of the two phases. There was also the assumption that one or both of the robots could be damaged due to the high radiation levels.
The first robot made it ¾ of the way through the planned trip. It caught itself on a piece of debris and was unable to move but was still transmitting data. By the following day TEPCO decided to cut the communication cable and abandon the first robot in containment.

The first inspection found conditions similar to what early scope inspections found, considerable amounts of debris, charring and blistered paint where paint remained. Small wafts of steam were seen on the robot video. Recorded temperatures were slightly above those found from the remaining containment sensors. Radiation levels in the video ranged from 7 - 13 sieverts with a brief peak at 24.9 sieverts. The peak would translate to roughly 8e+15 Sv/h if there was no water covering the area. These readings are lower than those found underwater in the suppression chamber room and in the outdoor vent stack tower.

The second robot entered containment around April 15, 2015 and took a different route through containment headed towards the steam pipes.

The second robot was able to complete its route, return to the entry area and then head the other direction to follow the path of the first robot. It was able to view the stranded robot and
then had its camera degrade making any further movement impossible. The second robot was also abandoned in containment.

A third containment inspection is planned. This one will drop a scope type camera mounted on a robot, down from the catwalk to look at the containment floor and the reactor pedestal doorway. This is a potential location of at least some of the melted reactor fuel. If this work goes as planned it could determine if any of the melted fuel remains in the pedestal or containment floor. That knowledge is critical to the clean up process. IRID’s reporting for this planned work gave no future date for when this will take place.

In some documents intended more for industry insiders than the public, clearer admissions on the condition of unit 1 have been made. Unit 1’s melted fuel is assumed to no longer be in the reactor vessel (RPV) and not in the reactor vessel pedestal. It is assumed to at least have left the pedestal and attacked the containment shell. That would be the outside lip on the containment floor that is vulnerable to burn through. If the melted fuel successfully burned through that lip it would end up in the suppression chamber room. That is considered outside of containment.
TEPCO conducted a survey of the contamination levels of water remaining in the basement areas of the unit 1 turbine building. This work found significantly elevated levels of cesiums and beta radiation. This work was conducted to determine the feasibility of lowering the water levels inside the building basements as they lowered outside groundwater levels through pumping of water out of the existing subdrain pit system. These findings may be playing a role in Japan’s nuclear regulator decision to prevent TEPCO from turning on the frozen wall system. They have since come to an agreement for incremental operation of the frozen wall. More recently, TEPCO announced that they have been able to reduce water levels in unit 1’s basements to block contaminated reactor building water from flowing directly into the turbine building.

In preparation for removal of the cover building from unit 1 in July, an airflow blocking doorway was hastily installed at the last minute. An inflatable plug had been installed in the equipment shaft well before the cover removal was announced. That plug began having problems after concrete debris fell on top of it. The steel and plastic airflow blocking door installed near the ground level overhead door area of unit 1 is intended to prevent air from blowing contaminated dust out the top of the damaged building. The first roof panel was removed on July 28, 2015. After removal, a number of readings were taken and panel removal stalled. By October 1st all of
the roof panels were removed. Work ongoing into 2016 involved attempts to vacuum up small debris and dust deposits above the collapsed roof.

A series of additional robot and scope inspections were planned for unit 1. The first of those reported was a scope inspection of the TIPS room. This is a room housing probes used to monitor the reactor. High radiation levels were found in a few locations but TEPCO thought the room could be decontaminated to the point workers could enter. Other work was scheduled to look at the main steam valve room, the adjacent SHC room and an airlock chamber. We have not found any reporting on those other investigations to date. These inspections would help guide repair and dismantling work along with identifying locations where radiation could be high.

Unit 2

IRID planned the muon scan of unit 2 for May of 2015. What IRID didn’t mention was that Nagoya University had already done unannounced scans of units 5 and 2 in the summer of 2014. The university team concluded that unit 2 had totally melted down after comparing the scans of unit 5 and unit 2, leaving no fuel likely in the reactor vessel. Nagoya’s best case estimate was 70% of the fuel was out of the reactor vessel. The muon scans have been unable to clearly image the very bottom of the reactor vessel leaving a small amount of uncertainty in the estimates, so a 100% declaration could not be made by the university. In August of 2015 TEPCO announced that their muon scanners were too large to fit into the location in the building. No further reporting on that problem could be found but Nagoya University did put out further information on their scans that left little doubt that unit 2’s meltdown was considerable.
In addition to the muon scan, the decommissioning authority has admitted they have a better understanding of the condition of unit 2 related to the missing melted fuel. Images from inside the reactor pedestal were apparently obtained during the last scope inspection, even though they have not been released to the public. This document states that the view inside indicated that there is a reactor vessel failure but it is not large. This would mean that yes, the bottom of the reactor vessel did fail but it may have failed through a smaller hole rather than a massive total melting of the bottom head of the vessel. This is a known phenomenon in meltdowns and usually indicates the fuel would collect in the pedestal and burn straight down rather than flowing out of the pedestal. This visual confirmation raises concerns about a potential melt through of the concrete base mat that could complicate both removal of the fuel debris and control of contaminated water leaks over the longer term.

The other major work conducted at unit 2 has been to prepare for a robot containment inspection similar to unit 1. As work began to remove a wall of radiation shielding blocks from the recessed area containing the control rod drive hatch, problems began. With some of the blocks removed a robot was sent to investigate radiation levels. Deadly high radiation levels were found around the hatch where workers planned to conduct the robot insertion into the containment structure. On closer inspection melted debris was found to have oozed out the
hatch. This is assumed to be the failed gasket for the hatch combined with some form of highly radioactive material. This failure is a likely example of how the hundreds of containment penetrations can fail under the intense heat and pressure of a reactor meltdown.

This was not the only complication. As shield blocks were removed it was discovered that the bottom row was stuck to the floor. With the extremely high radiation in the area, workers could not go in to remove them. Work began to implement a robot to dislodge the blocks and dispose of them.
By late 2015 the robot containment inspection had been postponed indefinitely. Work to decontaminate the area is planned with few details how they intend to do so. There are a number of specialized decontamination robots used on site but it is not clear if these are capable of handling the high levels of radiation around the control rod drive hatch. Levels will need to be reduced to the point human workers could stay in the area for an extended period of time to do the containment inspection. What has yet to be addressed is what may be inside the control rod drive pipe behind the hatch. Radiation levels there could pose an additional problem.

An admission with serious implications came out in December when TEPCO admitted to a design failure of the steam relief valve system at unit 2. Steam relief valves are a critical safety system to depressurize a reactor vessel to prevent failure. TEPCO documented this problem in a recent set of accident review reports. The pneumatic air control lines that operate the steam relief valves had insufficient heat resistance. These pneumatic air lines fail at 200 degrees Celsius while containment temperatures during the meltdown were assumed to be well over that level. Without a way to operate the steam relief valves, attempts to do so from the control room were futile. This also may have contributed further to the problems with injecting water into the reactor vessel with fire trucks. NHK had already documented that all or most of that water had flowed backwards into the turbine building condenser. Without any drop in pressure from the
steam relief valves this may have caused higher pressures to remain in the reactor. This left only the containment venting system or containment failure as ways the systems could relieve pressure.

We produced an extensive report on unit 2 in 2015. After an exhaustive review of the events and newer information for this unit we concluded that the meltdown at unit 2 was far worse than TEPCO had been presenting it as. Concerns exist about the location of the melted fuel, highly radioactive leaks outside of containment and a 2.5 hour venting to the atmosphere during the height of the meltdowns.

Unit 3

In March of last year TEPCO announced that they would begin removing the spent fuel from unit 3’s fuel pool within the 2015 fiscal year. That has not happened while efforts to prepare for this work have lagged.

Inspections in late March 2015 checked the spent fuel pool gates. These gates help retain water in the pool. Both gates were found to be damaged. Gate 1, the outer gate, had a portion that appears slightly damaged. Gate 2 is bent or dislodged. TEPCO didn’t think these two gates would be further damaged by removing the refueling crane that fell into the pool.
TEPCO removed the refueling crane from the unit 3 spent fuel pool in early August. No additional problems were mentioned during the work.
IRID & TEPCO planned a containment scope inspection of unit 3 for October of 2015. This would be the first attempt to look inside the containment of unit 3 since the initial disaster. The work took place on schedule and included determination of the water level, temperatures and radiation levels within containment. TEPCO had previously guessed that water levels inside unit 3’s containment were higher than in other units and they were correct in this assumption. This indicates that unit 3 is capable of holding water to a larger extent than units 1 and 2.

What was found visually were layers of thick light colored splatters. This does not match containment findings from units 1 and 2. It is not clear if this is remains of the paint finishes or thick splatters of a melted substance.
Radiation levels were unusually low with levels further inside containment being below 1 sievert. It was not immediately clear if this was due to a lack of melted fuel mass within containment or the deeper cover of water that would act to shield any fuel mass.

The decommissioning authority did hint at where melted fuel could be. They consider most to still be in the reactor vessel with a small amount in the pedestal and none migrated further out. What this doesn’t seem to consider is the extensive contamination that was spread around unit 3 and appeared to have been contained in the plumes that escaped the reactor. Further investigation of the reactor vessel is needed to determine how much fuel if any still remains there. The current state of investigations of the containment structure and suppression chamber (torus) room seem to confirm most of the decommissioning authority’s estimate.

TEPCO used a very small 3D printed robot consisting of the robot, a smart phone and a series of WIFI repeaters to inspect the equipment hatch that leads to containment. They found traces of water and corrosion indicating the gasket has been leaking over time. This hatch would be below the current water level inside containment.
3D scanning work to document the structures and damage in the unit 3 suppression chamber (torus) room were planned for December 2015. Results of this work was published in late February 2016. Radiation levels were roughly half of what they were during a robot inspection in 2012. The highest 2016 level being 161 mSv/hour near a hatch into the torus tube on the north side of the building, below the spent fuel pool four floors above.

The cover building for unit 3 has a planned installation schedule that begins around March of 2016. The building itself is modular and has been staged at the Onahama port facility. Components can be brought on site and installed on the remains of unit 3.
The actual spent fuel removal work will be done remotely due to the high radiation levels in the area. This includes the potential to have to cut apart fuel racks or fuel assemblies.

More interesting than the decommissioning work is the new admissions made on the meltdown of unit 3. JAEA thinks Unit 3 may have released a large amount of contamination north and west of the plant between March 15 to 16. This is after all of the venting activities and the explosion of unit 3 so the exact mechanism isn’t completely clear. TEPCO later admitted that unit 3’s containment failed between March 14 to 16. They cited the heat rather than the pressure for the failure. Unit 3’s containment may have actually been considered “failed” at the point of the explosion on the 13th but the new admission is of interest. Those in the know have been slowly admitting what the public has suspected for the last five years.

Unit 4

Unit 4 has seen little activity since the spent fuel was removed from the pool in 2014. There are eventual plans to tear down the entire reactor and building but no solid date for this to take
place has been mentioned in the last year. As unit 4 has no fuel remaining in the building it has no longer been a priority.

**Unit 5**

Between April and May of 2015 TEPCO removed all of the fuel assemblies from the Unit 5 reactor vessel. Those assemblies are now in the spent fuel pool along with the inventory in the pool from 2011.

Later in 2015 some admissions about the events at unit 5 during the initial disaster came out. An IAEA report documented those early events at unit 5. This reactor was in a maintenance outage with fuel still in the reactor. Workers had been preparing to pressure test the reactor vessel before the earthquake hit. The reactor vessel was over filled with water and the containment vessel cap and reactor well concrete cover were also removed. Both lower containment doors were left open. Half of the steam relief valves for the reactor vessel were locked out in preparation for this test. This configuration defeated a number of critical safety features and left routes that could allow radiation to leak to the outer environment. The combination of an over filled reactor and lost cooling ability caused things to quickly become dire. Workers were able to avoid a major catastrophe at unit 5 but things could have easily gone the other direction. More details about these events are available in our report.

**Unit 6**

Unit 6 had no documented or significant work within the last year. The last reported work was the transport of some of unit 4’s spent fuel to the spent fuel pool of unit 6 in 2014.

**Other New Findings**

TEPCO admitted in early 2016 that they had covered up the meltdowns during the early months of the disaster. In May of 2011 they finally admitted three of the reactors had melted down but tried to claim the meltdowns were minimal. This new disclosure shows they knew two of the reactors had melted down by March 14th but did not officially disclose this to the government or the public. Testimony from various disaster investigations showed that both TEPCO and the government knew the reactors had melted down and lied to the public for months.

A 2015 NHK report found that of the water injected into the reactors by fire engines in an effort to try to control the meltdowns may have actually made things worse. Only about 4.4 gallons per minute is estimated to have made it into the reactors. This caused potentially more radioactive releases as the water turned to steam rather than quenching the overheated fuel.
The unit 1-2 vent tower had been the location of extremely high levels of radiation in 2011. New readings were taken in 2015. This time they opted to protect the worker taking the readings with a titanium or lead full body shielded suit, unlike the worker who took readings in 2011. The reading in 2011 at the base of the tower was 10 Sieverts/hour. The same location had dropped to 2 Sieverts/hour by 2015.

Japan’s NRA also disputed TEPCO’s claim that the unit 2 cable trench was the only source of contaminated water leaks to the sea. NRA says there are more pathways that leak to the sea but didn’t provide specifics.

Workers monitoring the HIC (High Integrity Containers) containers that hold used radioactive water filters discovered the containers were leaking contaminated water. After extensive investigation it was found that the containers were producing hydrogen. This caused additional pressure in the containers that forced some of the water out of the container. What was more concerning was that the hydrogen production in the containers could cause them to explode.

Copyright SimplyInfo.org 2016
22
After another contaminated water leak at the plant in July of 2015, TEPCO went looking for similar hose problems. They found that there were 159 similar hoses still in use at the plant and that 90% of them were installed improperly. These kanaflex hoses were supposed to have been phased out years earlier as they had a high failure rate.

**Decommissioning R&D**

Decommissioning plans and related work has received very little public attention. Various parties are involved in the research and planning towards decommissioning the disaster site but IRID has been the main coordinator.

It was announced early in 2015 that multiple approaches would be considered for removing melted fuel from the reactors. The initial plan had been to flood the containment of each unit and remove fuel debris from the top of the reactor via the refueling floor. This evolved into multiple methods as it became apparent that the melted fuel was not neatly contained in the reactor vessels or pedestals as had been previously claimed by TEPCO.
More recently members of Japan’s NRA are saying that all of the fuel debris likely can’t be removed at Fukushima Daiichi. That it may be more realistic to remove as much as possible then immobilize what is left. They also clarified that just covering the buildings with a concrete cover similar to Chernobyl would absolutely not work for the site. NRA has developed a risk reduction system for the site. This covers a number of risk factors at the plant and places a priority on preventing certain large scale failures. This sort of change in tactic makes work at the plant go slower but reduces the chance of serious error, failure of the task or a catastrophic outcome. That of course does not mean there is not still high risk in the work at the plant.

New information confirmed in 2015 indicates that both the need for multiple ways to retrieve melted fuel and that some of it may not be recoverable appear to be accurate estimations of the situation. Serious concerns about the full containment flooding approach were made in 2014 including the risk that a flooded containment failure could result in an uncontrolled radioactive releases to the environment both airborne and to the water.

Under any of the fuel removal scenarios a certain amount of reinforcement work will need to be done. Work to seal and stabilize the torus structures and also the suppression chamber (torus) rooms are now a definite work project. Stabilization would include filling with concrete, bracing steel structures or using heavy duty expanding polymers to seal gaps.

Efforts to 3D scan the internal portions of the reactor buildings have allowed researchers to build a virtual reality system to view inside the buildings. This concept allows people to examine in detail the actual condition inside an area of the building without exposing themselves to contamination or unstable building risks. As much of the work has little margin for error, being able to take time planning minute steps of the work in a safe environment is a drastic improvement over early efforts to investigate the reactor buildings.

Researchers have been working on a number of new technologies including this small autonomous drone to use inside the reactor buildings. In conjunction with JAEA a new mock up facility has been opened in Naraha near Fukushima Daiichi. A radioactive material analysis center is being constructed in Okuma and is expected to open in 2018. JAEA has been doing extensive research to try to estimate the condition and type of fuel debris that may be encountered as decommissioning work takes place. This is an important task as it will help anticipate the potential criticality of the fuel debris and also what tools would work best to cut and remove it.

Multiple versions of the ALPS filtration systems have been added at the plant. Newer versions have some improvements over older installations. What is actually IN the ALPS systems has been less clear. We do know that they can now filter out cesium, strontium and cobalt isotopes.

Both Kurion and Rosatom have started tritium removal system trials. This is a promising development as officials in the US and France along with the IAEA had been trying to convince Japan to just dump all the tritium laced water into the Pacific. Rosatom’s Triton system is...
expected to begin construction in early 2016. Kurion's system received a large grant from the Japanese government in 2015. The company has a working prototype at their facility in Washington state. Kurion also claims to have a working portable nuclear waste vitrification system. The tritium systems all have extreme challenges to become a usable system. They require large amounts of energy to separate the tritium and produce hydrogen in the process.

Kurion has implemented a portable strontium 90 removal system at Fukushima Daiichi. The filtration system is housed in a shipping container and can be transported around the site to run on an individual contaminated water tank. A second portable system was added in 2015.
Frozen Wall & Sea Wall Projects

TEPCO has been in the process of installing a steel piling seawall for a couple of years. A section near unit 4 had been left open for groundwater to flow out of. In September of 2015 they closed the final section of the sea wall. Over the summer TEPCO had also done a test run of the land side section of the underground frozen wall system. That concluded in August. By November the steel piling wall was bowing outward and the seafront concrete deck was bulging upwards under the built up water pressure. By December traces of seawater were being found behind the wall. These changes happened even as TEPCO began routinely pumping groundwater out of the existing subdrain pits near the reactor buildings to try to control water build up. That water was sent to the contaminated water system for treatment.
The frozen wall began a test run in April 2015 that was stopped in August. This was only for the land side section. Construction and preparation of the seaside section of the wall was completed by fall of 2015. An early task associated with the frozen wall system was to freeze the end of a trench that led to the unit 2 turbine building. This plan failed despite multiple tactics including dumping large quantities of ice near the trench chillers. As this failed, TEPCO decided to go ahead and concrete in the entire unit 2 trench. Highly contaminated water was pumped out as the trench was filled with concrete.

TEPCO intended to begin full scale freezing of the wall by early 2016 until NRA stopped the plan. NRA’s concern was that groundwater levels would drop too low near the reactor buildings causing highly contaminated water to leak out. TEPCO suggested pumping groundwater back into the subdrain pits if groundwater dropped too low, NRA did not accept the idea. Per NRA’s request the seaside of the frozen wall will begin freezing in early March. The seaside section should take about two and a half months. It will take roughly eight months to freeze the entire system.
Trench Concreting

As an early part of the frozen wall project an effort was made to try to freeze the sea front trenches filled with highly contaminated water. This tactic never fully worked and was abandoned. The replacement plan was to concrete in the trenches while pumping out the highly radioactive water. This appears to have helped in some capacity. Unintended consequences remain to be seen. There is the potential that this could just force highly contaminated water to find a new route. TEPCO began concreting the unit 2 trench in November of 2014, that work is now completed with contaminated water pumped out. The unit 3 trench concreting began on February of 2015 and was completed in July of that year. Unit 4’s trench concreting work began in February of 2015. Progress has been made but an official completion of unit 4’s trench work has not been announced. There appears to be no plan to concrete the trench of unit 1. During the same time the trench concreting work began, an abrupt spike in radiation levels at the unit 1 discharge canal showed up. There has not been a conclusive confirmation that the two are related.
Port Concreting

Soon after the disaster TEPCO concreted the floor of the sea port. TEPCO again concreted the port floor, finishing in April of 2015. There was no reasoning given for the need to concrete the port floor a second time.

Unit 1 Discharge Canal

The unit 1 discharge canal was rarely reported on in the early years of the disaster. Reporting became more common after TEPCO was forced to admit the extent of continued leaks to the sea. In February of 2015 the discharge canal began to see an increase in contamination levels. Those levels went higher in March of the same year and saw another spike in July. By September an even higher reading was found. TEPCO noted during the September spike that the frozen wall had been in test operation and that groundwater around unit 1 had been lowered. In late November TEPCO installed a portable filtration system for the unit 1 discharge canal. This work had not been previously announced to the public. Based on the regularly reported contamination levels for the unit 1 discharge canal, this filter system appears to be working. Readings for the canal have trended down and stayed at much lower levels since the filtration system was put into operation.

Drainage Systems

In early 2015 TEPCO admitted that the “K” drainage canal had leaked highly radioactive water to the sea. This drainage system is part of the existing stormwater runoff systems at the plant. The newly admitted leak originated from the roof of unit 2. Contaminated water had been running off the roof of the building to the sea since the initial disaster in 2011. TEPCO stated that they would create a method to reroute water from the K drainage system back into other contaminated water handling or the port depending on contamination levels. This leak has been known since at least 2014 and likely longer. TEPCO did take some other low tech measures to try to lessen the contamination runoff from unit 2’s roof. The rerouting system failed to retain contaminated runoff in April. Spikes within the K drainage canal were found through the summer. TEPCO recently rerouted the K drainage system to permanently run into the port. The port is currently not sealed off from the sea but does have some very low tech filtration curtains on the port opening.
Stormwater runoff systems that had previously been modified to lower the chance of contaminated water reaching the sea saw another leak. The leak was lower along the drainage canals and TEPCO didn’t have a ready answer for the cause. Another leak in the H4 tank farm up on the hill may have been the cause. More about the H4 tank farm can be found here.

The diagram above shows the extensive stormwater drainage system original to the plant.

**Tank Farms**

The disaster site currently has [1106 holding tanks on site](#). TEPCO plans to have 20 more new tanks added in 2016 to deal with the 30,000 gallons of water generated at the plant. These tank needs and total stored water would be much higher had they not gained permission to dump “treated” water in the Pacific. The newer tanks are welded and expected to last longer. Awnings have been installed between newer tanks to lower the amount of rainwater that flows between the tanks to try to reduce contaminated runoff.
An involved process has been established to deal with the now defunct bolt together tanks. The tanks are dismantled in a systematic way to attempt to lower the incidence of further contamination. The tank sections are then taken to a controlled building to be further broken down and stored as nuclear waste.

TEPCO Water Dumping To Sea

TEPCO managed to gain government and local fisheries approval to dump contaminated groundwater in the Pacific. The only stipulation has been was that the water needed to be below World Health Organization levels for contamination of cesium 134 & 137, Strontium 90 and tritium. Newer filtration systems are doing a better job of filtering out other isotopes but those isotopes are not part of the approval for dumping process.
Worker Deaths

Two workers have died at the plant in the last year. A worker for construction company Kajima had his head crushed in the hatch of a tanker truck. The on site emergency room doctor went to the scene and they had the worker on his way to a local hospital within an hour but he died of his injuries. A second worker died in August of 2015 after he reported feeling unwell. A number of the worker deaths that were not the result of physical trauma started as the worker reporting not feeling well then dying soon after. A radiation alarm went off at the plant on the same day but it is not clear if the two events were related. Earlier in 2015 a pair of worker deaths caused TEPCO to halt work at the plant to try to sort out safety lapses.

Reactor Materials Released To The Environment

In previous years various researchers documented black substances found in the evacuation zone and well beyond Fukushima prefecture. Analysis of the substances discovered that they were from inside the reactors at Fukushima Daiichi. These substances were a mix of reactor fuel, fuel cladding and steel from the reactor vessels. It is unknown currently how much of these substances exist or the actual extent of their distribution. Documented findings showed they could be found at least 45 km from the plant and there are a number of possible sightings around Tokyo.

A new study this year found tiny highly radioactive glass particles 45 km from Fukushima Daiichi. These particles are small enough to inhale and contained both reactor fuel and what is assumed to have been from the reactor building concrete. Alternatively, the extra substance could be from the seawater injections. Concrete in the spheres would mean they were produced after the reactor fuel left the reactor vessel and had an opportunity to begin burning the concrete containment. If the extra substance is due to seawater, it would mean the spheres were created fairly late in the meltdowns. Since so little of the seawater actually made it into the reactors, this scenario may be the less likely one. Both the black substances and the glass spheres defy the earlier claims that the meltdowns were completely contained within the reactor buildings and plant grounds.
Environmental Damage

Damage to the environment continues to be documented after the disaster. Bird species population and diversity declined in Fukushima. These declines continued even as radiation levels began to drop. Researchers found a positive correlation between radiation levels and mutations in Japanese fir trees in Fukushima. Monkeys living 70km from Fukushima Daiichi were found to have lower blood cell counts and also radioactive cesium contamination. Similar problems were not found in monkeys tested in another prefecture far from the disaster.

Five years after the disaster, officials are still trying to deal with tsunami debris on the seafloor near Fukushima Daiichi. Vehicles, concrete and building debris need to be removed from the sea floor up to 20 km from the plant site. The problem has become more urgent as fishing groups want to expand trial fishing closer to the disaster site. Debris removal is further complicated by the need to find somewhere on land to dispose of the probably radioactive debris.
There was a concerning yet fascinating finding from a local hospital. In March of 2011 black spots began appearing on x rays at a hospital in Iwaki. Staff later discovered that only older x ray cassettes that were in use in March of 2011 had the spots show up on the x ray film. Newer cassettes did not have the same problem. It was determined that radioactive particles had found their way into the felt liner of the film cassettes. The radiation levels given off were enough for hospital officials to have staff limit their time in contact with the cassettes.

In September of 2015 heavy rains fell on the Japanese mainland. Residents had complained of the placement of bags of contaminated soil near residences and in high risk locations. Some have been found on beaches, areas that are normally swamps and along river banks. This ill conceived work came back to bite officials when hundreds of these bags were swept away in the flooding. 395 were washed away in Fukushima prefecture with many never recovered. In Tochigi 334 bags were swept away. 20 empty bags were found in the river area after the flooding, the rest were unaccounted for. Central government officials said they would move contaminated soil bags or “tie them with ropes” in response to the flooding problem.

The government has initiated plans to move bags of contaminated soil from locations around Japan to a central “temporary” site in Fukushima near the nuclear plant. Only 1% of the needed
land has actually been acquired. Contaminated soil isn’t the only problem. Shiga prefecture discovered someone had dumped radioactive wood chips in a river. Further investigation found a company had transported contaminated wood chips from Fukushima prefecture and dumped them in various locations as far away as Kagoshima. The owner of the company who did this has been convicted of violating waste disposal laws.

A radiation map published by NRA in February of 2015 showed a slight reduction in some of the radiation levels in the region near the disaster site. The newest map based on data collected in November of 2015 showed little has changed in the radiation levels over the year.

Reconstruction

The disaster reconstruction has been slow and bloated with wasteful spending. New homes built on higher ground to replace those wiped away by the tsunami remain unoccupied. Construction projects seem to prioritize construction company wants over community needs.

Naraha has been at the center of the government program to force evacuees to return to the nuclear evacuation zones. This has proven far more complicated than the central government had anticipated. Even if former residents succumbed to the pressure to return, many don’t have a home to return to. Over 1000 homes in Naraha alone are set to be demolished. Damage from the 2011 disaster and additional damage as the homes sat unoccupied has done widespread damage.

The reopening of Naraha has had many problems. A lack of services and stores made those willing to return reluctant. Currently, most of the town’s inhabitants are Fukushima Daiichi workers. There have also been extensive problems with decontamination efforts. Illegal practices were used in some of the decontamination work in the town. Large stockpiles of contaminated soil bags remain. Naraha is where pieces of debris from Fukushima Daiichi were found. It is unknown how much more debris from the plant may be in the town. Citizen groups that did their own radiation testing found levels far higher than the government was claiming for the town. Soil tests showed extremely high levels of radiation still exist in the soils. The town’s water supply has high levels of radiation in the soil at the bottom of the water reservoir that have yet to be addressed by the government.

The central government wants to continue this trend and reopen most of the nuclear evacuation zone by 2017. Any area with up to 20 mSv/year in estimated radiation levels would be reopened in 2016. This radiation level is 20 times what is allowed for public exposures by ICRP. Areas with up to 50 mSv/year would be reopened in 2017. 20 mSv is the maximum radiation exposure total allowed for adult male nuclear workers over a 5 year period. 50 mSv/year would require a nuclear worker to cease working at nuclear facilities.
Evacuees

This government plan to reopen the nuclear evacuation zone only 5 years after the disaster is dependent upon forcing the evacuees to do what is expedient for the government. Mainichi Shimbun uncovered internal government documents that showed how the government planned to force the hand of all the evacuees except those from “difficult to return zones”. Only enough replacement public housing to house that sub-population would be built. Official efforts to bar other evacuees from obtaining any sort of public housing were also put in place to make it extremely hard for these people to find new homes.

Evacuees who voluntarily evacuated would have their compensation terminated in 2017. Everyone except those from the difficult to return zone would see their compensation ended in 2018. The Fukushima government is offering people $853 USD for moving expenses if they move back to the nuclear evacuation zone. They also considered offering some temporary housing subsidy money but it is conveniently too little to help someone stay in an apartment in Tokyo where many of the evacuees fled. Life for many of these evacuees has been tough. Divorce and loss of friendships has been a common problem.

People who lost their homes, either an actual structure or their geographic and traditional home community, live this disaster daily. As with previous nuclear disasters there is a systematic effort to marginalize and render people invisible. They do not just face uncertainty about the future of their home and community but the future of their health. These well founded concerns for one’s health are at odds with official efforts to quickly declare “no harm”. Efforts like the Fukushima Health Survey have made it extremely difficult for people to seek independent medical care for issues such as thyroid concerns as people are pressured to use a system that may not be acting in the best interest of one’s individual health.

This is all part of an official effort to forget Fukushima. Nuclear disasters include a long slow moving timeline of environmental contamination, health risks and personal loss. A description of this from Dr. Robert Jacob’s “On Forgetting Fukushima” explains:

"Some of the difficulty in remembering those affected by nuclear disasters is systemic, and some is strategic. Radiation is difficult to understand. Exposure to radiation embodies what Rob Nixon describes as slow violence, “formless threats whose fatal repercussions are dispersed across space and time.” The slow impact of the catastrophe of nuclear disaster dislocates it from the disaster itself."

The entrenched interests and those willing to help them push their agenda as with previous nuclear disasters seek to declare the disaster over as quickly as possible, before the true extent of the harm begins to show up. These purposeful efforts are intended to make the public forget, so government and business can get back to business as usual as soon as possible.
In what may be a game-changer, a family that voluntarily evacuated has won a lawsuit against TEPCO. The family said that TEPCO's compensation offer was insufficient compared to the hardships they faced. The court awarded significantly more to the family in the verdict. This may open the way for other voluntary evacuees to recover some of their losses.

Smaller businesses also face losing out as their compensation is being ended. The government plans to issue lump sum payments to cover compensation for 2016. If the business needs further compensation after 2016 they will have to open a totally new case against TEPCO.

**Human Health**

Radioactive contamination has continued to be found at low levels in tap water in certain parts of Japan. Tests in February and March of 2015 found cesium contamination in a number of cities but it also found a reading of iodine 131 in a town in Chiba prefecture. Upon further investigation the town has a medical radiation treatment center that could have been the cause of the contamination. Iodine 131 is used as a medical treatment for certain thyroid conditions and can make its way into waterways and tap water if proper precautions are not taken. September 2015 tests found low levels of cesium in tap water around the Tohoku region and in areas around Tokyo, showing how persistent the problem is.

Thyroid cancers in children continued to mount. 11 new cancer cases were announced in December 2015. 19 of 39 second round cancers had a clean test on the first round indicating they had no nodules or cysts that could indicate they had a problem previous to the disaster.

The total of second round suspicious or confirmed cancers was 51 by February of 2016. The number of new cancers that previously had clean screenings has been difficult for the official health survey to explain. One official provided an excuse that they possibly were too small to be seen on ultrasound thus were missed but he was unable to provide any basis for this claim that appears to be conjecture. A committee member also claimed that radiation doses were “too low” for these now one hundred plus cancers to be radiation related. Considerable uncertainties exist in the dose estimation process making that claim far from being the last word on the issue. A new research paper concluded that the number of thyroid cancers being found in the areas impacted by significant fallout was too large to be explained as a “screening effect” from conducting the ultrasound examinations.

The push back on providing timely screenings and health care for those who were exposed has been seen as another cost cutting measure by the government and worse, as a way to bury the actual health impact of the disaster. This has become one of the more politicized issues of the disaster.
Contaminated Foods

Contaminated foods continued to be a problem in the fifth year of the disaster. A huge food scandal broke out in Taiwan. The country banned food products from five prefectures and certain food products from anywhere in Japan after the disaster. The deception came from the import labels placed on the products carrying a false origin location. This mislabeling appeared to be conducted in both Japan at certain exporters and by import agents in Taiwan. The banned foods included a number of well known brands.

A Taiwanese import broker was arrested as part of the investigation. He was found to have been faking import certificates and safety testing of food imports. Our investigation of Taiwan's food testing of Japanese imports found six instances of Japan exporting food products over their own radiation limits. All six of these were in green tea products from Japan. Since these import tests are only spot tests, other contaminated foods likely made it into the food supply in Taiwan. As late as June of 2015, contaminated green tea were still being found in Taiwan, though the levels were below both countries arbitrary radiation limits.

Japanese burger chain Mos Burger, was caught using mis-labeled banned Japanese food products in their stores in Taiwan around the same time as the larger importing scandal. The Taiwan food scandals also called attention to contaminated Japanese tea products being found in Hong Kong in 2014. China found banned Japanese baby formula products had been imported. Officials said none had “excessive” radioactive contamination. The shipments were sent back to the exporter in Japan. In late 2015 four packages of mushrooms were found in stores in Gunma to be contaminated and over the government contamination limit for sale. Certain products like mushrooms, wild game and wild berries will continue to be a problem for decades as they have in regions contaminated by Chernobyl. Independent researchers also found that the level of strontium 90 in food in Japan was being underestimated. The government had been using an assumed ratio of cesium to strontium 90 but a review of the actual government testing showed that the ratio of strontium 90 had been increasing in foods over time.

The Japanese government continues food testing but the testing tends to be less useful. There is an abundance of cattle meat testing done from all over Japan while testing of food crops from certain areas that were known to be problematic have limited testing. The Health Ministry continued to test wild game from the impacted regions. This frequently is found to be over the government limits for contamination in food products.

Pacific Contamination

By August of 2014 cesium contamination levels in the Pacific off the North American coast had neared the lower range of the expected peak contamination levels. The predicted time frame for the peaks to begin approaching the North American coast was 2014 - 2015.
By December of 2015 readings were published that reached the expected peak contamination range off of the California coast. The expected peak arrival was not until 2016. The actual finding was collected in June of 2015. The early research that established time frames and contamination ranges were all based on just the initial contamination release estimates and did not include the later admitted ongoing releases from Fukushima Daiichi to the Pacific.

Lawsuits

A number of lawsuits have emerged in the last year. A contract worker at the plant developed multiple cancers in 2012 and 2013. His recorded exposure was 56.41 mSv but it is well known that early exposures at the plant were not properly recorded. He has filed suit against TEPCO and the contract company he worked for. Another worker had his leukemia approved as being tied to his radiation exposure at the plant between October 2013 and December 2013. Even with a low recorded exposure, the health ministry approved his health damage as likely being tied to his work at the plant.

An oversight committee for TEPCO suggested the company should sue a number of the contractors who did work at the site where the projects failed to operate as planned. These include a couple of projects where it was known TEPCO requested downgrades to materials used by the contractors. Contract workers in the past have complained about TEPCO’s severe corner cutting to attempt to hold down costs.

TEPCO executives faced indictments that were approved by the court in early August. The charges of negligence include their repeated actions to ignore the earthquake risks and design problems at Fukushima Daiichi. Trials have not begun yet. The proceedings may bring some compensation to the people impacted by the disaster. They may also provide a public venue to compel TEPCO insiders to disclose what really took place before and during the disaster. Indicted executives face up to five years in prison.

Conclusions

The effort to erase the disaster rather than effectively deal with it has never been clearer than this last year. Arriving at five years after the disaster has been seen as an end point by the government. Efforts to create the illusion of conclusion to the disaster have gotten press circulation, but the underlying problems still exist.

Considerable progress has been made at the plant to deal with various ongoing problems. The central problem of locating the melted fuel and directly addressing how to mitigate that has fallen short. Numerous tactics that could help locate the fuel have not been done even though they may be possible at this point. Key work at the reactors frequently goes unreported to the
public adding to confusion and distrust. Information that helps assemble the true picture of what has happened at Fukushima Daiichi drips out, but keeping up appearances for TEPCO and the government still take precedence.

Efforts to minimize or explain away the ongoing impact on the population have been unrelenting. The motivation to make the world forget is still strong. TEPCO and the government have made sure the people will pay the price for the disaster in every way, while the powers that be continue on unchecked and unscathed.

The disaster may be five years from the most serious phase but there is much more work to be done. New data still comes out on a daily basis that helps us refine our analysis of the disaster. The slightly slower moving pace of events also allows for deeper analysis of the available information. We have a number of new major reports in the works for 2016.

For more information contact us at:

www.SimplyInfo.org
info@simplyinfo.org