Accidents and Breakdowns at Nuclear Power Plants and Nuclear Fuel Facilities

(April 2020 to March 2021)

Year	Date	Facility Name	Accident Overview	RC*
2020	Apr. 10	Mihama Unit 3	**Automatic shutdown of emergency diesel generator seawater pump**. During a regular inspection, the 3A seawater pump automatically shut down and cooling water could not be supplied to emergency diesel generator A. 3B seawater pump, on standby, was therefore started up.	
	Apr. 13	Shimane Unit 3	**Emergency diesel generator lubricating oil system pipe flange joint orifices installed in reverse direction.** During a site patrol, it was discovered that the orifices installed in the bearing oil supply lines of the emergency diesel generators (A, B, and C systems) had been installed in the reverse direction.	
	Apr. 24	Fukushima Daiichi Units 1, 2 and 3	**Defective indication of nitrogen concentration in nitrogen gas separator (B).** After switching from the nitrogen gas separator (B) to (A) for a regular test of the nitrogen sealing equipment in the containment vessel, it was discovered that the nitrogen flow rate did not decrease even after the separator (B) was stopped, and that there was an abnormality in the control panel that sends the indicated values of the nitrogen to be sealed (sealed amount, concentration, pressure, etc.) to the central monitoring room. It was confirmed that the nitrogen concentration in the containment vessel was less than the operation limit of 2.5%. TEPCO presumes that activated carbon powder found its way into the nitrogen gas separator (B) control panel, causing a power supply abnormality.	○
	May 11	Shimane Unit 1	**Emergency diesel generator lubricating oil system pipe flange joint orifice installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Shimane Unit 1 that an orifice installed in the lubricating oil system of the emergency diesel generator (system A) had been installed in the reverse direction.	
	May 14	Kashiwazaki-Kariwa Units 1-7	**Emergency diesel generator orifices installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Kashiwazaki-Kariwa Units 1-7 that four orifices in the diesel fuel tank of Units. 1, 3 and 4, three lubricating oil orifices in the emergency diesel generator of Units 2 and 7, and two orifices in the cooling water system of the emergency diesel generator of Units 5 and 6 had all been installed in the reverse direction.	
	May 15	Hamaoka Units 3 and 4	**Emergency diesel generator orifices installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Hamaoka Units 3 and 4 that four orifices, including the emergency diesel generator lubricating oil systems in Units 3 and 4 had been installed in the reverse direction.	
	May 15	Shika Unit 1	**Emergency diesel generator orifices installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Shiga Unit 1 that 3 orifices, 2 in the lubricating oil systems of emergency diesel generators and one in the reactor auxiliary cooling system had been installed in the reverse direction	
	Jun. 01	Fukushima Daini Unit 1	**Emergency diesel generator orifices installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Fukushima Daini Unit 1 that the emergency diesel generator (B) freshwater expansion tank return line orifice and the freshwater expansion tank feed water supply line orifice had been installed in the reverse direction.	
	Jun. 12	Fukushima Daiichi Unit 5	**Emergency diesel generator orifice installed in reverse direction.** The inspection of the horizontal deployment of Shimane Unit 3 led to the discovery in Fukushima Daiichi Unit 5 that the emergency diesel generator (A) transfer pump minimum flow recirculation pipe orifice had been installed in the reverse direction.	
	Jul. 16	Sendai Unit 1	**Deformation of control rods discovered.** During a routine inspection, when a control rod cluster was moved from the spent fuel pool to the fuel inspection area for visual inspection, and then moved back to the spent fuel pool for insertion into the original spent fuel, one of the 24 control rods in the cluster was found to be deformed. Kyushu Electric Power Co. inferred that the control rod cluster had been moved without securing it properly in the fuel handling machine, and that it had come into contact with the spent fuel rack.	
	Jul. 20	Ohi Unit 3	**Large neutron flux deviation occurs in output region.** When the reactor power was lowered for a routine inspection, a “large deviation of 1/4 neutron flux” alarm sounded, indicating that the power output had become uneven. The core, thought of as a circular cylinder, is divided into four equal parts, and output is monitored by four neutron detectors. When the reactor was operating at more than 50% power, the alarm was tripped because the difference between the four detectors was more than 2% (2.2%).	
	Jul. 20	Hamaoka Units 3 and 4	**Leakage from portable water injection pump vehicle B discharge pressure meter hose.** During an emergency recovery drill, when the water injection pump of portable water injection pump vehicle B was started up and pressure increased, a fissure of about 2 cm occurred when the rated output (1.4 MPa) was reached, and injection water leaked	

			from the hose.	
	Aug. 05	Rokkasho Reprocessing Plant	**Damaged inspection seal in the uranium-plutonium mixed denitration building.** In the roasting reduction room No. 4 on the first basement floor of the Uranium-Plutonium Mixed Denitration Building, the inspection seal of the pull box, which is attached to the top of the glove box and contains cables for data transmission of the plutonium inventory estimation device, was found to be damaged. The pull box is mounted near the ceiling at a height of 4.8 meters. Based on the damage marks left on the pull box, JNFL has concluded that the inspection seal was damaged during the dismantling of the scaffolding used to carry out water overflow countermeasure work at the site. The inspection seal was replaced by the IAEA and the NRA on August 19.	
	Aug. 31	Ohi Unit 3	**Fissures in pressurizer spray piping welds.** During a routine inspection, an ultrasonic inspection of the pressurizer spray piping detected a significant signal, and fissures were found near the welds at the bends of the piping. The pressurizer spray piping branches off from the primary coolant piping, is made of stainless steel (SUS316) with an outer diameter of about 114 mm and a thickness of about 14 mm, and is used to adjust the pressure inside the pressurizer. Kansai Electric Power Company (Kanden) initially planned to make simple repairs, but as the NRA pointed out that the conditions for a leak before break (LBB) could not be confirmed, the company decided to replace the piping. When the piping was cut out and liquid penetrant inspection, etc. of the inner surface was conducted, a circumferential fissure 4.4 mm deep and 60 mm long was found along the weld boundary. It is presumed by Kanden that stress corrosion cracking occurred due to the formation of an unusually hard area near the inner surface of the pipe caused by the application of more than necessary heat during the welding process.	
	Sep. 20	Kashiwazaki-Kariwa	**Unauthorized entry into the central control room of the nuclear reactor building.** A central control room employee could not find his ID card he thought he had placed in his locker, and took the ID card of a fellow central control room employee who was not on duty that day out of an unlocked locker. When entering the perimeter protected area, facial recognition failed several times, but while harboring doubts the security guard (employee) instructed him to rewrite the registration details of the ID card. Using the rewritten ID card, the central control room staff member entered the perimeter protected area, the protected area, and then the central control room. He then left the area without changing the ID card information. The next day, an error occurred when his colleague, a central control room employee, entered the area, and since a security guard (employee) who just happened to know what had occurred the previous day was there, the unauthorized use of the ID card was discovered.	
	Sep. 28	Takahama Unit 4	**Malfunction of spent fuel pit area surveillance camera.** During the monthly inspection of the spent fuel pit area monitoring cameras installed in the fuel handling building, it was discovered that images from one of the two cameras, spent fuel pit area monitoring camera A, were not displaying. There was no abnormality in the video encoder or switching hub, and the problem was found to be due to camera failure.	
	Sep. 29	Ikata Unit 3	**Fire broke out during installation work at a facility to handle specific serious accidents.** During the installation of air-conditioning ducts in a facility for dealing with specific serious accidents (outside the controlled area), a worker was grinding embedded metal parts using a grinder on a scaffold when another worker working under the scaffold noticed flames rising from near the scaffold, immediately extinguishing the fire with a fire extinguisher.	
	Oct. 20	Hamaoka Unit 3	**Cracks on exhaust pipe expansion joint bellows on emergency diesel generator (A).** During an inspection of the emergency diesel generator (A), cracks were found on the bellows of the expansion joint of the exhaust pipe. The bellows were replaced with a spare part.	
	Oct. 30	Rokkasho MOX Plant	**Corrosion (rust) of rebars discovered in the construction of the MOX fuel fabrication plant.** The rebars on the basement third floor of the fuel fabrication building, which has been under construction since 2013, had been exposed in the open until 2017, and were protected between 2017 and 2020. When the construction works were resumed in September 2020, it was found that rust had developed over the entire outer surface of the rebars. A material inspection was therefore conducted on the approximately 17,300 steel bars in the floor by extracting several bars of five different diameters. It was found that rebars with small diameters (D22, D29 and D30: D being the diameter of the rebars in millimeters) met the specifications for yield point and tensile strength, but did not meet the specifications for elongation. JNFL says it will replace about 3,100 rebars of D32 or less and five rebars of D35 whose thickness has been reduced in the extremities.	
	Nov. 11	Ikata Unit 3	**Improper installation of cables in seawater pipe trench room.** In the trench room of the seawater pipe in the reactor building, the control cable tray for the system A seawater pump, etc. should have been covered with a steel enclosure as a fire prevention measure, but there was an opening on the upper surface, and four ventilation and air-conditioning system cables were found to have entered the tray in an exposed manner. In addition, it	

			was also found that there was a break in the fireproof wall between systems A and B, which should have been completely separated by the fireproof wall.	
	Nov. 11	Ikata Unit 3	**Inappropriate placement of a detector in control panel room.** One of the heat sensors of one of the automatic fire detectors mounted on the ceiling of the control panel room was found to be located near a ventilation opening.	
	Nov. 11	Sendai Unit 2	**Improper cable installation in wiring processing room.** In the wiring processing room, it was found that there were openings on the upper surfaces of the safety shutdown system cable trays that are covered with steel enclosures. It was found that there were three locations in system A and five locations in system B where cables had been added into the trays after the steel enclosures had been fixed, requiring that openings be made.	
	Nov. 11	Fukushima Daiichi	**Rest area survey not conducted in large equipment maintenance building.** It is stipulated that surface contamination density and airborne radioactive concentration are to be measured once a day in the rest area on the second floor of the large equipment maintenance building to confirm that there is no contamination. However, it was found that neither were measured on July 1, and airborne radioactive concentration was not measured on July 3 and 6.	
	Nov. 11	Fukushima Daiichi Unit 3	**Facial contamination during rainwater countermeasure work on turbine building roof.** On August 18, a worker on the roof of the turbine building of Unit 3 was not wearing a mask and his face was contaminated while applying a base coat for waterproofing the roof and cleaning remaining sand. The worker's face was decontaminated a nasal smear measuring about 250cpm was taken. The whole-body counter indicated less than the recordable level (2mSv).	
	Nov. 11	Fukushima Daiichi Unit 2	**Operating error in refilling water in the spent fuel pool skimmer surge tank.** On August 20, when a TEPCO employee on duty was refilling water in the spent fuel pool skimmer surge tank of Unit 2, an alarm for "high primary system differential flow" sounded, and the primary system pump (B) of the spent fuel pool, which was in operation at the time, shut down due to an interlock. This was because the interlock was not cancelled before the refilling operation.	
	Nov. 11	Fukushima Daiichi Units 5 and 6	**Faulty fire signal reception by automatic fire alarm system.** On August 28, it was found that when the fire alarm in the Unit 5 "motive power distribution switchboard (M/C) 5E building" was activated, the fire indicator panel in the Units 5 and 6 central control room of did not indicate that a fire had occurred. This was due to a lack of proper design control in equipment replacement work.	
	Nov. 12	Fukushima Daiichi Unit 1	**Subcriticality monitoring was disabled due to shutdown of all exhaust fans in containment vessel gas management equipment.** All of the exhaust fans of the containment vessel gas management system shut down, and radiation monitoring of the gas management system became impossible, making it impossible to monitor the subcritical state. It was found that the shutdown of the exhaust fans was caused by a mistaken operation, and they were restarted about two hours later.	
	Nov. 20	Takahama Unit 4	**Damage to heat transfer tubes of steam generators.** During a regular inspection, when eddy current flaw detection of the heat transfer capillary tubes of three steam generators was carried out, one signal in A steam generator and 3 signals in C steam generator were found near the tube support plate, which appeared to indicate wall thinning from the outside of the heat transfer tubes (secondary system side). When a minicam was inserted inside the steam generator to investigate the appearance of the thinned tubes, it was found that deposits were adhering to the part from where the signal was emitted in the A steam generator, and scratch marks were found on the surface of the capillary tubes, scratch marks also being found on the surface of each of the three thinned tubes in C steam generator. Deposits were also found in the gaps, etc. between the capillary tubes in C steam generator. The deposits are platelets (called "scale") that consist mainly of ferric oxide It is thought that ferrous/ferric ions and iron particles brought in by the feed water precipitated and enlarged at the bottom of the capillary tubes during the long shutdown period. Kanden assumes that after the resumption of operation, thermal expansion caused the deposits to detach from the capillary tubes, the hard scale scratching the outer surfaces of the tubes. The secondary side of the steam generators at the Takahama nuclear power plant has not been cleaned with a chemical wash, and this is thought to have had an influence on the formation of the scale. The steam generators of Takahama Units 3 and 4 have not been replaced, and Kanden says it is considering replacing them.	○
	Nov. 24	Hamaoka Unit 5	**Damage to the fuel changing machine's mast automatic swivel device.** When the overhead crane was moved for inspection on the 5th floor of the reactor building, the hook of the overhead crane came into contact with the fuel changer, and the fuel changer's mast automatic swivel device was damaged.	
	Dec. 14	Kashiwazaki-Kariwa Unit 6	**Spent fuel pool coolant purification system pump (B) shutdown.** The spent fuel pool coolant purification system pump (B), which was operating on the second floor of the reactor building, automatically shut down due to a "high discharge flow rate" alarm sounding. TEPCO assumes that this was due to an instantaneous increase in the pump	

			discharge flow rate when the spent fuel pool coolant purification system pump (B) filtration demineralizer inlet valve was opened to check its status.	
2021	Jan. 10	Mihama Unit 3	**Monitoring camera malfunction occurred in spent fuel pit area.** During a routine inspection, an operator confirmed that the image of the monitoring camera in the spent fuel pit area was not displaying. After inspecting the monitoring camera, the coaxial LAN converter (transmission signal converter) and the monitoring camera were restarted, operation of the camera being restored about four and a half hours later.	
	Jan. 27	Kashiwazaki-Kariwa	**Loss of nuclear material protection function.** A TEPCO subcontractor reported to the NRA that one part of the nuclear material protection equipment (surveillance cameras, etc.) involved in intrusion detection at the plant had been inadvertently damaged. It was also discovered that 15 other intrusion detection facilities were inoperable, and the regulatory agency pointed out that the alternative measures TEPCO was taking were insufficient. In fact, an unannounced onsite inspection by the regulatory agency found that the alternative measures were not working. On March 23, a "Severe Safety Assessment: Red" (a level indicating significant impact on safety assurance functions or performance) was issued by NRA, and a "Response Category: Category 4" (the purpose of activities in each monitoring area have been satisfied, but the safety activities conducted by the operator have been degraded for a long period of time or have been severely degraded) was also issued, as it had not been possible to detect unauthorized intrusion at the plant for more than 30 days. In addition, on April 14, NRA issued an order stating that "TEPCO must not move specified nuclear fuel materials at the Kashiwazaki-Kariwa Nuclear Power Station."	
	Feb. 08	Ohi Unit 4	**Defective pressurizer pressure indicator on reactor shutdown panel external to central control room.** During a routine inspection, an operator who was conducting the monthly indicator verification test of the reactor shutdown panel external to the central control room noticed that the pressurizer pressure was higher than the normal value. Later, when the indicated values of the pressurizer pressure in the central control room were checked, it was found that all four indicated values of the pressurizer pressure were stable at their normal values and that there was no abnormality in the related parameters, indicating that the pressurizer pressure in the reactor shutdown panel external to the central control room was not displaying correctly. The pressurizer pressure indicator of the reactor shutdown panel external to the central control room was replaced.	
	Feb. 10	Tokai Daini	**Inappropriate entry into a controlled area by temporary entrants.** On October 28, 2020, during a site observation by the Nuclear Safety Promotion Association, one JAPC employee guide and one observer entered the liquid waste neutralization tank room to check the cleaning work in the liquid waste neutralization tank A of the "RadWest facility inspection work." Because of the high radiation dose, the waste liquid neutralization tank room is a special restricted entry area with a "dose equivalent rate category 3," and although prior application is required for temporary visitors to enter the room, it became clear that no prior application had been made at the time.	
	Feb. 13	Fukushima Daiichi	**Abnormalities in power plant caused by earthquake.** A magnitude 7.3 earthquake off the coast of Fukushima Prefecture recorded maximum accelerations of 235 gals horizontally and 117 gals vertically at the Unit 6 reactor building, and 213 gals horizontally and 181 gals vertically at the Unit 5 reactor building. Units 5 and 6 spent fuel pools and the common pool experienced water overflow, puddles forming on the floor. The third cesium adsorption unit (SARRY II) temporarily shut down due to a communication failure. Leakage from flanges, etc. occurred in the tank area where contaminated water is stored. It was also discovered that debris containers had overturned, and more than 50 contaminated water tanks had been displaced. The water level in Units 1 and 3 containment vessels was found to have dropped. In addition, it was revealed on February 22 that the seismograph installed in Unit 3 had been left in disrepair and no record of the earthquake had been obtained.	
	Feb. 13	Onagawa	**Abnormalities in power plant caused by earthquake.** A magnitude 7.3 earthquake off the coast of Fukushima Prefecture caused several abnormalities, including the opening of a blowout panel in the turbine building of Unit 3. The Units 2 and 3 water discharge monitors failed to measure discharge due to the shutdown of the intake pumps for sampling. Failure of the large-capacity power supply system occurred and the operation of six transformer pressure relief valves occurred due to oil level fluctuation. Shutdown of one dust extractor for seawater also occurred in Unit 3.	
	Feb. 13	Onagawa Unit 3	**Bolts, etc. fall into spent fuel pool, etc.** Due to the shaking caused by the earthquakes off the coast of Fukushima Prefecture on February 13 and off the coast of Miyagi Prefecture on March 20, it was confirmed that 13 bolts and accompanying nuts and washers fell to the floor and into the spent fuel pool from the inspection scaffold installed near the ceiling of the top floor of the reactor building. In addition, during the earthquake on March 20, one component of this scaffold was confirmed to have fallen to the floor and a further one into the spent fuel pool.	

	Feb. 18	Fukushima Daiichi	**Fire damage to pipe trace heater of rooftop sprinkler pump on miscellaneous solid waste incinerator building.** A worker found fire damage to a pipe trace heater of a rooftop sprinkler pump (A-a) on the miscellaneous solid waste incinerator building.	
	Mar. 02	Fukushima Daiichi	**Leakage of nuclear fuel and other materials in a temporary storage area.** A high radiation alert (set at 1,500 Bq/liter) was issued by a simple radiation detector installed in a drainage channel at FDNPS, indicating an increase in radiation levels. Several clumps of earth with a high radiation level, 70 micrometer dose equivalent rate at the soil surface (a maximum of 5mSv/h), much higher than the surrounding area, were confirmed on March 22 in the temporary storage area W, where radioactive waste was being stored on the west side of the elevated area from which water was flowing into the landing discharge channel. One of the clumps contained a gel-like substance. In an inspection on March 24, a maximum of 13mSv/h was detected and all the clumps, along with surrounding soil, were removed. 38 containers were piled up and stored in temporary storage area W, one of which contained large amounts of adsorbent materials containing water which had been placed in the container as radioactive waste. TEPCO presumes that this container was corroded and leaking	○
	Mar. 25	Takahama Unit 4	**Leakage from thermometer draw tube on reactor vessel head.** When the pressure in the system was raised to 2.75 MPa (about 27 atmospheric pressures) in order to prepare for a primary coolant system leak inspection and the inspection of the upper part of the reactor vessel was conducted, water was found to be leaking from one of the three thermometer draw tubes installed in the reactor vessel head. The system pressure was reduced and an investigation was conducted, but while no abnormality was found in the connection or packing, the packing was replaced to restore the system.	