COZEN O'CONNOR

GLOBAL INSURANCE GROUP WHITE PAPER

The Earthquake and Tsunami in Japan:

A Factual Overview and Preliminary First-Party Analysis

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INTRODUCTION

The tragic events of March 11th, when an earthquake and then a tsunami struck northeastern Japan in quick succession, will undoubtedly generate a host of insurance claims by large American corporations that have property in that country or do business with Japanese customers and suppliers. Such a company would typically have an all risk first-party policy with business interruption and extra expense coverage and also coverage for loss by the perils of earthquake and flood. A loss occasioned by nuclear reaction, nuclear radiation, or radioactive contamination would almost certainly be excluded, however. In addition, our hypothetical corporate policyholder would likely have selected and purchased sue & labor coverage and extensions of coverage for contingent business interruption ("CBI") loss and loss caused by service interruption, order of civil authority, and ingress/egress restrictions. Each and every one of the foregoing provisions might be implicated by fact patterns arising from the disaster in Japan.

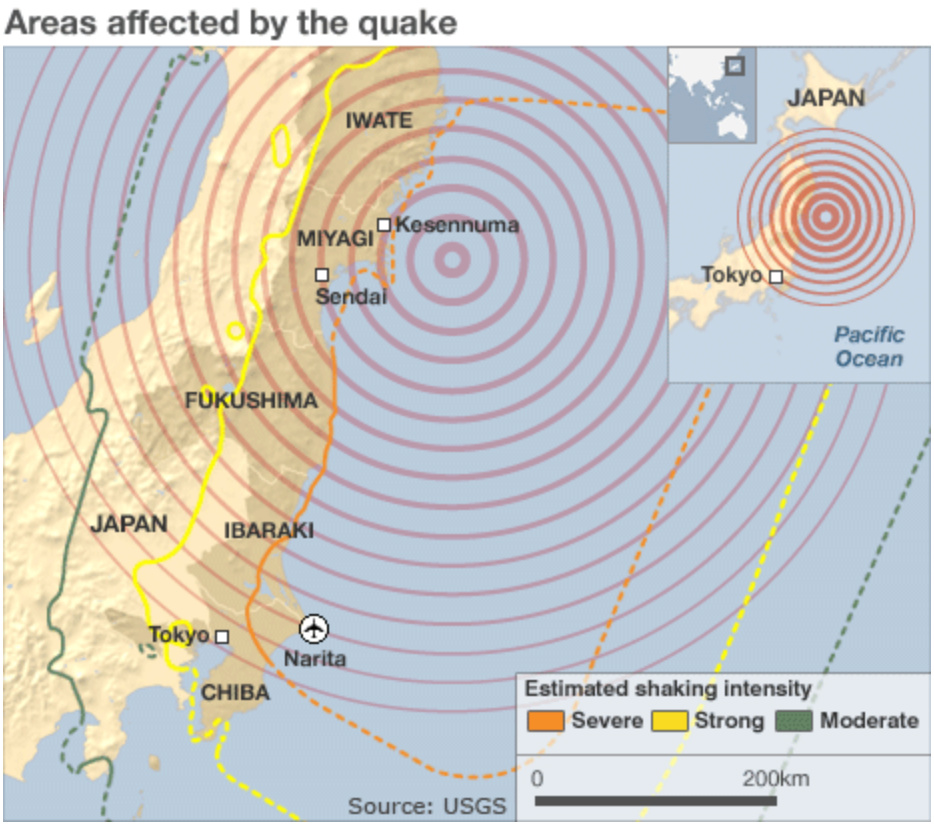
It is axiomatic that each claim must be examined on its own merits; broad generalizations about whether an event is covered or not are always a risky exercise. That is even more true than usual here. The types of loss for which claim will be made must be carefully analyzed to identify the proximate cause or causes. Was loss occasioned by earthquake or flood or radioactive contamination or orders of civil authority occasioned by a well-grounded (or perhaps groundless) fear of such contamination? A good many claims asserted by American business partners of Japanese suppliers will be the result of supply chain disruptions – blackouts and other power grid problems and difficulties experienced by the Japanese company in securing the transportation, water, and raw materials necessary to continue to do business with its American customer. Many such claims will also involve situations in which neither the American policyholder nor its Japanese supplier experienced direct physical loss or damage on March 11th. In such situations, to what extent is there coverage under the terms and conditions of the contract of insurance at issue?

At this juncture, we can provide no definitive guidance. This white paper will summarize the facts that are known to date, however, and it will briefly canvas coverage for CBI loss and the extent to which a typical policy affords or bars coverage for loss by the perils of earthquake, flood, and radioactive contamination.

FACTUAL OVERVIEW: THE EARTHQUAKE

Japan, like all of the countries located along the so-called Pacific Rim, is susceptible to powerful earthquakes. The Great Kanto Earthquake of 1923 killed over 140,000 people in and around Tokyo; the date is commemorated every year as "Disaster Prevention Day" in Japan. In 1995, Kobe was rocked by a quake that killed 6,434.

On the afternoon of Friday, March 11, the country was struck by yet another earthquake. It occurred at 2:46 p.m. local time, which is 5:46 a.m. GMT or 12:46 a.m. EDT. The epicenter was approximately 20 miles deep and 78 miles off the coast of the main island of Honshu, to the ENE of the port city of Sendai. The quake occurred near a fault line where the North American Plate (on which Hokkaido and the northern half of Honshu are located) rises up over the Pacific Plate to the east.



It was the fourth most powerful earthquake since 1900 and the largest ever recorded in Japan. It was initially reported to be an 8.9 magnitude quake, but the United States Geological Survey updated its strength to magnitude 9.0 on Tuesday the 15th. It moved nearby portions of Japan's northeast coastline 13 feet eastward and dropped them 2 feet closer to sea level.

The Tsunami and the Aftershocks

The submarine quake displaced massive amounts of water, causing a tsunami to radiate outwards from its epicenter. This is a phenomenon which is well known in Japan.[1] Tsunamis are characterized by extremely long and rapidly-traveling waves; in water 15,000 feet deep, a tsunami may move as fast as 400 miles an hour, but it would barely be noticeable to a vessel on the surface. As the tsunami reaches shore, however, it both slows considerably and increases to tremendous height.

[1] The word "tsunami" comes from a combination of the kanji (Japanese characters) for "harbor" and "wave."

The tsunami here began to strike the coastline of nearby Honshu approximately 30 minutes after the earthquake. Reports indicate that it was up to 33 feet (10 meters) in height at Sendai. The Fukushima Dai-Ichi nuclear power station 60 miles south was struck by a 20 feet high wave.

Over the course of the following week, the area experienced hundreds of aftershocks. Thirty-five occurred later on Friday the 11th, and Saturday the 12th saw another 90. By Friday the 18th, one week after the initial earthquake, there had been over 550 aftershocks, and 35 of these were of magnitude 6.0 or greater.

The Devastation

The earthquake and the tsunami damaged or destroyed tens of thousands of buildings. Walls of water that washed ashore and then receded took entire villages with them, obliterating every structure in sight. Three passenger trains in Iwate and Miyagi prefectures disappeared completely, and 200 fires were still burning as of Sunday the 13th.

The confirmed death toll has been rising steadily. As of Thursday the 24th, the official count stood at 9,452 dead with 14,671 still missing. On Friday the 18th, one week after the disaster:

- 1.6 million people were still without running water;
- 850,000 were without electricity;
- 452,000 were homeless;
- 350,000 were housed in emergency shelters; and
- over 80,000 buildings were believed to have been damaged or destroyed.

Snow and freezing temperatures in northern Honshu in the days after the quake compounded the victims' misery.

For search and rescue operations, Japan deployed 100,000 troops – one-half of the country's Self-Defense Force ("SDF") or military establishment – in the largest mobilization since World War II. The United States, whose Seventh Fleet is based in Japan, also sent military assets to assist, spearheaded by the aircraft carrier *U.S.S. Ronald Reagan*.

The tsunami radiating outward from Sendai traveled across the Pacific, striking Alaska, Hawaii, and the west coast states of Washington, Oregon and California. Physical loss or damage was largely confined to Japan, however. The only reports of significant damage here in the United States involved Crescent City, the northernmost California municipality, and Santa Cruz immediately to the south. Offshore underwater geology renders both harbors uniquely vulnerable to wave damage. Crescent City saw an 8 foot swell that killed one resident and sank 16 fishing boats. Santa Cruz experienced what is presently estimated to be $26.5 million in damage to boats and docks.

FACTUAL OVERVIEW: THE NUCLEAR RADIATION ISSUE

From a coverage standpoint, the compensability of loss occasioned by the perils of earthquake or flood (tsunami) raises relatively straightforward issues. The most problematic aspect of this loss, however, is that *nuclear radiation* also features in the causal chain. As a result, it is important to understand what happened at the nuclear power station that was damaged by the earthquake and tsunami. The *exact* sequence of events is not entirely clear – as one would expect only days after the disaster – but we can still reconstruct at least some of what has happened.

Japan has relatively few coal and oil deposits, and it has relied extensively on nuclear plants as a result. Some 30% of the country's electrical power is presently generated by 54 of these facilities.[2] Nuclear plants must always be built adjacent to a major source of water in order to cool their condensers. In Japan, that has meant that virtually all of the nation's plants are situated along the coastline.

The Fukushima Facility

Two nuclear power stations are located along the coast of northern Honshu some 60 miles south of Sendai and 150 miles north of Tokyo. The southernmost one – Fukushima Daina – was out of operation and was not seriously damaged on Friday the 11th. Its northern cousin, however – Fukushima Dai-Ichi ("Fukushima") – is a different story altogether.

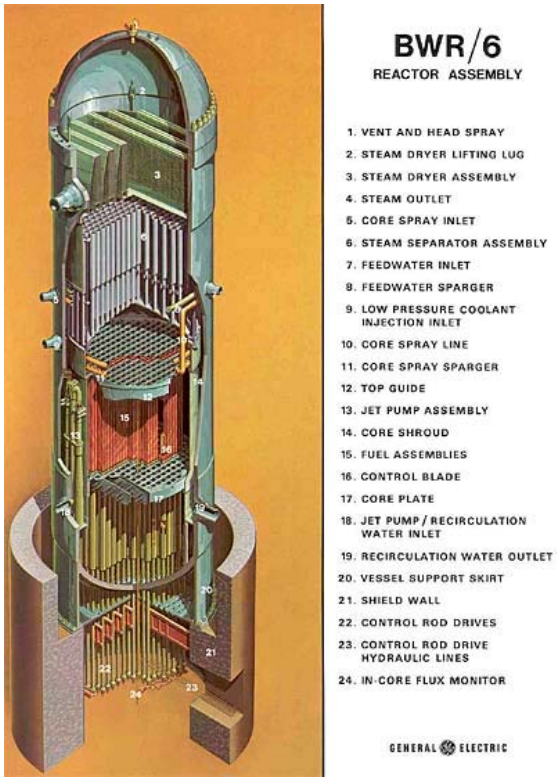
Fukushima had six boiling water reactors ("BWRs"), three of which were in operation on March 11. It is one of the country's oldest nuclear plants; the reactors were constructed between 1970 and 1979, and they were reaching the end of their projected life when the earthquake struck.

[2] By contrast, the United States has 104 nuclear plants, but these generate only 20% of its electricity.

Both facilities were owned and operated by Tokyo Electric Power Company ("Tepco"), a utility that has been criticized for its handling of safety-related issues in the past. In 2002, Tepco admitted to the falsification of safety test results at Fukushima Unit No. 1, and similar incidents at other facilities were reported in 2003, 2007, and 2009.

The Affected Reactors

All nuclear reactors power turbines that are used to generate electricity. Most modern facilities are pressurized water reactors ("PWRs"). In a PWR, primary coolant is pumped under high pressure through the reactor core where it is superheated by nuclear fission. It then passes into a steam generator where it transfers its heat to the feedwater in a secondary system. The feedwater flashes to stream which is then used to power the turbines.



BWRs were originally developed by General Electric Company ("GE") in the 1950's, and they represent a simpler and less-expensive design. The primary coolant is itself converted to steam in the reactor core and used to power the turbines in the adjacent turbine hall, eliminating the need for a steam generator and a secondary feedwater loop. The primary coolant is then converted back into a liquid in the condenser and injected back into the reactor core by massive reactor coolant pumps ("RCPs").

The Reactor Cores and Their Protective Systems

The reactor cores at Fukushima consisted of fuel rod assemblies, each some 15 feet long and 6 inches square. An individual assembly was made up of either 64 large-diameter or 81 small-diameter fuel rods, and each such rod was essentially a stack of ½ inch long uranium pellets inside a zirconium alloy tube or "cladding."

When in operation, normal core temperature in the Fukushima reactors was approximately 550° F. Maintaining and moderating this temperature is achieved in two ways. First, the core is *always* submerged in liquid primary coolant – water laced with boron, a substance that absorbs the neutrons that sustain nuclear fission. Second, control rods – cruciform-shaped devices made of boron carbide metal – can be fully or partially inserted between the fuel assemblies to moderate the nuclear fission. *Both* are necessary. The full insertion of control rods will shut down the nuclear reaction in a fully-submerged core, but the control rods alone cannot stop the reaction in the absence of primary coolant.

Five of the six Fukushima reactors were the GE "Mark 1" design, a diagram of which is shown below.[3]

The first line of defense against any radiation release is the stainless steel *reactor vessel*. This is the copper-colored vessel in the center of the diagram. It houses the reactor core. The second line of defense is the *reactor*

[3] Fukushima's Unit No. 3 is a Tobisha BWR that used a very similar design. The principal difference was that Unit No. 3 uses mixed oxide ("MOX") fuel pellets containing both low-enriched uranium and *plutonium* recycled from nuclear weapons. Plutonium has a greater concentration of radioactive elements and operates at a hotter temperature than conventional nuclear fuel. As a result, it is generally believed that the radioactive plume from this reactor would be more dangerous than that from any of the other five.

containment – the steel-reinforced concrete structure that surrounds and encloses the reactor vessel. The third line of defense is the metal building itself.

The GE "Mark 1" design was popular precisely because its reactor containment system was smaller and cheaper to build than competitors' products. Thirty-two such reactors are still in operation worldwide. It has been criticized since 1975, however, because a number of scientists believe that a dynamic loss-of-coolant accident such as that experienced at Fukushima could lead to a rapid build-up of pressure that the reactor containment could not withstand. It is presently unclear whether that happened here.

The Spent Fuel Pools

The spent fuel pools were the other major source of radiation at Fukushima. In the GE "Mark 1" design, these were located on the highest level of the building. In the diagram above, the spent fuel pool is shown immediately below the orange-colored overhead crane. When the fuel assemblies in a reactor's core become depleted, the reactor vessel and the reactor containment are opened at the top, and the overhead crane is used to pluck the assemblies out and transfer them to the nearby pool. The upper level location minimizes the distance that these must be moved.

The important point here is that the spent fuel pools are *shielded by nothing* but the metal building structure. Spent fuel must be kept submerged in iridescently-blue, boron-laced water and cooled for *years* before it can safely be moved to an off-site location. At Fukushima, each reactor building had a 45 feet deep pool, meaning that 30 feet of water was covering the 15 feet long spent fuel assemblies. Each pool held 1500-2000 tons of coolant, which was constantly circulated around the assemblies by pumps. The normal temperature in the pools is 77º F.

In most cases, the spent fuel pools contained no more than one reactor core's worth of fuel assemblies. Unit No. 4 was more problematic, however, because its pool had the assemblies from several cores. These included 548 assemblies that were removed from the reactor in December 2010 and that still had a relatively-high degree of radioactivity as a result.

The Incident

On Friday, March 11, the earthquake struck Fukushima. Seismic sensors promptly initiated a "scram" – an emergency shutdown of the plant. Electric power was knocked out almost immediately, but on-site back-up diesel generators kicked in to continue to run the RCPs and other essential systems. Only Unit Nos. 1, 2, and 3 were operating at the time, but their control rods were fully-deployed to shut down the nuclear reaction.

Approximately 30 minutes later the tsunami hit. The protective sea wall at Fukushima was only 16 feet high; as noted above, the tsunami was 4 feet higher. It knocked out the emergency diesel generators.

The exact reason is not known. Some newspapers report that the diesels were housed in concrete bunkers that were *below ground level*. This made them less susceptible to air strikes, cyclones and typhoons, but it may well have made them more susceptible to a tsunami. Other news accounts state that the generators were knocked out

when associated above-ground fuel tanks and electrical switching equipment were washed away. It is undisputed that the effect was to shut down the RCPs and the pumps that circulated coolant in the spent fuel pools.

The Initial Failure and The Danger Of A Meltdown

The first notice of serious problems took place on Saturday the 12th when Tepco employees observed that radiation levels were rising in Unit No. 1. This indicated that coolant levels were falling in the reactor core, exposing the fuel rods and creating the danger of a hydrogen explosion. When the rods are exposed, the steam created as coolant boils reacts with the zirconium cladding to create zirconium-oxide on the one hand and pure hydrogen on the other, leading to a build-up of hydrogen gas in the reactor vessel. This is potentially explosive, requiring that the reactor vessel periodically be vented into the reactor containment and that the containment then be vented into the top of the building housing the unit.

This was done, but at 3:36 p.m. on Saturday the 12th, an explosion of the accumulated hydrogen gas blew the top off Unit No. 1's building, injuring 4 Tepco employees. The presence of radioactive cesium – a by-product when uranium fuel rods are cracked open – in the suppression pool below the reactor core subsequently confirmed that the unit's fuel inventory has sustained some damage as well.

The utility then decided to use fire-extinguishing hoses and temporary fire pumps to inject *seawater* laced with boron into the reactor core to replace the primary coolant that the RCPs had been circulating throughout the vessel prior to the loss. It was clearly not a decision that Tepco made lightly. As Robert Alvarez, a former senior policy adviser to America's Secretary of Energy explained to the media, "it's sort of a Hail Mary pass". Seawater is highly corrosive; by injecting it, Tepco in effect *destroyed* Unit No. 1's reactor.

Press accounts frequently speak in terms of "meltdowns." The facts are as follows. At 1500º F., the fuel rods' zirconium cladding will buckle and blister, and cracks in the metal will allow radiation from the uranium pellets inside to escape. At 2200 º F., the cladding may burst, allowing pellets to drop to the bottom of the reactor vessel, where their proximity to one another accelerates the fission reaction and ramps up the temperature even more. At 4000 º F., the pellets begin to melt into a molten mass of uranium which *theoretically* has the potential to eat through both the bottom of the stainless steel reactor vessel and the concrete floor of the reactor containment, with a massive release of radiation into the environment once it comes into contact with underlying soil and water.

This is the so-called "China Syndrome" – a molten mass that eats its way all the way through the earth. *It has never happened anywhere*, and the 1979 Three Mile Island ("TMI") incident – a partial meltdown with no reactor vessel breach and very little release of radiation – demonstrated that it almost certainly never will. The bottom line, however, was that Unit No. 1 had experienced at least some fuel rod damage and that continued injection of seawater would require periodic "controlled containment venting" with its concomitant release of radiation for months or even years to come in order to avoid additional hydrogen explosions.

The Subsequent Failures

All five of the other Fukushima units were ultimately implicated to some degree. At Unit No. 3, falling coolant levels meant that Tepco had to begin seawater injections and controlled venting at 11:37 p.m. on Sunday the 13th. As with Unit No. 1, a hydrogen explosion took the top off of this reactor's metal building at 11:01 a.m. on Monday the 14th, injuring 7 employees and possibly damaging the reactor containment as well.

Unit No. 2 was next. Water coolant levels in the reactor core were known to be falling by Monday afternoon, but a malfunctioning valve made it inadvisable to inject seawater because any hydrogen gas build-up in the reactor containment could not be vented. By 10:00 p.m. on Monday the 14th, it was believed that the core was "almost empty" of water. At 6:14 a.m. on Tuesday, a hydrogen explosion – which was presumably the result of hydrogen accumulating from reactions between the zirconium cladding and steam from the evaporating coolant – blew a 25 foot square hole in the side wall of the building; though it did not damage Unit No. 2's metal roof, it is believed to have damaged the concrete reactor containment at that unit as well. Seawater injection is also being employed at Unit No. 2.

Unit No. 4 followed. This reactor was down for maintenance on Friday the 11th, but, as noted above, its spent fuel pool contained a particularly hot load of freshly-depleted fuel. The explosion at adjacent Unit No. 3 on Monday started a fire on the upper story of Unit No. 4's building, but this was quickly extinguished. A second fire in the same area broke out on Wednesday the 16th, however, and this ultimately damaged most of the roof. It was subsequently discovered that the temperature in the spent fuel pool was rising because the water in the pool was either boiling away or leaking out through cracks occasioned by the earthquake, exposing the tops of the fuel assemblies and causing a hydrogen build-up.

A spent fuel pool temperature rise subsequently cropped up in Unit No. 3 as well, as did somewhat lesser rises in temperature in the pools at Unit Nos. 5 and 6 (which were also out of service at the time). By the end of the week, Tepco was convinced that these represented the primary danger of radiation release because the pools were

located *outside* of the buildings' principal containment structures. Since then, efforts have been made to dump water into the spent fuel pools at the four units using fly-overs by Japanese SDF CH-47 Chinook helicopters and chains of water-cannon trucks borrowed from Tokyo's riot control police. Holes were punched in Unit Nos. 5 and 6's roofs to facilitate these efforts.

FACTUAL OVERVIEW: THE RADIATION DANGER

The Fukushima radiation leaks caused massive physical disruption in Japan. At 7:00 a.m. on Saturday the 12th, the government ordered everybody within six miles (10 km) of the plant to evacuate. The mandatory evacuation zone was expanded to a 13 mile (20 km) radius the next day, and some 200,000 people were ultimately relocated. On Tuesday the 15th, those within 19 miles (30 km) were also directed to stay inside and to "seal all windows and doors." Potassium iodide was also distributed to nearby residents.[4] On Thursday the 24th, residents in this zone were told by the Japanese government that they should also evacuate if at all possible.

The United States took a somewhat more alarmist view of the crisis on Wednesday the 16th, when Gregory Jaczko, the Chairman of the Nuclear Regulatory Commission ("NRC"), characterized the nearby radiation levels as "extremely high" and stated that "for a comparable situation in the United States, we would recommend an evacuation for a much larger radius than is currently being provided in Japan." Our embassy in Tokyo counseled that all Americans within *50 miles* of Fukushima should evacuate. The U.S. government also advised that any of the 50,000 American military dependents within *200 miles* of the plant were free to depart on flights being arranged by the United States. Australia, Britain, and Germany have also advised their citizens to evacuate northern Honshu.

[4] Radioactive iodine from a nuclear accident accumulates in the thyroid gland. After Chernobyl, thyroid cancer was found to be the biggest public health risk to nearby residents. Potassium-iodide reduces the gland's ability to absorb radioactive iodine.

The International Atomic Energy Agency ("IAEA") is a nuclear watchdog agency established in 1957. Its International Nuclear & Radiological Event Scale ("INES") rates events such as this from One ("Anomaly") to Seven ("Major Accident"). The problems at Fukushima were originally deemed to be a category Four ("Accident With Local Consequences") by the Japanese government. On Friday the 18th, however, Japan stepped this up to a category Five ("Accident With Wider Consequences") as a result of the fuel damage known to have been experienced in Unit Nos. 1, 2, and 3.

The only category Seven ever experienced took place at Chernobyl in 1986. The lone category Six was a 1957 waste tank explosion at Kyshtym, which is also in the Soviet Union. The 1979 TMI incident was a category Five.

Press accounts frequently reference Chernobyl, but the fact is that the Russian disaster was of a massively-greater magnitude. Chernobyl Unit No. 4 was an experimental reactor *with no containment structure*. It also used powdered graphite instead of boron-laced water to moderate the fission reaction. During electrical testing, the graphite caught fire, ultimately burning for four days and sending a huge plume of radioactive soot into the atmosphere. The radiation spread around the globe.

At Chernobyl, the recorded radiation levels at the plant were *10,000 times higher* than anything yet recorded at Fukushima. Twenty-eight of the workers who fought to contain the disaster died within three months of acute radiation sickness, and 106 others subsequently developed symptoms of this disease. To this day, no one is allowed to live within an 18 mile radius of the plant.

Radiation Levels

The prevailing winds over Honshu blow from west to east, but no reputable expert in either America or Japan presently believes that there is any chance that significant radiation will reach the United States. Trace amounts of the radioactivity have already crossed the Pacific, however; detectors in Sacramento, California recorded miniscule levels on Saturday the 19th. Of more concern, trace amounts of radioactive iodine in excess of Japanese safety levels were found in milk from farms within 20 miles (30 km) of Fukushima and in spinach from farms within 60 miles (100 km) of the facility on Saturday the 19th. Trace amounts were also detected in Tokyo's tapwater on the same date. The government has since banned the sale of milk and leafy vegetables such as cabbage, cauliflower, and broccoli from Fukushima prefecture and from some six other nearby prefectures.

By Saturday, April 4th, discharges of extremely radioactive water from the plant had led to readings that were as high as *7.5 million times* the legal limit in the ocean in the vicinity of the facility. Japan has forbidden all fishing within 13 miles (20 km) of the plant, but fish caught as far away as 50 miles (80 km) from Fukushima Dai-Ichi have contained levels of radioactive isotopes that render them unsalable.

Burial

At Chernobyl, Unit No. 4 was buried in a temporary "sarcophagus" of sand and clay that was dumped on top of the reactor by helicopters in order to smother the graphite fire. This is *not* deemed to be a viable option here, however. Air drops might inflict additional damage at Fukushima, cracking open containments or reactor vessels and exposing their cores. In addition, entombing a hot reactor core could accelerate the heating process, leading to a meltdown through the bottom of the reactor vessel and the floor of the containment that would allow the molten core to reach soil and water.

Permanent burial in a concrete structure of some kind may well be called for once the reactors have been permanently cooled and stabilized, but that could take years.[5]

The Prognosis

The prognosis for Fukushima is uncertain, and the situation at the plant is still critical. It is difficult to forecast the outcome, and part of the reason is that Tepco and its Chairman of the Board Masataka Shimizu have been roundly criticized for not being more forthcoming with the facts. So has the government – which only assumed control of the Fukushima stabilization efforts on Wednesday the 16th – and Prime Minister Naoto Kan.

Tepco's personnel have been heroic. Five utility workers were killed by the earthquake and the tsunami, and two remain missing as of today's date, but 50 Tepco workers – dubbed "nuclear samurai" in Japan and the "Fukushima Fifty" by the western media – have remained at the plant throughout the crisis, even though 750 others were evacuated on the morning of Tuesday the 15th. Indeed, Japan's Nuclear & Industrial Safety Agency ("NISA") – the equivalent of our NRC – increased the legal limit for nuclear plant workers from 100 millisieverts ("mVs") per year to 250 mSv per year last week in order to allow the 50 workers to keep working to save the facility.[6] By the 19th, their efforts and the falling radiation levels at Fukushima enabled Tepco to re-deploy 500 more employees at the nuclear station.

Initial indications were that progress was being made and that the situation could be stabilized fairly quickly. Tepco quickly began bringing in cable from a remote site that would allow the restoration of electric power to the plant. By the end of the day on Monday the 21st, power cables had reached the facility, and lights and control room power at all six reactors were ultimately restored. In addition, lines were hooked up that allowed the utility

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[5] Russia is presently seeking $1.4 billion in international funding to encase the Chernobyl facility in a more permanent and stable "sarcophagus."

[6] Workers at an American nuclear facility are limited to exposure of up to 50 mVs per year.

to begin pumping *fresh water* into the units' cores and spent fuel pools in lieu of the seawater that was previously employed.

Tepco's short term goal has been to keep the fuel rods cool, and that evidently has been achieved. Its intermediate term goal, however, which was to restart the reactor coolant pumps so that the units' own cooling systems could maintain an appropriate level of water in the cores and the spent fuel pools, has *not* been accomplished to date.

To run the facility's on-site cooling systems, the off-site electric lines must be dragged through and connected up in a network of rooms and passageways in the basements of the turbine buildings. On Thursday the 17th, three employees of a Tepco sub-contractor who were pulling electric cables through the basement of Unit No. 2's turbine building were exposed to dangerously-elevated radiation levels (173-181 mSv). The source of the radiation was a 5 inch deep pool of water, and two of the workers sustained "beta ray burns" when it overtopped their rubber boots, requiring hospitalization.

The radioactivity in the water signaled that there were leaks in either Unit No. 2's reactor vessel itself or somewhere else in the extensive network of pumps, pipes and valves that make up its primary cooling system. Water has since been found in the basements of the turbine buildings of Units Nos. 1, 3, and 4 as well. It is now known that the fuel rods in Units Nos. 1 and 2 suffered a partial meltdown, and Unit No. 3's core almost certainly sustained damage as well.

The problem that Tepco faces is that it must continue to circulate fresh water through the cores to keep them cool. There are leaks in either the reactor vessel or the cooling system piping in Unit No. 2, however, and there *may* be leaks in the same places in Unit Nos. 1 and 3 as well. That means that the injection of fresh water is constantly replenishing the flooding of large areas of the turbine hall basements. In the absence of access to those spaces, Tepco cannot: (1) determine where the leaks are; (2) assess and repair any earthquake or tsunami damage to the on-site cooling systems; and (3) restore electric power to the reactor coolant pumps.

Tepco's priority at the present time is to pump out the radioactive standing water. By Saturday, April 2nd, it had filled every empty surge tank and condensate storage tank at the plant, and it was forced to begin pumping some 11,000 tons (30 million gallons) of radioactive water stored in those locations into the ocean in order to make room for the pumping out of additional water from under the turbine buildings.

Meanwhile, radioactive standing water had begun to find its own pathways to the ocean. A crack in the concrete wall of a 6 foot deep pit near the seawater intake pipes for Unit No. 2 allowed water with extremely dangerous levels of radioactivity (1000 mSv per hour) to flow directly into the Pacific. As Tepco Vice-President Sakae Muto recently observed, the utility "cannot say at this time how many months or years it will take" to stabilize the plant.

FACTUAL OVERVIEW: THE ECONOMIC EFFECTS

The overall economic impact of the earthquake and the tsunami will undoubtedly be massive. On Thursday the 17th, the National Bank of Australia predicted that the total damage could reach $200 billion dollars.[7] Japan's Economic Minister Kaoru Yosana put the overall economic cost at 20 trillion yen ($248 billion) on Sunday. Risk Management Solutions estimated that the economic losses would total $200-300 billion on Monday the 21st, and the World Bank has put that figure as high as $235 billion.

Japan's Nikkei Index was down fully 17.5% by the close of trading on Wednesday the 16th, but it recovered somewhat during the last two days of the week, finishing for a net loss of 10.3% on Friday. It recovered another 3.4% on Monday the 21st.

The northeastern Honshu region generates only 6% of Japan's overall gross domestic production; the country's economic heartland lies predominantly to the south and west of the area. As a result, many of the major economic effects in Japan itself will likely flow from *disruptions in the power grid* in the form of rolling blackouts and *supply chain problems* caused by difficulties in securing transportation, water, and raw materials. There is likely to be considerable uncertainty over how severe, how lengthy, and how frequent these power outages and supply chain problems are going to be over the coming months.

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[7] By contrast, the 2004 Indian Ocean tsunami, which killed over 225,000 people, had an economic impact of only $10 billion dollars.

To the extent that actual physical loss or damage *is* involved, the massive scale of the losses mean that repairs will take quite some time. After the 2005 earthquake, many of Kobe's manufacturers were unable to resume full production levels for *15 months.* The World Bank has stated that a full recovery may take as much as *5 years*.

Insured American businesses will also see this translate into supply chain problems, though existing inventory probably means that most of these won't begin to crop up until the second quarter of this year. Japan's $5 trillion economy is the world's third largest; the country is the world's fourth largest exporter. Notable examples include:

Cars & car parts: Japan is the source of 14% of the world's automotive parts, and one-third of American imports from Japan are cars and car parts. Certain models such as the extremely popular Toyota Prius are made exclusively in Japan itself.

Electronics: The country produces one-fifth of the world's semiconductors and fully 60% of the silicone wafers used to manufacture semiconductor chips.

Steel

Machine Tools

Solar Panels

Infrastructure Disruptions

Rolling blackouts in the eight prefectures in northern Japan, *including Tokyo*, began on Monday the 14th. These caused widespread disruptions because the schedule was not properly published in advance, though that situation will undoubtedly be ironed out. The absence of the ten reactors at Fukushima Dai-Ichi and Fukushima Daina lead Tepco to announce that 10% of its electrical production is presently off-line and that rolling blackouts will likely continue until *the end of April*. As discussed above, at least three of Fukushima's six reactor cores are now scrap metal.

Railways in northern Japan shut down completely after the earthquake, and only 20% of these were up and running by Tuesday the 15th.

The government declared a no-fly zone within 19 miles (30 km) of Fukushima. In addition, many air carriers embargoed goods on all flights in and out of northern Japan's airports, including Tokyo's huge Narita International; their planes are presently shipping only mail and relief supplies to Japan.

There are already severe gasoline shortages. Fourteen percent of Japan's refining capacity was knocked out on March 11, and another 4% is operating at reduced levels due to earthquake and tsunami damage.

One result of all of this has been empty grocery store shelves from Tokyo northwards.

Automotive Industry Disruptions

Toyota initially announced that it was shutting all twelve of its Japanese plants through Wednesday the 16th. It subsequently extended the projected closures; neither domestic production nor production for the export market was underway again as of Monday the 21st. Nissan followed suit, and it also announced that nine of its own Japanese factories and those of 35 domestic suppliers had been either damaged or destroyed by the earthquake and the tsunami. Honda suspended all of its operations until at least Wednesday the 23rd, and it also informed its American dealers that it isn't sure if it will be able to resume a full production schedule until *May*.

The “trickle down” effect of this is already starting to be felt here. As noted above, all Toyota Priuses are manufactured in Japan. American dealers have approximately one month’s supply at the present time. One beneficiary of that situation should be Chevrolet’s electric car, the Volt, but that uses transmissions manufactured in Japan.

Chrysler announced that it has a 4-6 weeks supply of spare parts from Japan, and GM has completely idled a Shreveport, Louisiana plant that manufactures small pick up trucks and reduced the output of two European factories as a direct result of the quake.

Electronic Industry Disruptions

NAND chips are lightweight, flash memory chips used in most modern digital cameras, smart phones, and tablet computers, and 35% of these are made in Japan. Apple secures one-third of its NAND chips from the country. Tobisha, Japan’s biggest seller of NAND chips and the world’s second largest manufacturer of them by volume, announced on Tuesday the 15th that it was closing a number of its factories due to quake damage. Sony, Canon, and Fujita have also announced electronic component factory closures. Japan’s semiconductor manufacturer Renesas Electronics reports that seven of its 22 factories are now closed due to power grid disruptions.

Texas Instruments of Dallas has also informed the press that one of its chip manufacturing suppliers will not be able to ship again at full volume until *September* due to damage to water, chemical, and gas lines supplying its plant. One-third of the electronic components used in Boeing’s new 787 Dreamliner are reportedly also imported from Japan. Shin Etsu Chemicals, the world’s largest silicon wafer manufacture, reported that its main manufacturing plant was damaged.

The *potential* disruption in some cases is extremely severe. Japan manufactures 90% of the world’s supply of bismaleimide-triazin or BT resin, for example. This is the substance used in the production of virtually all printed circuit boards.

Other Disruptions

American and European companies are also incurring relocation costs as a result of the events of last week. By Friday, BMW, Daimler, SAP, Coca Cola, and Air Liquide had all either evacuated their employees from Japan entirely or moved their Tokyo headquarters to locations further south such as Kobe and Osaka. Finally, the baseball season (scheduled to start on Friday the 25th) may be delayed.

Insurance Industry Considerations

Utilities such as Tepco are required to buy liability insurance through the Japanese Atomic Energy Insurance Pool. Their liability is also capped at 120 billion yen ($1.5 billion). There is apparently no conventional vehicle to insure plants such as Fukushima against earthquake and tsunami.

Most American insurers have a relatively small property and casualty book in Japan.[8] Ninety percent of such business is insured by three large domestic groups (MS&AD, Tokio Marine, and NKSJ), all of which are reinsured by a Japanese captive which is in turn backstopped by the Japanese government.

Over the course of the last week, both the *Wall Street Journal* and AIR Worldwide have predicted that global insurance losses could reach 35 billion dollars. Monday the 21st saw similar estimates of the insured loss from the World Bank ($14-33 billion) and Risk Management Solutions ($20-30 billion).

CONTINGENT BUSINESS INTERRUPTION COVERAGE

While business interruption coverage is designed to indemnify an insured for business income losses sustained due to damage or destruction of the insured's own property, contingent business interruption ("CBI") coverage, also known as dependent business properties coverage, provides indemnity for business income losses that the insured sustains due to damage or destruction of another's property.

Many businesses in today's global economy are contingent or dependent on other business entities, such as customers or suppliers. CBI coverage protects a company whose income is largely derived from these "dependent properties." Typically, coverage is provided to an insured under CBI insurance when a supplier or customer suffers a direct physical loss that interrupts the insured's own business, resulting in a loss of earnings. A related category of coverage to CBI coverage is contingent extra expense coverage, which generally provides coverage for the extra expenses or increases in cost that the insured incurs as a result of the physical loss or damage to a supplier or customer.[9] The perils insured against are those covered by the insured's own policy, not by any policies purchased by the insured's customers and suppliers.

Because of Japan's significant position in the global economy, damage caused by the Japanese earthquake and tsunami will undoubtedly disrupt not only businesses in Japan, but also companies located in the United States that are dependent on Japanese suppliers and customers. The Japanese earthquake and tsunami have caused the shutdown of facilities, disruptions in the power grid, and difficulties in securing transportation, water, and raw materials. As a result, domestic companies that are dependent on Japanese suppliers and customers will almost

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[8] The exception is AFLAC, which sold a very popular line of cancer insurance to individuals there.

[9] While not specifically addressed here, another category of coverage known as interdependency coverage may also be implicated by the Japanese earthquake and tsunami. Interdependency coverage typically provides indemnity for a company's loss of revenue caused by the suspension of business at another one of the company's divisions or locations. For example, a domestic corporation may have a loss of business revenue resulting from the suspension of business at one of its subsidiaries located in Japan.

certainly be facing business suspension and revenue losses. For example, any U.S. company that depends on component parts or goods manufactured in Japan may suffer a loss from the Japanese suppliers' inability to provide the necessary parts or goods. Additionally, many domestic businesses may also suffer losses as a result of the inability to deliver products or services to their Japanese customers. Insurers are certain to see claims from domestic policyholders that are dependent on the delivery to or receipt of goods from Japanese entities under the CBI portions of their commercial property policies.

CBI coverage can be provided either by a stand-alone policy or by an endorsement to an existing property policy. While CBI insurance is most often found in manuscript policies drafted by brokers, standard dependent property forms do exist. For example, the "Business Income from Dependent Properties-Broad Form" issued by the Insurance Services Office provides:

> We will pay for the actual loss of Business Income you sustain due to the necessary "suspension" of your "operations" during the "period of restoration." The "suspension" must be caused by direct physical loss or damage to "dependent property" at a premises described in the Schedule caused by or resulting from a Covered Cause of Loss.

See ISO Form No. CP 15 08 (Ed. 04 02) (Coverage may also be offered on a Limited Form, ISO Form No. CP 15 09 (Ed. 04 02), which provides coverage in much the same manner, but on a more limited basis, allowing the insured to customize the business income coverage as needed.) As the ISO form demonstrates, there are several requirements to CBI coverage: a "dependent property" must have (1) suffered direct physical loss or damage; (2) caused by a covered peril; (3) that suspends the insured's business operations; and (4) results in a business income loss to the insured.

What Constitutes "Dependent Property"?

CBI coverage generally requires that "direct physical loss or damage" occur to "dependent property" that is scheduled within the policy itself. If the "dependent property" is not scheduled, the coverage grant is frequently significantly limited. One example is the following:

> C. The following is added to ADDITIONAL COVERAGES:
> Miscellaneous locations. We will pay for the actual loss of Business Income you sustain due to direct physical loss or damage at the premises of a "dependent property" not described in the Schedule caused by or resulting from a Covered Cause of Loss. But we will not pay more than .03% of the Limit of Insurance for each day's suspension of "operations" due to loss arising from any one location.

ISO Form CP 15 08 (Ed. 4 02).

In the ISO form quoted above, "dependent property" is defined as "property operated by others" on whom the insured depends. Of course, other policy forms, whether broker manuscripted or issued by individual carriers, may utilize different language providing narrower or broader definitions of dependent property, damage to which can

give rise to CBI coverage. Generally, there are four categories of dependent properties or locations which, when damaged, may give rise to CBI coverage:

> (1) *Contributing Properties* deliver materials, parts, or services to the insured or to others on the insured's account. These "upstream" suppliers usually provide materials and services necessary for the insured to conduct its business. An example might include a U.S. camera manufacturer that suffers business interruption losses due to the closure of a Japanese NAND chip manufacturer. Some policies carve out certain types of contributors from the definition of dependent properties, such as water supply services, power supply services, or communication supply services, including internet access. *See, e.g.*, ISO Form NOs. 15 08 and 15 09.
>
> (2) *Recipient Properties* accept the insured's products or services, i.e., customers. A recipient location lies "downstream" of the insured's operations and is usually one of the insured's prime customers. For example, a U.S. manufacturer of industrial machines whose primary customers are Japanese manufacturing plants may sustain business interruption losses due to the closure of its customers' facilities.
>
> (3) *Manufacturing Properties* are locations that produce products for delivery to the insured's customers under contract of sale. For example, a U.S. automobile distributor, which does no manufacturing of its own, takes orders from customers for vehicles and places the orders with a Japanese car manufacturer. The Japanese car manufacturer manufactures the vehicles for the automobile distributor to ship to its customers. Earthquake damage at the Japanese car manufacturer's plant may prevent the manufacturer from supplying the ordered vehicles to the distributor's customers, resulting in financial losses to the U.S. automobile distributor.
>
> (4) *Leader Properties* are other businesses that attract customers to the insured's business. The businesses need not be related. The leader location is typically located in the vicinity of the insured and attracts customers to the insured's business, as well as its own. As a result of the typical proximity requirement, leader properties will not likely play a significant role in domestic companies' claims resulting from the earthquake and tsunami in Japan.

As noted above, CBI coverage is often written on manuscript forms, and these forms typically offer broader coverage than that offered in the standard ISO forms. Some manuscript policies will refer generally to the "suppliers" and "customers" or "receivers" of the insured. Some examples of such language include the following:

> *Example 1*
>
> This policy … also insures against loss resulting from damage to or destruction by the perils insured against, of … property that directly prevents a supplier of goods and/or services to the insured from rendering their goods and/or services, or property that prevents a receiver of goods and/or services from the insured from accepting the insured's goods and/or services, such supplier or receiver to be located anywhere in the policy territory, but such supplier or

> receiver shall not be an insured under this policy. Coverage hereunder also includes real and personal property located at attraction properties.
>
> *Example 2*
>
> This policy covers against loss of earnings and necessary extra expense resulting from necessary interruption of business of the insured caused by damage to or destruction of real or personal property, by the perils insured against under this policy, of any supplier of goods or services which results in the inability of such supplier to supply an insured location.

Some courts have interpreted this policy language very broadly, noting that it does not limit coverage to suppliers in direct contractual privity with the insured. *See Archer-Daniels-Midland Co. v. Phoenix Assurance Co*., 936 F.Supp. 534, 544 (S.D. Ill. 1996). In this case, the court construed the above contingent business interruption endorsement (*Example 2*) in the aftermath of extensive flooding in the American Midwest during the summer of 1993. The insured, Archer Daniels Midland Co. (ADM), is a large industrial farm processing company. In a very broad construction of the CBI coverage, the court held that the U.S. Army Corps of Engineers and the U.S. Coastguard were "suppliers of goods and services" to ADM because they constructed and managed the facilities on the Mississippi River needed to make it navigable to shipping. Moreover, the various farmers who grew crops processed by ADM were suppliers for purposes of CBI coverage, even though ADM did not directly contract with the farmers, but rather purchased grain from dealers. *Id*. at 544. The court noted that the policy language did not limit coverage to those suppliers in direct contractual privity with the insured. *Id*.

Other courts have limited the meaning of "supplier" for purposes of CBI coverage. *See, e.g., Pentair, Inc. v. Am. Guar. & Liab. Ins. Co.,* 400 F.3d 613, 615 (8th Cir. 2004) (applying Minnesota law). In Pentair, a product manufacturer who was a supplier to the insured, Pentair, was unable to manufacture its products because it had no electrical power for its Taiwanese factories as the result of damage to an electrical substation caused by an earthquake. When production resumed two weeks later, Pentair shipped orders from Taiwan via airfreight to meet its customers' needs, resulting in additional costs. Pentair filed a claim to recover its additional costs under the "Contingent Time Element" provision of its all-risk manuscript property policy, which extended business interruption coverage to include losses incurred as the result of "damage" to "property of a supplier of goods and/or services to the Insured" that is caused by a covered peril. *Id*. at 615. The court held that the electrical substation, though physically damaged by the earthquake, was not a "supplier of goods and/or services" to Pentair within the meaning of the policy. The court explained that although it supplied power to the Taiwanese factories, the power company did not supply a product or service ultimately used by Pentair. *Id*.

Is There a Direct Physical Loss or Damage to the Dependent Property Which Caused the Loss?

CBI coverage typically requires that the dependent property suffer physical damage caused by a covered peril that wholly or partially prevents the operation of that property. However, CBI coverage does not necessarily require a total shutdown of the other "dependent property."

In *Arthur Andersen LLP v. Federal Ins. Co*., 3 A.3d 1279 (N.J. Super. Ct. App. Div. 2010), the insured accounting firm, Arthur Andersen LLP (Andersen), sought recovery of $204 million in revenue losses under the contingent business interruption provision of its all-risk commercial property insurance policy as a result of property damage to the World Trade Center (WTC) and the Pentagon on September 11, 2001. The CBI provision in Andersen's policy provided:

> This policy … is extended to cover *the actual loss sustained by the Insured* resulting from the necessary interruption of the business conducted by the Insured, whether partial or total, *caused by loss, damage or destruction* covered herein … to . . . [p]roperty that directly or indirectly prevents a supplier of goods, services or information to the Insured from rendering their goods, services, or information or *property that directly or indirectly prevents a receiver of goods, services or information from the insured from accepting or receiving the Insured's goods, services or information*."

Id. at 1282. Andersen did not own or lease any property at the WTC or Pentagon and could not identify any supplier or client who was unable to receive services as a result of property damage to the WTC or Pentagon. The court held that Andersen failed to present any evidence that the claimed business losses were caused by damage to property that prevented the flow of goods or services resulting in the interruption of Andersen's business. *Id*. at 1288.

Many claims resulting from the supply chain disruptions caused by the Japanese earthquake and tsunami will involve scenarios where no actual physical loss or damage occurred to the American policyholder's Japanese supplier. For example, the electrical blackouts present an interesting issue with respect to CBI coverage as such loss of electrical power alone may not constitute physical damage to the dependent property insured under the policy. Some courts have found that the mere loss of use or function as a result of the loss of power does not constitute direct physical loss or damage. *See, e.g., Pentair, Inc. v. Am. Guar. & Liab. Ins. Co*., 400 F.3d 613, 616 (8th Cir. 2004) (applying Minnesota law). Additionally, some of the disruptions to the transportation systems and electrical blackouts may have resulted from orders of civil authority. Insureds will contend that business income losses stemming from orders of civil authority prohibiting access to dependent property should be covered even where there is no direct or physical loss or damage to the dependent property. By the same token policyholders will argue that civil authority extensions contained in policies that apply to business interruption coverage should likewise apply to CBI coverage.

The Direct Physical Loss or Damage to Dependent Property Must Result from a Covered Peril

Significantly, CBI policies typically require that the cause of the damage and the type of damage to the dependent property be the same as would be covered for the insured's own property. The ISO forms and manuscript language typically provide that the business interruption must result from a "Covered Cause of Loss" or "covered peril." Therefore, if the insured's policy excludes coverage for damage caused by earthquake or flood and earthquake or flood is determined to be the cause of the loss or damage to the dependent property, there is no contingent business interruption coverage for such loss.

While commercial property policies commonly exclude coverage for earthquakes and tsunamis through earthquake and flood exclusions, most major corporate policyholders are likely to have purchased coverage for such losses by way of endorsements to their polices or stand-alone coverage. However, even the largest corporate policyholders will almost certainly not have coverage for losses caused by nuclear reaction, nuclear radiation, or radioactive contamination. As a result, each CBI claim must be closely examined to identify the proximate cause or causes.

Period of Indemnity

The CBI period of indemnity is also typically limited to the period of restoration. This period is described in the ISO CBI form as follows:

> "Period of Restoration," with respect to "dependent property", means the period of time that: a. Begins 72 hours after the time of direct physical loss or damage caused by or resulting from any Covered Cause of Loss at the premises of the "dependent property" … and b. Ends on the date when the property at the "dependent property" should be repaired, rebuilt or replaced with reasonable speed and similar quality.

(Note that the ISO CBI Forms exclude from the period of restoration any increase in the period due to the enforcement of any ordinance or law that (a) regulates the repair, demolition, or constructions of any property or (b) requires anyone to test, treat, or in any way respond to the effects of pollutants.) Additionally, the expiration date of the CBI policy does not cut short the period of restoration.

The period of restoration is a theoretical period – the length of time needed to repair the damaged property in the exercise of due diligence and dispatch, starting seventy-two hours after the loss.

Conclusion

Based on what is known to date, the damage resulting from the Japanese earthquake and tsunami will likely have a substantial economic impact on U.S. companies dependent on Japanese suppliers and customers. Insurers for these entities can expect an influx of claims for CBI coverage as a result. The CBI claims will present significant coverage issues concerning whether the insured's loss was caused by physical damage suffered by a supplier or customer, and whether the physical damage to the suppliers' or customers' property was caused by a covered loss

under the insured's own policy. These claims must be carefully analyzed based on the facts presented in each loss and the particular policy at issue.

EARTHQUAKE DAMAGE

Unlike many prior major earthquakes which have occurred outside of commercial centers, the 2011 earthquake in Japan is likely to affect commerce throughout the world. Not only was this earthquake one of the largest magnitude quakes ever recorded (9.0) but the earthquake was at a shallow depth (19.9 miles) and of long duration (3 to 4 minutes). Aftershocks, some of which have been of a substantial magnitude, will occur for months. Although Japan's building codes are well developed in terms of preventing earthquake damage, under this scenario there is an increased likelihood of damage. Many structures which were within the area of earthquake movement had been damaged in prior earthquakes and subsequently retrofitted.

Earthquakes release energy differently depending on, among other factors, the type of fault where the activity occurs (i.e. horizontal vs. vertical movement) and the geology of the affected area. Depending on parameters such as earthquake depth, soil type, and frequency (large, slow movements v. small, fast movements), the energy dissipation and the way an earthquake affects buildings will be different. Concrete, steel, masonry and wood building components each behave differently with different types of earthquake movement. Damage to buildings may be caused by the shaking which occurs; some may be caused by fissures in the ground; and some may be caused by the uplift of the building. Damage can occur at numerous locations in a structure, some of which will be immediately evident and some of which may be found only after a much more detailed structural inspection, testing and analysis.

In addition to damage which may occur to structures as a direct result of the movement that occurs in an earthquake, another type of damage may occur as a result of the lateral and uplift forces (and subsequent "dropping") that will occur to building mechanicals and heavy equipment which are not adequately anchored during an earthquake occurs. Not only may heavy equipment and/or mechanicals be damaged by lateral movements, but the uplift forces and the "dropping" effect (after uplift) can cause local damage to underlying slabs/flooring and other components of the building structure.

Clearly, earthquake losses present unique issues due to the nature of the damage and the policies under which earthquake claims may arise. Whether or not it is "the big one," severe seismic activity is likely to continue to occur in sizeable population center areas in the future and, as recently seen in Chile, New Zealand and Japan, it will cause extensive property damage, suffering, potential loss of life and result in billions of dollars in property claims.[10] Predictions are that Japan's earthquake will result in $35 billion in insurance claims. As of 2005, the 1994 Northridge Earthquake, the last substantial (6.7) earthquake in a populated area in California, resulted in more than 600,000 insurance claims and $15.3 billion in insurance payments.

[10] For example the US and CA geological surveys say there is a 99.7% chance of a 6.7 magnitude earthquake in California in the next 50 years.

The majority of the coverage cases involving earthquakes in the United States have been litigated in the California state or federal courts and the majority of those cases stem from the 1994 Northridge earthquake.

Although U.S. insurers may not typically be called on to address claims for physical damage that occurred in Japan and are more likely to be asked to respond to contingent business interruption claims, a review of basic issues related to earthquake claims is warranted.

Policy Forms

The first distinction in the analysis of earthquake claims is whether (1) the policy excludes loss caused by earthquakes and/or other types of earth movement, or (2) the policy provisions provide coverage for earthquake damage. While on its face a basic question, the nuances of this issue can be complex. In many instances, earthquake coverage is obtained by way of an endorsement to a property policy which otherwise excludes earth movement. There are other situations where an earthquake policy, separate from the other property coverages and sometimes with a different carrier, has been obtained. On larger commercial risks there may be several layers of coverage, sometimes with different policies (and different policy provisions) at each layer. In these scenarios how different types of policies and policy provisions interface, if they do at all, may become an important issue.

To the extent that there is a separate earthquake policy in existence, typically that type of coverage is likely a "named peril" coverage as opposed to the more frequently used first-party forms providing "all risk" coverage. One other type of policy not frequently encountered which also becomes relevant in earthquake scenarios is a "DIC" or "Difference In Conditions" policy. DIC policies typically are "gap fillers" and come into play only where there is a "gap" between the coverages provided by two policies which were intended to be comprehensive.

Whether coverage is written on a "standard" form (*i.e*., ISO form) or as manuscript coverage is also an important distinction. As there are far too many types of policy forms to address in this paper, we will focus on issues that frequently appear with respect to standard policy forms in use.

A typical *exclusion* in all risk policies for "earth movement" is as follows:

> We will not pay for loss or damage caused directly or indirectly by any of the following. Such loss or damage is excluded regardless of any other cause or event that contributes concurrently or in any sequence to the loss.
>
> 1. Earthquakes, including any earth sinking, rising or shifting related to such events;
>
> 2. Landslide including any earth sinking, rising or shifting related to such event;
>
> 3. Mines subsidence meaning subsidence of a man made mine whether or not mining activity has ceased;
>
> 4. Earth sinking (other than sinkhole collapse), rising or shifting including soil conditions with which caused settling, cracking

> or other disarrangement of foundations or other parts of realty. Soil conditions include contraction, expansion, freezing, thawing, erosion, improperly compacting soil and the action of water and the action of water under the ground surface.
>
> But if Earth Movement, as described in (1) through (4) above results in fire or explosion, we will pay for the loss or damage caused by that fire or explosion. . . .

Whether it be by endorsement to an all risk policy or by separate named peril policy, a typical earthquake *coverage* may include the following:

> Section 1 – Property is amended as follows:
>
> A. The following are added to Paragraph A.3. Covered Causes Of Loss:
>
> 1. Earthquake
>
> 2. Volcanic Eruption, meaning the eruption, explosion or effusion of a volcano.
>
> B. All Earthquake shocks or Volcanic Eruptions that occur within any 168-hour period will constitute a single Earthquake or Volcanic Eruption. The expiration of this policy will not reduce the 168-hour period.
>
> C. With respect to the coverage provided by this endorsement, we will not pay for loss or damage caused by or resulting from:
>
> 1. Fire, explosion (other than volcanic explosion), landslide, mine subsidence, tidal wave, flood, mudslide or mudflow, even if attributable to an Earthquake or Volcanic Eruption.
>
> 2. Any Earthquake or Volcanic Eruption that begins before the inception of this insurance.
>
> But, if this policy replaces earthquake insurance that excludes loss or damage that occurs after the expiration of the policy we will pay for loss or damage by Earthquake or Volcanic Eruption that occurs on or after the inception of this insurance, if the series of Earthquake shocks or Volcanic Eruptions began within 168-hours prior to the inception of this insurance.[11]
>
> …

[11] See ISO Form BP 10 030702.

"Named Peril" vs. "All Risk" Policies

Many Earthquake policies provide only named peril coverage, i.e., coverage for only losses caused by the specific peril or perils insured. This is contrasted with the more widely used "all risk" property policies which provide coverage for all risks of direct physical loss, subject to exclusions set forth in the policy.

The distinction between named peril coverage and all risk coverage is important not only in terms of the breath of what is covered but because it is the policyholder's burden under a named peril policy to establish that the named peril caused the loss in question. On the other hand, with an all risk policy it is the burden of the insurer to establish that the loss comes within one of the exclusions of the policy if coverage is challenged. *Garvey v. State Farm Fire & Casualty Co.*, 770 P.2d 704, 710 (Cal. 1989).

When an endorsement is made to an all risk policy adding earthquake coverage, the policy is likely to retain its all risk character – the difference is that a coverage previously excluded (i.e. earth movement) is withdrawn by virtue of the endorsement.

Causation Questions

Claims for damage after earthquakes frequently involve other types of damage as well as the actual damage caused by the shaking of the earthquake itself. In the 1906 San Francisco earthquake, the majority of the property damage was caused by fire following the earthquake. Earthquake claims have also been known to highlight damage caused by construction defects and a variety of other causes. Even if earthquakes are covered under the terms of an all risk policy, other causes of loss may be excluded by the policy language.

From a purely scientific standpoint, there is no question that the devastating tsunami which followed the earthquake in Japan was in fact caused by that offshore earthquake. Typically it is the vertical movement of the oceanic plates, one uplifting and the other moving downward, which causes a tsunami to occur in the ocean. Earthquake zones such as those in California where the plates tend to move laterally rather than vertically, the risk of an earthquake causing a tsunami diminishes even in coastal areas. The connection between the earthquake in Japan and the subsequent tsunami, and the power plant failures that followed may raise complex questions of legal causation depending on the policy language and the jurisdiction in which a claim is raised.

Although the question of causation is equally important with named peril and all risk policies, because of the burden of proof assigned to the insurer with respect to an all risk policy, the causation question appears to be more frequently litigated in connection with all risk policies. The three factors which will determine the outcome of the causation question with an all risk policy are (1) the policy language; (2) the facts of the loss; and (3) how the law of the jurisdiction in which the case arises addresses the first party causation question.

Because the majority of the litigation involving earthquake claims has occurred in California, this paper will focus on California's efficient proximate cause analysis. Other jurisdictions address causation questions differently. Although many states have adopted the efficient proximate cause analysis, some jurisdictions will provide

coverage for all concurrent causes not excluded. Other jurisdictions will attempt to apportion covered and excluded concurrent causes.

Under California law, an insurer owes policy benefits to an insured under an all risk policy if the "efficient proximate cause" of the insured's loss is a covered peril, even when other excluded perils contribute to cause the loss. Cal. Ins. Code, § 530 (2010). Efficient proximate cause is only an issue where two or more causes contribute to cause a loss. The efficient proximate cause of a loss is the "predominating cause." *Garvey v. State Farm Fire & Cas. Co.*, 770 P.2d 704, 708 (Cal. 1989). If more than one peril contributes to a loss, the question of which is the efficient proximate cause generally is a factual matter for the jury to resolve. Expert testimony may be required to assist in making such determination.

Howell v. State Farm Fire & Cas. Co., 218 Cal.App. 3d 1446 (Cal. Ct. App. 1990) (overruled on other grounds), is illustrative of how complex a causation question may become. In *Howell*, a fire stripped a riverbank of vegetation. After heavy rains, a landslide subsequently occurred resulting in damage to the insured's property when large pieces of the property were lost because there was no vegetation to hold the river bank. The court held that the efficient proximate cause of the loss was fire which was covered under the policy, as opposed to landslide, which was excluded from coverage.

After *Garvey*, insurers made a variety of attempts to avoid the concurrent causation "problem". Some policies included "anti-concurrent causation" language in all risk policies. The *Howell* court held that the policy exclusions were not enforceable to the extent they conflicted with California law.[12]

In considering how the efficient proximate cause analysis works in California, a question naturally arises as to how any fire or tsunami that occurs as a result of the initial seismic activity will be treated under insurance policies. As discussed above, many of the forms which provide separate earthquake coverage appear to anticipate that separate fire or other loss typically covered under an all risk policy will come into play and be the result of the earthquake. Some policies will exclude that later damage and some will cover it. Since the date of the *Garvey* decision, the subject has not been addressed in the context of an earthquake loss in reported decisions.[13] To the extent that separate earthquake policies are not all risk policies but are rather named peril policies, one can argue that the efficient proximate cause analysis should not apply as all that is insured under a named peril policy is the specific peril identified in the coverage.

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[12] The California Supreme Court confirmed *Howell's* reasoning in *Julian v. Hartford Underwriters Ins. Co.*, 110 P.3d 903 (Cal. 2005). The court analyzed section 530 and the efficient proximate cause doctrine to assess whether an insurer could deny coverage for a rain induced landslide by invoking, among other exclusions, a provision that excludes coverage for losses caused by weather conditions that "contribute in any way with" an excluded cause or event such as a landslide.

[13] See discussion addressing tsunami claims, *infra*.

TSUNAMI DAMAGE

The scale of destruction to the northeast coast of Japan wrought by the tsunami of March 11, 2011 is difficult to comprehend. In places the damage to buildings, property and infrastructure is complete, with vast sections of cities, towns, residential areas, and agricultural land laid waste. Earthquake damage by itself would have been severe, given the magnitude of the seismic event. Yet the quake damage, in places, became nearly irrelevant as the tsunami leveled almost everything in its path. American businesses with property located in the disaster area, or entities whose business is dependent on property of others located there, for contingent business interruption purposes, may or may not have insurance coverage for tsunami damage, depending on the policy purchased. Insurers that issued property insurance policies to owners of property in the affected areas will handle an enormous volume of claims based on damage from the tsunami. As with any catastrophe, the claims will necessarily be handled individually, and they will raise insurance coverage issues that likely will be as challenging as the practical difficulties of processing the claims.

The Flood Exclusion

It would be a fortunate property owner who purchased flood insurance for property lost in the effected area or a policy designed specifically to cover tsunami damage. Many policyholders will not be so lucky. Most standard commercial property insurance policies *exclude* flood. Inevitably, this fact will stimulate creative arguments as to the nature of specific losses and as to legal causation as policyholders seek insurance coverage for the catastrophe.

A common flood exclusion is found in the ISO "Causes of Loss – Special Form," CP 10 30:[14]

> We will not pay for loss or damage caused directly or indirectly by any of the following. Such loss or damage is excluded regardless of any other cause or event that contributes concurrently or in any sequence to the loss.
>
> * * *
>
> a. Water
>
> (1) Flood, surface water, waves, tides, tidal waves, overflow of any body of water, or there spray, all weather driven by wind or not;
>
> (2) Mudslide or mudflow;
>
> (3) Water that backs up or overflows from a sewer, drain or sump; or
>
> (4) Water under the ground surface pressing on, or flowing or seeping through:

[14] Certainly not all property policies applicable to property in the affected earthquake and tsunami area will use ISO language. But even manuscript policies that exclude the peril of flood will likely contain provisions based upon or similar to standard policy forms.

(a) Foundations, walls, floors or paved surfaces;

(b) Basements, whether paved or not; or

(c) Doors, windows or other openings.

But if Water, as described in g.(1) through g.(4) above, results in fire, explosion or sprinkler leakage, we will pay for the loss or damage caused by that fire, explosion or sprinkler leakage.

Other policies may express the exclusion for flood damage in terms of water damage:

> We do not insure under any coverage for any loss which would not have occurred in the absence of one or more of the following excluded events.
>
> Water Damage, meaning: (1) flood, surface water, waves, tidal water, tsunami, seiche, overflow of a body of water, or spray from any of these, all weather driven by wind or not.

Regardless of whether the exclusion language refers to "tidal wave" or "tsunami," the wall of water that inundated much of Japan's northeast coast on March 11 will likely be considered a "flood" as that word is commonly understood. The common meaning of "flood" from the dictionary includes:

1. A body of moving water, especially when large.
2. The flowing in of the tide, or the highest point of the tide.
3. A rising and overflowing of a body of water that covers land not usually under water.

Webster's Third New International Dictionary (3d. ed. 1993).

A similar definition was adopted by regulation under the National Flood Insurance Act, 42 U.S.C. §§ 4001-4129 (2011):

(a) a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) the overflow of inland or tidal waters.

44 C.F.R. §59.1 (2011).

The tsunami, although unique in many ways in terms of origin, development, and magnitude of force, meets these definitions of flood. This makes the presence or absence of a flood or water damage exclusion, or a specific flood coverage grant, in the policy a critical first step in evaluating a property or business interruption claim arising from the tsunami.

Causation: Flood or Earthquake

Tsunamis are a series of enormous waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or meteor.[15] They differ from wind-generated waves in that they have very long wavelengths. Tsunamis come ashore more like a long-lasting flood wave rather than breaking surf seen at the beach.[16]

Tsunamis are most commonly generated by earthquakes, frequently associated with the movement of tectonic plates in the earth's crust. Fractures occur where plates meet, releasing enormous energy as one or both plates is displaced upward. The vertical movement is transferred from the seafloor to water and the energy propagates outward as a tsunami.[17] The March 11 tsunami in Japan was caused by a magnitude 9.0 subduction earthquake off the northeast coast of Honshu island where two plates meet.

For insurance purposes, was the flood damage caused by tsunami or earthquake? The causation analysis will depend on the rules of insurance causation in the jurisdiction applicable to the interpretation of the particular insurance policy. Many states have adopted an efficient proximate cause analysis, whereby the predominant cause, or the peril that "sets in motion a chain of events which results in a loss without the intervention of any new or independent force" is considered the proximate cause of loss.[18] For a seismically-generated tsunami, it could be argued that the tsunami itself consists of a new and independent force that caused damage on land wholly different from that caused by the earth shaking. This conclusion could be significant if the property policy excluded earthquake but covered water damage or flood, or vice versa. On the other hand, the earthquake could be viewed as the force that set all other causes of damage in motion to produce the loss.

Following the devastation to New Orleans by flooding during Hurricane Katrina, some property owners claimed that their insurance policies, which excluded water damage or flood, covered their property damage after failure of certain levees along canals allowed inundation of their property. They argued that the flood exclusion was limited to purely natural events and that their damage was caused by man-made forces, namely negligence in the design, construction, or maintenance of the levees that failed. The insureds asserted that the flood exclusion was ambiguous because the word "flood" was not defined and the policies did not specifically exclude damage resulting from negligence in this context. In *In re Katrina Canal Breaches Litig.*, 495 F.3d 191 (5th Cir. 2007), the Fifth Circuit Court of Appeals disagreed and rejected the distinction between natural and non-natural causes in applying the flood exclusion. The court held that what happened in New Orleans was flooding, something that the policies clearly excluded from coverage. The flood exclusion applied to prevent coverage, even though the flooding in that case was triggered by the failure of several canal levees. Furthermore, the insureds' focus on

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[15] See *http://www.fema.gov/hazard/tsunami/index.shtm*.

[16] See *http://www.ess.washington.edu/tsunami/index.html.*

[17] See *http://www.tsunami.noaa.gov/tsunami_story.html.*

[18] 7 COUCH ON INSURANCE, §101:44 (2010).

negligence as the cause of their damage, rather than flood, was a mere recharacterization of the actual cause of loss, which was flood.[19]

Causation: Flood or Pollution

The tsunami caused massive physical destruction, damaging or obliterating dwellings, retail and industrial facilities, and infrastructure. It also left behind a polluted and contaminated landscape. Industrial and household chemicals, fuel and other petroleum products, pulverized building materials, and sewage mixed with seawater and spread over effected areas.

Owners of contaminated property not covered by flood insurance may seek coverage for pollution damage, raising the issue of the proximate cause of the damage, the tsunami or the release of pollutants. Policyholders will encounter a further challenge in the pollution exclusion, present in most all-risk property policies. The exclusion attempts to bar coverage for property damage arising from the discharge, dispersal, seepage, migration, release or escape of pollutants, broadly defined as any contaminant or irritant.[20] Because the tsunami impacted all property alike in its path and caused the release of both traditional pollutants (petroleum products; sewage; industrial chemicals) and other products that, although irritants, are normally substances released to the environment for accepted purposes (agricultural herbicides; cleaning products), claims of damage from dispersed contaminants will likely extend the on-going debate concerning the scope of the pollution exclusion. That is, whether the pollution exclusion is limited to "traditional" environmental pollution or if it also applies to contaminants not ordinarily considered "pollution" if released for their intended purpose.[21]

Causation: Flood or Debris Impact

Much of the tsunami damage resulted from the overwhelming force of the water alone. Damage also resulted from the impact of debris carried by the water as it moved inland and then retreated to the sea. Houses were lifted and shoved against other buildings. Ocean-going ships and fleets of floating automobiles slammed into buildings or bridges far from the ocean. In places the damage from water alone may have been less than the impact damage from the debris it carried. Property owners without flood insurance may attempt to characterize their damage as debris impact.

In *Naumes, Inc. v. Landmark Ins. Co.*, 849 P.2d 554 (Or. Ct. App. 1993), an intense rainstorm dumped two inches of rain in approximately 30 minutes. A water-charged mudflow deposited debris on the insured's property, located in

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[19] In re Katrina Canal Breaches Litig., 495 F.3d 191 (5th Cir. 2007); see also Kish v. Ins. Co. of N. Am., 883 P.2d 308 (Wash. 1994) (policy excluded flood but covered loss caused by rain; insureds could not avoid the flood exclusion by recharacterizing flood as rain because the loss was caused by rain-induced flood, which was excluded).

[20] *See, e.g.*, ISO "Causes of Loss – Special Form," CP 10 30.

[21] *See, e.g.*, *Doerr v. Mobil Oil Corp.*, 774 So.2d 119 (La. 2000); *cf Kent Farms, Inc. v. Zurich Ins. Co.*, 969 P.2d 109 (Wash. Ct. App. 1998), *aff'd,* 998 P.2d 292 (Wash. 2000); and *Cook v. Evanson,* 920 P.2d 1223 (Wash. Ct. App. 1996).

a narrow canyon, damaging buildings. The insurer denied coverage because of the surface water exclusion in the property policy. The insured sued, and argued that the damage was caused by rock, mud, soil, and debris, all covered perils, and not surface water. Although everyone agreed that the heavy rainfall and resulting surface water triggered the events leading to loss, the court refused to grant summary judgment for the insurer, finding a question of fact as to whether the loss was caused by surface water or a "debris torrent." Some victims of the tsunami in Japan will also likely argue that their property losses were caused by forces other than flood.

Ensuing Loss

As the tsunami ravaged cities, towns and communities along the Japanese coast, fires broke out among the remains of buildings, some still floating in flood water or even burning after being swept out to sea, and others burning at buildings or facilities not totally destroyed by the tsunami. Although the fires were not direct flood damage, they resulted from the impact or consequence of the flooding. Property insurance policies commonly contain exclusions that preclude coverage for certain perils, such as flood, water damage or construction defects, but preserve coverage for "ensuing loss" caused by the excluded peril, provided the ensuing loss is itself not excluded. The standard all-risk policy form, quoted above, contains an ensuing loss provision in its water exclusion:

> But if Water, as described in g.(1) through g.(4) above, results in fire, explosion or sprinkler leakage, we will pay for the loss or damage caused by that fire, explosion or sprinkler leakage.

ISO "Causes of Loss – Special Form," CP 10 30.

In the absence of flood insurance for property damaged in the tsunami zone, an ensuing loss provision may preserve coverage for the property if it was damaged by a separate peril that resulted from the flood. Such could be the case if the impact of the tsunami started a fire, a peril completely separate from flood. For the ensuing loss exception to an exclusion to apply, the insured must show damage from a distinct, new, covered peril. This may be possible in the case of flood waters causing a fire. But a consequential loss is not necessarily a separate ensuing loss. In the leading case of *Acme Galvanizing Co. v. Fireman's Fund Ins. Co.*, 270 Cal.Rptr. 405 (Cal. Ct. App. 1990), the inherent vice of faulty welds in a kettle containing molten zinc caused the kettle to rupture and spill its contents. The court held that the damage caused by the spilled molten zinc was not a distinct, new peril, coverage for which would be preserved by the inherent vice exclusion's ensuing loss provision. Rather, the damage was the result of the inherent vice itself. Similarly, losses incurred during testing and assessment of Y2K compliance were not caused by a peril distinct from Y2K remediation so as to be excepted from the inherent vice exclusion.[22]

[22] *Port of Seattle v. Lexington Ins. Co.,* 48 P.3d 334 (Wash. Ct. App. 2002).

Unlike a fire resulting from the tsunami, mold damage from exposure to water following the flood may not be viewed as an independent peril that broke the chain of events leading to the damage.[23] Ensuing loss issues are fact specific and must be examined carefully, typically with the assistance of experts, to reach the correct coverage decision.

RADIATION DAMAGE

While insured losses in Japan sustained as a result of the earthquake and consequent tsunami are projected by some news agencies to reach $35 billion, projected property losses caused by the ongoing nuclear crisis at the Fukushima Dai-Ichi nuclear power station remain unquantified. We have already seen reports of radiation leaks emanating from the plant at dangerous levels and at least 200,000 residents have been ordered to evacuate. Japan has now urged some residents near the plant and as far as Tokyo to stop drinking tap water after high levels of radioactive iodine were detected. As noted above, shipments of milk, spinach and other local vegetables harvested from the area have also been suspended after testing positive for radiation.

Fears are also growing that fish from Japanese waters may be contaminated with radiation. Some sushi restaurants across Asia have already dropped from their menus fish from Japan. So far, the FDA has not suspended Japanese food imports, but has reported that it may increase the monitoring of food and raw ingredients from Japan for radiation contamination, which will likely cause a business disruption to US food chains, restaurants and distributors who receive and market such goods and products. A disruption in the manufacturing of Japanese autos and electronics is also expected in areas with high radiation levels. If the radiation levels in and around the facility are too high, then the facility would be closed. The concern there is not necessarily on the actual contamination of such products, but on the safety of the people working in the facility because radiation particles typically deposit on manufactured products, such as autos and electronics, and can be washed off. Food, on the other hand, is a much more pertinent issue for radioactive contamination because crops and animals ingest the radiation particles.

Property losses stemming directly from the release of radiation are likely to include claims for direct physical loss to covered property located in Japan or any other area affected by the radiation cloud(s) emanating from the Fukushima Dai-Ichi facility, and/or loss of use of covered property contaminated by radiation. Claimants would include property owners unable to access or occupy their homes and businesses due to radiation contamination. For US policyholders, such losses may include direct losses to factories and warehouses in Japan owned by the policyholder and physically located in a contaminated area, as well as the goods and products they manufacture or store at those locations.

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[23] *Fiess v. State Farm Lloyds,* 202 S.W.3d 744 (Tex. 2006) (mold resulting from roof and window leaks was not an ensuing loss by "water damage" but rather a natural consequence of the non-covered leaks); *Wright v. Safeco Ins. Co. of America,* 109 P.3d 1, 7 (Wash. Ct. App. 2004) (water leaks (covered) did not preserve coverage for mold damage where the water leaks were caused entirely by construction defects (non-covered): "The efficient proximate cause rule does not allow a claimant to focus on one covered cause out of a causal chain.").

We also anticipate claims for economic losses or lost profits due to business interruption and/or contingent business interruption occasioned by US companies in the business of importing goods and products from Japanese partners or subsidiaries, in the event those goods or products have been destroyed or rendered unmarketable as a result of the contamination. Business interruption and contingent business interruption claims may also arise in instances where the manufacturing or shipment of Japanese goods and products is disrupted or delayed due to the increased monitoring of Japanese imports for radiation contamination or the complete shutdown of Japanese manufacturing facilities due to high levels of radiation in the air around the facility.

As illustrated above in the factual overview, it is difficult, if not impossible, to presently identify with any degree of certainty the exact cause or causes of any of the anticipated property losses occasioned by this catastrophe, particularly those losses involving the release of radiation from the nuclear power station severely damaged by the earthquake and tsunami. Depending upon a particular jurisdiction's rule on efficient, multiple and/or concurrent causation, it will be necessary to identify a series of causes of loss that may ultimately be deemed responsible for any anticipated property damage claims made. Therefore, an ultimate determination as to coverage for any of the anticipated property damage loss scenarios noted in this white paper is first dependent upon a careful examination into causation based on the facts of the loss claimed and the law of the particular jurisdiction.

Radiation "Contamination" as Physical Loss or Damage

Consistent with established insurance law, physical injury or damage must occur to insured property before coverage applies. Thus, as a general rule, if the insured property remains physically intact and undamaged, there is arguably no coverage under the language of a standard form property policy. An example of the relevant policy wording can be found in the standard commercial property ISO Form Insuring Agreement, which provides as follows:

> A. Coverage
>
> We will pay for direct physical loss of or damage to Covered Property at the premises described in the Declarations caused by or resulting from any Covered Cause of Loss.

ISO Form CP 00 10 (04/02). This wording is substantially similar in all standard and broker manuscript property policies.

Anticipated claims for direct physical loss to covered property and/or loss of use of covered property contaminated by radiation thus beg the initial threshold question as to whether "contamination," in and of itself and without evidence of tangible injury or physical damage to the property, can constitute "direct physical loss" to property.

A review of US case law addressing this issue makes clear that the term "direct physical loss" may, in some instances, encompass loss of use or loss of the functional use of property, even absent tangible damage to the property. The cases suggest that when loss of use occurs in combination with some physical damage, a court will be even more inclined to find that the insured has sustained physical loss or damage. A closer review of the cases

further suggests that two essential elements must be present if the loss of the functional use of insured property is to constitute physical loss, as that term is used within an insuring agreement. First, there must be some physical intrusion or change to the insured property or property in the vicinity of insured property and, second, there must be some physical impairment that acts to prevent the use of the insured property.

With regard to anticipated claims for radioactive contamination of property not otherwise physically injured, the physical introduction of nuclear radiation into the insured property arguably satisfies the first element of the physical loss requirement. The second element would also be satisfied in instances where, by order of civil authority, the property may no longer be used, inhabited or occupied, or manufacturing and distribution of the property is disrupted or delayed. A decision from the Colorado Supreme Court, *Western Fire Ins. Co. v. First Presbyterian Church*, 437 P.2d 52 (Colo. 1968), is instructive.

In *Western Fire*, the Colorado Supreme Court addressed whether the insured (a church) suffered a "direct physical loss" when the accumulation of gasoline in and around the building caused a significant odor in the building and eventually rendered the building uninhabitable when it was closed down by the local fire department. The court found that there was a "loss of use" of the structure that was the result of the accumulation of gasoline vapors, which resulted in the building becoming uninhabitable and making further use of the building extremely dangerous. The court then concluded that all of these facts "equate to a direct physical loss within the meaning of that phrase" in an all risk policy. *Id*. at 55. In other words, the court concluded that if the building was uninhabitable (perhaps limited to a situation where it was uninhabitable due to the significant risk of personal injury), this constituted the physical loss required to trigger coverage under the policy of insurance.

To the extent a direct physical loss to covered property (in the case of direct property losses or business interruption claims) or dependent property (in the case of contingent business interruption claims, discussed above in greater detail) occurred during the relevant policy period, and to the extent the property damage claimed was proximately caused by radioactive contamination, a series of standard form property policy exclusions will likely operate to preclude coverage for such claims. They include the nuclear hazard exclusion and the pollution/contamination exclusion.

The Nuclear Hazard Exclusion

Standard form property policies, including those written on commercial property ISO Form CP 10 30 (04/02), exclude loss resulting from a Nuclear Hazard, except if a direct loss by fire results. By way of example, the relevant ISO policy language provides:

> B. Exclusions
>
> 1. We will not pay for loss or damage caused directly or indirectly by any of the following. Such loss or damage is excluded regardless of any other cause or event that contributes concurrently or in any sequence to the loss.
>
> * * *
>
> d. Nuclear Hazard

> Nuclear reaction or radiation, or radioactive contamination, however caused. But if nuclear reaction or radiation, or radioactive contamination, results in fire, we will pay for the loss or damage caused by that fire.

The Nuclear Hazard exclusion significantly limits a property insurer's exposure to radiation contamination losses. The language of the exclusion appears to apply not only to man-made radiation but to any naturally occurring radioactive contamination as well. Indeed, the availability of insurance coverage for such contamination is scant and often only afforded under US policies via an endorsement for an additional premium. *See, e.g., Sumitomo Marine & Fire Ins. Co. v. Cologne Reinsurance Co. of Am.*, 75 N.Y.2d 295 (N.Y. 1990); *see also* GA. CODE ANN. § 33-32-1(b) (2011) (Georgia statute outlining coverage for nuclear radiation in standard form property policy by endorsement only).

Case law considering the Nuclear Hazard exclusion in property insurance policies is virtually nonexistent – likely because losses potentially triggering its application are fortunately rare and also because it is generally accepted and universally understood that nuclear risk does not come within the ambit of standard form property insurance policies. Rather, damages attributable to nuclear accidents, such as that experienced at Fukushima Dai-Ichi, are typically accounted for under government mandated insurance pools for nuclear risks. Japan is no exception.

The Japan Atomic Energy Insurance Pool would be triggered to cover the public liability claims precipitated by the Fukushima Dai-Ichi nuclear crisis. Under Japan's 1961 Law on Compensation for Nuclear Damage, which was amended in 2010, power plant operators' liability for accidents, such as those after the earthquake and tsunami, is limited to 120 billion yen (about $1.5 billion), with the Japanese government assuming responsibility for any third-party property damage or bodily injury claims beyond that amount. To meet the requirements of the law, Japanese nuclear power plant operators buy property and liability insurance from the Japan Atomic Energy Insurance Pool ("JAEIP"). JAEIP provides nuclear property, nuclear liability, general liability and terrorism coverage to nuclear power plant operators.

A comparable model exists in the United States. The Atomic Energy Act of 1954 and the Price-Anderson Act of 1957 (an amendment to the Atomic Energy Act), sets up an indemnification and limitation of liability scheme for "public liability" arising out of the conduct of nuclear energy and weapons industries. 42 U.S.C.A. §§ 2011, *et seq*. (2011). "Public liability" is defined in the Act to include any legal liability arising out of or resulting from a "nuclear incident", including property damage from exposure to radiation or precautionary evacuation. The Act does not apply to workers' compensation claims by persons employed at the site where the nuclear incident occurs, claims arising from an act of war, and claims for damage to property located at the site. 42 U.S.C.A. § 2014(w).

The Price-Anderson Act of 1957 further provides for pool insurance for liability under the Act that would not otherwise be available on the open market. 42 U.S.C.A. § 2210. The Act consequently considers the absence of insurance for nuclear risk in standard property and liability policies issued to homeowners, property owners and businesses in light of the standard form Nuclear Hazard exclusion. The Act provides, however, that the "nuclear incident" subject to public liability must occur within the United States. 42 U.S.C.A. § 2014(q). Consequently, because the "nuclear incident" at issue here occurred in Japan, the Price-Anderson Act will not apply. Instead, the JAEIP would be triggered.

The international insurance markets are already reporting that they do not expect significant insurance losses from the nuclear incident at Fukushima Dai-Ichi. We suspect that most, if not all, of the radiation contamination claims will be indemnified under the JAEIP, and/or by the Japanese government once the claim fund is exhausted. This would include anticipated claims for direct physical loss to covered property and/or loss of use of covered property contaminated by radiation, including goods and products manufactured and/or located in the affected area.

Pollution/Contamination Exclusion

Standard form commercial property policies also typically exclude loss resulting from pollution. By way of example, the relevant ISO policy language provides:

> B. Exclusions
>
> * * *
>
> 2. We will not pay for loss or damage caused by or resulting from any of the following:
>
> * * *
>
> l. Discharge, dispersal, seepage, migration, release or escape of "pollutants" unless the discharge, dispersal, seepage, migration, release or escape is itself caused by any of the "specified causes of loss". But if the discharge, dispersal, seepage, migration, release or escape of "pollutants" results in a "specified cause of loss", we will pay for the loss or damage caused by that "specified cause of loss".
>
> This exclusion, l., does not apply to damage to glass caused by chemicals applied to the glass.
>
> * * *

ISO Form CP 10 30 (04/02).

The standard commercial property ISO Form further defines "pollutants" as "any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste." ISO Form CP 00 10 (04/02). While no longer specifically identified as an exclusion in the ISO Forms that currently predominate, the ISO all risk form at one time contained a reference excluding "contamination" from coverage. The current Form now includes "contaminant" as part of the definition of "pollutants".

In general, pollution exclusions in first party policies, such as that contained in the standard commercial property ISO Forms, have been enforced. *See, e.g., Brown v. Am. Motorists Ins. Co.*, 930 F.Supp. 207 (E.D. Pa. 1996) (upholding application of the pollution exclusion in homeowners' policy). The primary inquiry here will be whether nuclear radiation is a "pollutant". That term is often defined in standard form property policies, such as the ISO forms. However, the terms within the definition of "pollutants", including "irritant" and "contaminant", are not.

Cases evaluating the terms "pollutant" and "contaminant" have done so using the ordinary meaning of the words. For example, in *Peace v. Northwestern National Ins. Co.*, 573 N.W.2d 197 (Wis. Ct. App. 1999), *rev'd on other*

grounds, 596 N.W.2d 429 (Wis. 1999), a commercial general liability policy,[24] provided an identical definition of "pollutants" as that in the standard ISO Form, defining that term as "any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste." The *Peace* court defined "irritant," as that term is used in the definition of "pollutants," as the source of irritation, especially physical irritation. "Irritation" was defined, in the sense of pathology, as "a condition of inflammation, soreness, or irritability of a bodily organ or part." *Peace*, 573 N.W.2d at 200 (citing, AM. HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE, 406, (3d ed. 1992)).

"Chemical," in turn, was defined as "[a] substance with a distinct molecular composition that is produced by or used in a chemical process." *Peace*, 596 N.W.2d at 436 (internal citation omitted). The court then defined "contaminant" as "one that contaminates." "Contaminate" was defined as "to make impure or unclean by contact or mixture." *Peace*, 596 N.W.2d at 436 (internal citation omitted).

Similarly, the court in *Raybestos-Manhattan, Inc. v. Indus. Risk Insurers*, 433 A.2d 906, 908 (Pa. Super. Ct. 1981), noted that "contamination" connotes a "condition of impurity resulting from mixture or contact with a foreign substance." *Id*. (citing*, Am. Cas. Co. of Reading, Pa. v. Myrick*, 304 F.2d 179, 183 (5th Cir. 1962)). In *Webster's Third New International Dictionary*, the word "contaminate" is defined as follows: "To render unfit for use by the introduction of unwholesome or undesirable elements … contaminate implies an action by something external to an object which by entering into or coming into contact with the object destroys its purity." *Raybestos-Manhattan*, 433 A.2d at 907 (internal citation omitted).

The plain language of the standard definition of "pollution", coupled with the reasoning used in the well-established case law cited above, supports the conclusion that any nuclear radiation leaking from the Fukushima Dai-Ichi nuclear power station "polluted" the air in the vicinity surrounding the facility. Similarly, any products or goods manufactured or located within the affected area were similarly "polluted" by the radiation contamination. The nuclear radiation rendered the air impure, i.e., it contaminated the otherwise clean air.

It is possible that a court may view the radiation contamination as the damage itself, which manifested as a result of either the earthquake, tsunami and/or the failures at the Fukushima Dai-Ichi nuclear facility. Arguably, then, the exclusion for loss caused by or resulting from the release of "pollutants" would not apply, since the consequent radiation contamination is arguably the damage and not the cause of the loss. This would implicate the provision in the "pollution" exclusion negating application of the exclusion if the "discharge, dispersal, seepage, migration, release or escape [of pollutants] is itself caused by any of the 'specified causes of loss'."[25]

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[24] We recognize that pollution exclusions contained in CGL policies are sometimes treated differently from similar exclusions contained in first party property policies. However, the *Peace* case was selected because it involves exclusionary language the same as, or similar to, the pollution exclusion contained in the standard ISO Form. Under these circumstances, we believe the analysis in that case is instructive.

[25] In the standard ISO Form, the phrase "specified causes of loss" is defined to include: Fire; lightning; explosion; windstorm or hail; smoke; aircraft or vehicles; riot or civil commotion; vandalism; leakage from fire extinguishing equipment; sinkhole collapse; volcanic action; falling objects; weight of snow, ice or sleet; water damage.

This argument depends first on a determination as to legal causation, discussed above, and then on whether one or more other policy exclusions may nevertheless apply to preclude coverage for the radiation contamination. The Sixth Circuit's decision in *Am. Alliance Ins. Co. v. Keleket X-Ray Corp.*, 248 F.2d 920 (6th Cir. 1957), is instructive on this point. There, coverage was sought under a commercial property policy for loss resulting from an alleged explosion of a capsule containing highly radioactive radium salt, which disseminated throughout a manufacturing plant. The policy did not afford coverage for loss caused by radioactive contamination. The Sixth Circuit upheld the district court's factual findings that the claimed losses due to the contamination of covered physical property, including all business interruption losses, were "the direct, immediate and proximate result of the explosion of the radium source", a covered cause. *Id.* at 925. In doing so, the Sixth Circuit viewed the contamination as the damage and not the cause of the loss, which would have been excluded. The Sixth Circuit's opinion does not mention whether the policy at issue also contained a Nuclear Hazard exclusion, which may have nevertheless operated to preclude coverage for the entire loss.

CONCLUSION

We hope this factual overview proves helpful in understanding the factual circumstances surrounding the devastating earthquake and tsunami that struck the northeast coast of Japan on March 11, and the failures at the Fukushima Dai-Ichi nuclear power station resulting in significant releases of radiation. We also trust that our analysis provides a useful introduction to some of the more prominent insurance coverage issues raised by the event. We caution, however, that the foregoing is by no means an all-inclusive discussion of the many legal issues that property damage and business interruption claims arising from the catastrophe will pose for carriers and their counsel.

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