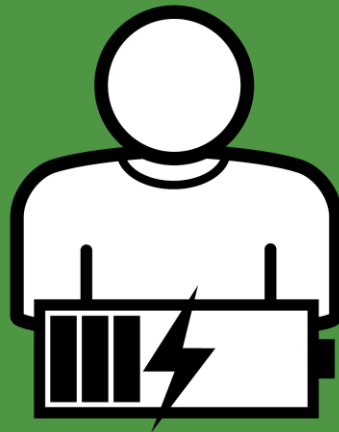


Fatigue Reduction: Fatigue Related Disasters





Fatigue Reduction – Three Mile Island Accident



Occurred:
28 March 1979.



Incident:
Nuclear Disaster.



Impact:
Nuclear Reactor Meltdown.



Fatalities:
None initially but
many made sick.

At approximately 4:00am on March 28th, 1979, an avoidable accident occurred at the Three Mile Island nuclear reactor. A valve became stuck open in the secondary nonnuclear section of the plant and began to leak coolant everywhere.

The valve had opened automatically to relieve the pressure after a mechanical failure had prevented water from reaching the steam generators, which was intended to keep the reactors cool. The valve should have closed on its own when the pressure was stabilized, but it did not. Instruments in the control room showed the valve as closed. By the time the crew was able to locate the source of the problem, the reactor's core had melted.

Unaware that they were dealing with a cooling problem, **crew members ultimately made decisions that worsened the situation**. The problem was complex enough, but when fatigue was added into the mix, they had the perfect recipe for disaster. **Investigators eventually ruled that sleep deprivation was a significant factor**.



The aftermath was devastating. It took 12 years to clean up the mess and cost around \$1 billion.

Hundreds were sickened within the immediate area, and many animals and plants perished.

The TMI-2 reactor has since been shut down permanently.



Fatigue Reduction – Bhopal Disaster, India



On December 2nd, 1984, the citizens of Bhopal went to bed unaware that many of them would never wake up. As they slept, one of the storage tanks at the Union Carbide India Limited pesticide plant began to leak.

A faulty valve allowed water into the tank, and pressure quickly rose to catastrophic levels. At around 1:00am on December 3rd, a loud rumbling was heard from the plant as the safety valve inevitably gave out. A plume of methyl isocyanate spilled into the air, and 3,800 people died instantly.



Drowsy workers in the middle of the night were cited as one of the causes of the unfortunate domino effect that resulted in this tragedy.

Approximately 15,000 people died and 600,000 were left with serious injuries ranging from respiratory problems to blindness.



Fatigue Reduction – Challenger Explosion



It takes a lot of preparation to launch a shuttle into space, which results in many sleepless nights and long days for crew and support staff alike.

On January 28th, 1986, the Challenger launched from Cape Canaveral, Florida. Seventy-three seconds later, it exploded, killing all seven people aboard as the world watched in horror. In the aftermath, **it was concluded that poor judgment due to sleep loss was a contributing factor.**

The **top managers had been on duty since 1:00am the day of the launch, after having had only a couple of hours of sleep the previous night.** This made it all too easy for mistakes to be made. Tragically, these mistakes resulted in a fatal outcome.



The mission was speculated to have been plagued by faults throughout much of the planning and the **problems forced managers and staff to overwork in order to stick to the scheduled launch.** As a result, it's reported they had little sleep the night before the scheduled take-off.

Some managers had only two hours' sleep the night before and had been on duty since 1am on the day of the launch (Challenger launched more than 10 hours later, at 11:38am).

Poor judgement and human error were reported as causes of the disaster, and these actions were brought upon by severe sleep deprivation.



Fatigue Reduction – Chernobyl



Occurred:
26 April 1986.



Incident:
Nuclear Disaster.



Impact:
Nuclear Reactor Explosion.



Fatalities:
31 direct fatalities.

Perhaps the most-known disaster, the Chernobyl accident occurred on April 26th, 1986. Due to a series of mistakes by plant operators, the No. 4 reactor was running on dangerously low power, which left it unstable.

The previous day, the crew had been preparing to test how long the turbines would supply power to the main pumps after a power loss. Seconds after the scheduled shutdown, a power surge occurred, resulting in a massive chemical explosion. The blast was so powerful that it blew the 1,000-ton cover off the reactor.

Fatigued workers making preventable mistakes contributed to the largest nuclear accident that the world had ever seen.

The fallout was catastrophic. Within 36 hours of the explosion, people were evacuated from the surrounding area. The exact death toll is still uncertain. The official number of deaths is 31, but it's unclear how many have died from cancer caused by radiation exposure. The 600,000 workers involved with trying to contain the disaster were all exposed, as were the 116,000 people evacuated from the 30-kilometer (18 mi) radius around the plant.



Long hours, tight deadlines, and working at night: this hardly sounds out of character for almost any occupation. It's safe to assume that we all, at one point, have put in a few extra hours at work to meet a project deadline.

Investigators concluded that fatigue – due to 13-hour shifts – was a leading contributor to the human error that led to the explosion. (A flawed reactor design was also to blame.)

Ignoring the signs of fatigue can not only affect your health, but your cognitive actions, reactions, and decision-making, and when combined with the risk of a nuclear explosion, proved disastrous.

In an ironic twist of fate, following the disaster, locals had to give up their jobs as drivers as the effects of radiation poisoning meant they were frequently falling asleep at the wheel.



Fatigue Reduction – Clapham Junction Rail Crash



Occurred:
12 December 1988.



Incident:
Rail Disaster.



Impact:
Train Collision.



Fatalities:
35 Fatalities and 484 injured.

On the morning of 12th December 1988, a crowded passenger train crashed into the rear of another train that had stopped at a signal just south of Clapham Junction railway station in London, and subsequently sideswiped an empty train travelling in the opposite direction. A total of 35 people were killed in the collision, while 484 were injured.

The collision was the result of a **signal failure caused by a wiring fault**. New wiring had been installed, but the old wiring had been left in place and not adequately secured. An independent inquiry chaired by Anthony Hidden, QC found that the signalling technician responsible had not been told that his working practices were wrong, and his work had not been inspected by an independent person.

The re-signalling project **had been planned assuming more people were available**, but employees felt that **the programme was inflexible** and that they were **under pressure** to get the work done.

Installation and testing was carried out at weekend during voluntary overtime, the **technician having worked a seven-day week for the previous 13 weeks**.



The re-wiring had been done a few weeks previously, but the fault had only developed the previous day when equipment had been moved and the loose and uninsulated wire had created a false feed to a relay.

Hidden was critical of the health and safety culture within British Rail at the time, and his recommendations included ensuring that work was independently inspected and that a Senior Project Manager be made responsible for all aspects of any major, safety-critical project such as re-signalling work.

British Rail was fined £250,000 for violations of health and safety law in connection with the accident.



Fatigue Reduction – Exxon Valdez Oil Spill



Occurred:
24 March 1989.



Incident:
Shipping Disaster.



Impact:
Major
11 million gallons of oil spilled.



Fatalities:
None.

Captain Joseph Hazelwood was ultimately responsible for navigating the Exxon Valdez, a 300-meter ship, through familiar waters to its destination. Unfortunately, **the Captain had downed a few drinks more than he should have** and wound up turning over the helm to sleep-deprived Third Mate Gregory Cousins.

Cousins was barely functioning because he **had slept only six hours** in the previous two days. Shortly after midnight, the Exxon Valdez collided with Bligh Reef, a well-known hazard on this route, which ruptured 8 of the vessel's 11 cargo tanks. The super tanker called for help immediately, but it didn't matter. Though there were no human lives lost, the damage to the environment and wildlife was already done.

The wheelhouse contained a Pilot, Captain, Helmsman and Third Mate, all of whom played their specific role in manoeuvring the vessel through the Valdez Narrows and around icebergs.

Fatigue is speculated to be a contributing cause to the Third Mate's inability to return the vessel back to its correct lane before it struck the reef. It's alleged the Third Mate had inadequate sleep, in fact, supposedly only one "cat nap" (that may not have lasted more than two hours) in the 16 hours leading up to the disaster.



A disturbing statement came from the Third Mate's boss, who said that **fatigue is simply part of the job: "This is just normal to me ... this is how you will work ... this is what is expected of you."**

What kind of disaster has to happen before high-risk industries take the dangers and outcomes of fatigue seriously?

The Exxon Valdez spill continues to hold the No. 1 spot for the costliest maritime accident of all time. Hundreds of miles of coastline were completely destroyed along with the ecosystem there.



Fatigue Reduction – Star Princess Cruise Ship



Occurred:
June 1995.



Incident:
Shipping Disaster.



Impact:
Environmental.



Fatalities:
None.

In June 1995, passengers on the Star Princess, a Liberian cruise ship, likely had a very different idea of what they were in for when they boarded the 246-meter (806 ft) vessel just five days earlier. The seven-day cruise from Vancouver to Skagway, Alaska, was cut short on the fifth day when it ran into Poundstone Rock, 40 kilometres (25 mi) from Juneau.

Though the Star Princess sustained some serious damage to its starboard side, its bottom, and its oil tanks—which ruptured and spilled about 19 litres (5 gallons) of oil, thankfully there were no injuries to the crew or the 1,568 passengers aboard.

The National Transportation Safety Board determined that the **grounding of the Star Princess was due to pilot performance, citing fatigue from sleep apnoea.**





Fatigue Reduction – American Airlines Flight 1420



Occurred:
1 June 1999.



Incident:
Air Disaster.



Impact:
Crash on Landing.



Fatalities:
11 fatalities and 108 injured.

Though weather played a significant role in the crash of American Airlines Flight 1420, **a better-rested pilot could have turned the whole thing around.** Flight 1420 left Dallas–Fort Worth International Airport on June 1st, 1999, for Little Rock National Airport.

The crew received information mid-flight about severe thunderstorms on their route. **In an attempt to outrun the bad weather, they made some landing decisions that caused them to overshoot the runway altogether.** The crew was in a hurry to reach their destination, so they refused to discontinue their approach at Little Rock despite the stormy weather. In addition, they did not ensure that the spoilers had fully extended after touching down.



The National Transportation Safety Board determined that judgment impairment stemming from fatigue and situational stress played a role in the crash.

Ten passengers and the captain were killed as the plane struck several trees 125 meters (411 ft) beyond the runway, passed through a chain link fence, and went over a rock embankment before colliding with a lighting system.

The first officer, the flight attendants, and 105 passengers were also injured.

The plane was destroyed in a post-crash fire.



Fatigue Reduction – Great Heck Train Crash



The Great Heck rail crash is one of the worst UK rail disasters of the 21st century. It is also known as the Selby rail crash in a nod to the town near the site of the tragedy.

On February 28th, 2001, **Gary Hart fell asleep while driving a Land Rover that was pulling a trailer on the M62.** He had had **little to no sleep the night before.** His vehicle veered off the roadway and down a steep embankment before coming to rest on the railway track.

Hart was able to make it out of his vehicle just 60 seconds before a passenger train struck it and derailed. Shortly after, a second train traveling northbound ploughed into the wreckage.



Hart called for help immediately, but it was too late. The crash claimed 10 lives that morning: six passengers and four railway crew members.

More than 80 people were also injured.

Hart was sentenced to five years in prison after being found guilty of 10 counts of causing death by dangerous driving.



Fatigue Reduction – Michigan Train Crash



The early morning quiet on November 15, 2001, was shattered when two Canadian National–Illinois Central freight trains crashed around Clarkston, Michigan. The operators of the **southbound train had failed to acknowledge stop signals** that indicated another train was approaching from the north. Traveling at 21 kilometres per hour (13 mph), the southbound train proceeded onto the mainline track and the two vehicles collided.

At the time, no one knew that **two crew members had been previously diagnosed with obstructive sleep apnoea**. Neither engineer Allen Yash nor conductor Jesse Enriquez of the southbound train had informed his employer of his condition. **Neither man had been successfully treated for the condition, either.**



The National Transportation Safety Board cited the crew members' fatigue as the cause of the accident, which claimed the lives of both the conductor and the engineer of the northbound train. Yash and Enriquez were hospitalized.

Around 11,400 litres (3,000 gal) of diesel fuel were leaked onto the tracks and surrounding area, which cost \$1.4 million to clean up.



Fatigue Reduction – Air France Flight 447



Air France Flight 447 was a routine passenger flight that left Rio de Janeiro and headed for Paris on June 1, 2009. Four hours later, the plane crashed, killing everyone aboard. So how did a routine flight suddenly—and without any warning—simply fall from the sky?

Everything started off normally. The crew was coming off a three-day layover in Rio de Janeiro. Captain Marc Dubois and his co-pilots, Pierre-Cedric Bonin and David Robert, should have been fully rested. But that was not the case. It was **revealed later that the captain had slept only one hour the night before the flight** and the two co-pilots were not any better off.

The first four hours went smoothly for the tired crew. So smoothly, in fact, that the **Captain decided to take a nap** in a bunk behind the cockpit. The nap was scheduled, and everything should have been fine.



But when the flight ran into a band of thunderstorms and turbulence soon afterward, **it took the Captain over a minute to get back to the cockpit. That minute was likely the difference between stabilizing the aircraft and the 11,600-meter (38,000 ft) plunge** that it ultimately took in a span of three-and-a-half minutes.

The tired co-pilots overcorrected when sensors iced over and the autopilot disengaged. They took the aircraft rapidly from 11,000 meters (36,000 ft) to 11,600 meters (38,000 ft) before it stalled.

By the time the captain reached the cockpit, it was too late and all 228 passengers and crew perished within minutes.



Fatigue Reduction – Stoats Nest Fatality



At around 00:28 hrs on the morning of 6th November 2018, **a passenger train** from London Victoria to Three Bridges, travelling at about 69 mph, **struck and fatally injured a track worker** in the vicinity of Stoats Nest Junction, near Purley. The accident occurred after the track worker had placed equipment on the track as part of the arrangements for the protection of an engineering possession.

Having placed the protection equipment, the track worker then walked along the track until he reached the end of the protected area, and continued **walking with his back to rail traffic on an open line**. He may have been going to look at some lineside equipment, and believed that no trains would approach on the line he was walking along. **He was probably fatigued**, and may have been distracted by personal issues linked to the fact that a second person, the possession support assistant who was supposed to be with the track worker, was not present as he had not attended for work that night.

Underlying factors associated with the accident were the nature of the work which exposed the track worker to risk while he was putting out protection for the possession; that the labour supplier's **management processes had not sufficiently identified and addressed the risk of fatigue among zero hours contracted staff**; and that the labour supplier's management processes had neither identified nor prevented staff absenting themselves from work without being detected.



The evidence available to investigators was insufficient to provide a certain explanation of the actions of the injured person. However, taken together it suggests that the accident occurred due to one or more of the following causal factors:

- **The injured person probably believed that no trains would approach** on the line he was walking along;
- **The injured person was probably fatigued** and possibly distracted by personal and financial issues;
- **The injured person was probably distracted** by going to look at the traction isolation switch equipment at Stoats Nest Junction

Source: RAIB Report 07/2019