UNIT –IV

SAFETY, RESPONSIBILITIES AND RIGHTS

Syllabus:

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

SAFETY AND RISK

Risk is a key element in any engineering design.

Concept of Safety:

A thing is safe if its risks are judged to be acceptable. Safety are tactily value judgments about what is acceptable risk to a given person or group.

Types of Risks:

Voluntary and Involuntary Risks

Short term and Long Term Consequences

Expected Portability

Reversible Effects

Threshold levels for Risk

Delayed and Immediate Risk

Risk is one of the most elaborate and extensive studies. The site is visited and exhaustive discussions with site personnel are undertaken. The study usually covers risk identification, risk analysis, risk assessment, risk rating, suggestions on risk control and risk mitigation.

Interestingly, risk analysis can be expanded to full fledge risk management study. The risk management study also includes residual risk transfer, risk financing etc. ***Stepwise, Risk Analysis will include:***

• Hazards identification
• Failure modes and frequencies evaluation from established sources and best practices.
• Selection of credible scenarios and risks.
• Fault and event trees for various scenarios.
• Consequences - effect calculations with work out from models.
• Individual and societal risks.
• ISO risk contours superimposed on layouts for various scenarios.
• Probability and frequency analysis.
• Established risk criteria of countries, bodies, standards.
• Comparison of risk against defined risk criteria.
• Identification of risk beyond the location boundary, if any.
• Risk mitigation measures.

The steps followed are need based and all or some of these may be required from the above depending upon the nature of site/plant.

Risk Analysis is undertaken after detailed site study and will reflect Chilworth exposure to various situations. It may also include study on frequency analysis, consequences analysis, risk acceptability analysis etc., if required. Probability and frequency analysis covers failure modes and frequencies from established sources and best practices for various scenarios and probability estimation.

Consequences analysis deals with selection of credible scenarios and consequences effect calculation including worked out scenarios and using software package.

RISK BENEFIT ANALYSIS AND REDUCING RISK

Risk-benefit analysis is the comparison of the risk of a situation to its related benefits.

For research that involves more than minimal risk of harm to the subjects, the investigator must assure that the amount of benefit clearly outweighs the amount of risk. Only if there is favorable risk benefit ratio, a study may be considered ethical.

Risk Benefit Analysis Example

Exposure to personal risk is recognized as a normal aspect of everyday life. We accept a certain level of risk in our lives as necessary to achieve certain benefits. In most of these risks we feel as though we have some sort of control over the situation. For example, driving an automobile is a risk most people take daily. "The controlling factor appears to be their perception of their individual ability to manage the risk-creating situation." Analyzing the risk of a situation is, however, very dependent on the individual doing the analysis. When individuals are exposed to involuntary risk, risk which they have no control, they make risk aversion their primary goal. Under these circumstances individuals require the probabilty of risk to be as much as one thousand times smaller then for the same situation under their perceived control.

Evaluations of future risk:

- Real future risk as disclosed by the fully matured future circumstances when they develop.
- Statistical risk, as determined by currently available data, as measured actuarially for insurance premiums.
- Projected risk, as analytically based on system models structured from historical studies.
- Perceived risk, as intuitively seen by individuals.

Air transportation as an example:

- Flight insurance company - statistical risk.
- Passenger - percieved risk.
- Federal Aviation Administration(FAA) - projected risks.

How to Reduce Risk?

1.Define the Problem

2.Generate Several Solutions

3. Analyse each solution to determine the pros and cons of each

4. Test the solutions

5.Select the best solution

6. Implement the chosen solution

7. Analyse the risk in the chosen solution

8. Try to solve it. Or move to next solution.

Risk-Benefit Analysis and Risk Management

Informative risk-benefit analysis and effective risk management are essential to the ultimate commercial success of your product. We are a leader in developing statistically rigorous, scientifically valid risk-benefit assessment studies that can be used to demonstrate the level of risk patients and other decision makers are willing to accept to achieve the benefits provided by your product.

Risk-Benefit Modeling	Systematically quantify the relative importance of risks and benefits to demonstrate the net benefits of treatment
Risk-Benefit Tradeoffs	Quantify patients' maximum acceptable risk for specific therapeutic benefits

CHERNOBYL CASE STUDIES

What Happened?

At 1:24 AM on April 26, 1986, there was an explosion at the Soviet nuclear power plant at Chernobyl. One of the reactors overheated, igniting a pocket of hydrogen gas. The explosion blew the top off the containment building, and exposed the molten reactor to the air. Thirty-one power plant workers were killed in the initial explosion, and radioactive dust and debris spewed into the air.

It took several days to put out the fire. Helicopters dropped sand and chemicals on the reactor rubble, finally extinguishing the blaze. Then the Soviets hastily buried the reactor in a sarcophagus of concrete. Estimates of deaths among the clean-up workers vary widely. Four thousand clean-up workers may have died in the following weeks from the radiation.

The countries now known as Belarus and Ukraine were hit the hardest by the radioactive fallout. Winds quickly blew the toxic cloud from Eastern Europe into Sweden and Norway. Within a week, radioactive levels had jumped over all of Europe, Asia, and Canada. It is estimated that seventy-thousand Ukrainians have been disabled, and five million people were exposed to radiation. Estimates of total deaths due to radioactive contamination range from 15,000 to 45,000 or more.

To give you an idea of the amount of radioactive material that escaped, the atomic bomb dropped on Hiroshima had a radioactive mass of four and a half tons. The exposed radioactive mass at Chernobyl was fifty tons.

In the months and years following, birth defects were common for animals and humans. Even the leaves on the trees became deformed.

Today, in Belarus and Ukraine, thyroid cancer and leukemia are still higher than normal. The towns of Pripyat and Chernobyl in the Ukraine are ghost towns. They will be uninhabitable due to radioactive contamination for several hundred years. The worst of the contaminated area is called “The Zone,” and it is fenced off. Plants, meat, milk, and water in the area are still unsafe. Despite the contamination, millions of people live in and near The Zone, too poor to move to safer surroundings.

Further, human genetic mutations created by the radiation exposure have been found in children who have only recently been born. This suggests that there may be another whole generation of Chernobyl victims.

Recent reports say that there are some indications that the concrete sarcophagus at Chernobyl is breaking down.

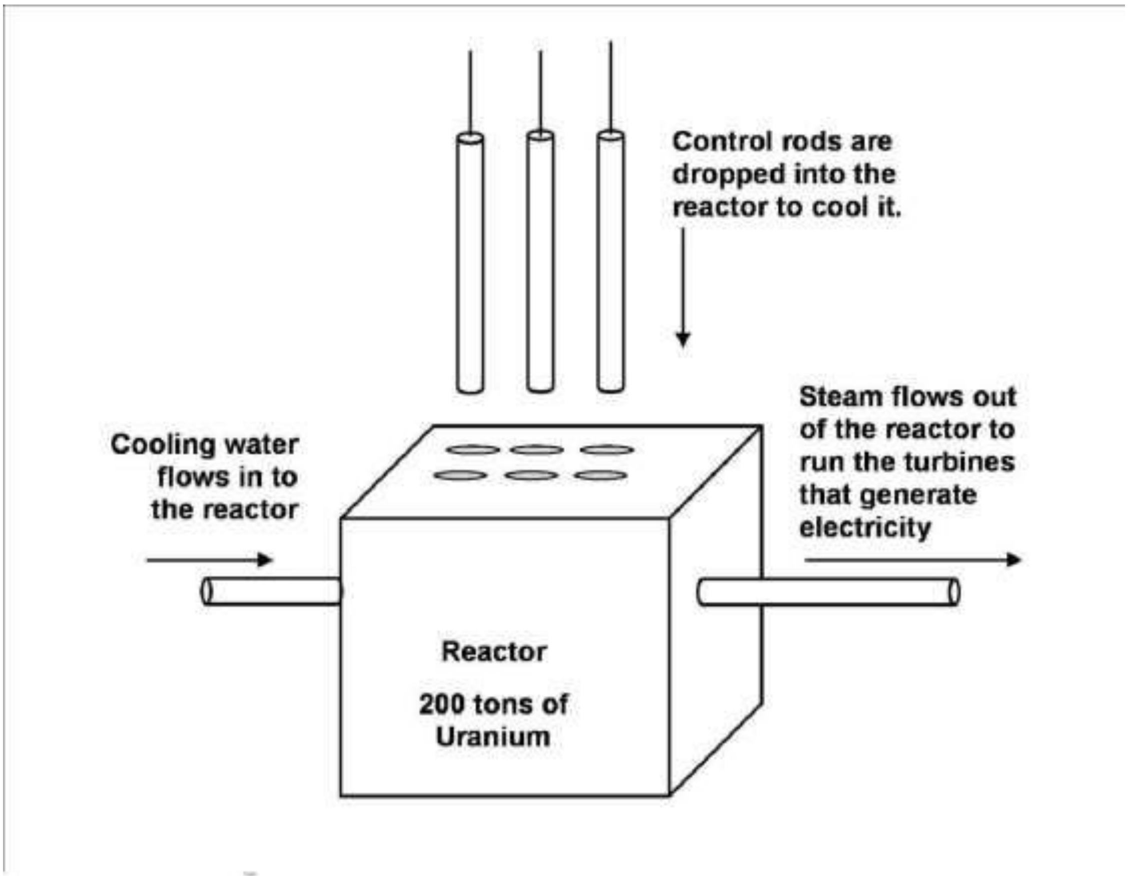
How a Nuclear Power Plant Works

The reactor at Chernobyl was composed of almost 200 tons of uranium. This giant block of uranium generated heat and radiation. Water ran through the hot reactor, turning to steam. The steam ran the turbines, thereby generating electricity. The hotter the reactor, the more electricity would be generated.

Left to itself, the reactor would become too *reactive*—it would become hotter and hotter and more and more radioactive. If the reactor had nothing to cool it down, it would quickly *meltdown*—a process where the reactor gets so hot that it melts—melting through the floor. So, engineers needed a way to control the temperature of the reactor, to keep it from the catastrophic meltdown. Further, the engineers needed to be able to regulate the temperature of the reactor—so that it ran hotter when more electricity was needed, and could run colder when less electricity was desired.

The method they used to regulate the temperature of the reactor was to insert heat-absorbing rods, called *control rods*. These control rods absorb heat and radiation. The rods hang above the reactor, and can be lowered into the reactor, which will cool the reactor. When more electricity is needed, the rods can be removed from the reactor, which will allow the reactor to heat up. The reactor has hollow tubes, and the control rods are lowered into these reactor tubes, or raised up out of the reactor tubes. At the Chernobyl-type reactors, there are 211 control rods. The more control rods that are inserted, the colder the reactor runs. The more control rods that are removed, the hotter the reactor becomes.

How a Nuclear Power Plant Works



Soviet safety procedures demanded that at least 28 rods were inserted into the Chernobyl reactor at all times. This was a way to make sure that the reactor wouldn't overheat.
Water was another method to moderate the temperature of the reactor. When more water ran through the reactor, the reactor cooled faster. When less water ran through the reactor, the reactor stayed hot.

Chernobyl Background

The list of senior engineers at Chernobyl was as follows: Viktor Bryukhanov, the plant director, was a pure physicist, with no nuclear experience.

Anatoly Dyatlov, the deputy chief engineer, served as the day-to-day supervisor. He had worked with reactor cores but had never before worked in a nuclear power plant. When he accepted the job as deputy chief engineer, he exclaimed, “you don’t have to be a genius to figure out a nuclear reactor.”

The engineers were Aleksandr Akimov, serving his first position in this role; Nikolai Fomin, an electrical engineer with little nuclear experience; Gennady Metlenko, an electrical engineer; and Leonid Toptunov, a 26 year-old reactor control engineer. The engineers were heavy in their experience of electric technology, but had less experience with the uniqueness of neutron physics.

The confidence of these engineers was exaggerated. They believed they had decades of problem-free nuclear work, so they believed that nuclear power was very safe. The engineers believed that they could figure out any problem. In reality, there had been many problems in the Soviet nuclear power industry. The Soviet state tried to keep problems a secret because problems are bad PR.

The Soviets had a number of nuclear accidents (this is a partial list of Soviet accidents before Chernobyl). In 1957 in Chelyabinsk, there was a substantial release of radioactivity caused by a spontaneous reaction in spent fuel; in 1966 in Melekess the nuclear power plant experienced a spontaneous surge in power, releasing radiation; In 1974, there was an explosion at the nuclear power plant in Leningrad; Later in 1974, at the same nuclear power plant, three people were killed and radiation was released into the environment; in 1977, there was a partial meltdown of nuclear fuel at Byeloyarsk; in 1978 at Byeloyarsk, the reactor went out of control after a roof panel fell onto it; In 1982 at Chernobyl, radioactivity was released into the environment; In 1982, there was there was a fire at Armyanskaya; In 1985, fourteen people were killed when a relief valve burst in Balakovo.

Had the engineers at Chernobyl had the information of the previous nuclear accidents, perhaps they would have known to be more careful. It is often from mistakes that we learn, and the engineers at Chernobyl had no opportunity to learn.

As a footnote, don’t think that the problems were just those mistake-laden Soviets. Here is a partial list of American accidents before Chernobyl: In 1951, the Detroit reactor overheated, and air was contaminated with radioactive gasses; In 1959, there was a partial meltdown in Santa Susanna, California; In 1961, three people were killed in an explosion at the nuclear power plant at Idaho Falls, Idaho; In 1966, there was a partial meltdown at a reactor near Detroit; In 1971, 53,000 gallons of radioactive water were released into the Mississippi River from the Monticello plant in Minnesota; In 1979, there was population evacuation and a discharge of radioactive gas and water in a partial meltdown at Three Mile Island; in 1979 there was a discharge of radiation in Irving Tennessee; In 1982, there was a release of radioactive gas into the environment in Rochester, New York; In 1982, there was a leak of radioactive gasses into the atmosphere at Ontario, New York; In 1985, there was a leak of radioactive water near New York City; In 1986, one person was killed in an explosion of a tank of radioactive gas in Webbers Falls, Oklahoma.

The engineers at Chernobyl didn't know about these nuclear accidents. These were secrets that the Soviets kept from the nuclear engineers. Consequently, no one was able to learn from the mistakes of the past. The nuclear plant staff believed that their experience with nuclear power was pretty much error-free, so they developed an overconfidence about their working style.

So, according to Gregori Medvedev (the Soviet investigator of Chernobyl), their practice became lazy and their safety practices slipshod. Further, the heavy bureaucracy and hierarchy of the Soviet system created an atmosphere where every decision had to be approved at a variety of higher levels. Consequently, the hierarchical system had quelled the operators' creativity and motivation for problem-solving.

April 25th, 1:00 PM

The engineers at Chernobyl had volunteered to do a safety test proposed by the Soviet government. In the event of a reactor shutdown, a back-up system of diesel generators would crank up, taking over the electricity generation. However, the diesel engines took a few minutes to start producing electricity. The reactor had a turbine that was meant to generate electricity for a minute or two until the diesel generators would start operating. The experiment at Chernobyl was meant to see exactly how long that turbine would generate the electricity.

The experiment required that the reactor be operating at 50% of capacity. On April 25th, 1986, at 1:00 PM, the engineers began to reduce the operating power of the reactor, by inserting the control rods into the reactor. This had the effect, you may recall, of cooling off the reactor—making it less reactive.

They also shut down the emergency cooling system. They were afraid that the cooling system might kick in during the test, thereby interfering with the experiment. They had no authorization to deactivate the cooling system, but they went ahead and deactivated it.

The experiment called for running the reactor at 50% capacity, thereby generating only half the electricity. At 2:00 PM, a dispatcher at Kiev called and asked them to delay the test because of the higher-than-expected energy usage. They delayed the test, but did not reactivate the emergency cooling system.

April 25th, 11:00 PM

At 11:00 PM, they began the test again. Toptunov, the senior reactor control engineer, began to manually lower the reactor to 50% of its capacity so that they could begin the turbine safety experiment.

Lowering the power generation of a nuclear reactor is a tricky thing. It is not like lowering the thermostat in a house. When you lower the thermostat in the house from 72 to 68 degrees, the temperature in the house will drop to 68 degrees and stay there. But in a nuclear reactor, the dropping of the temperature is not only the *result* of lowering the reactivity, but it is also a *cause* of lowering the reactivity. In other words, the coldness of the reactor will make the reactor colder. This is called the *self-damping effect*. Conversely, when the reactor heats up, the heat of the reactor will make itself hotter (the self-amplifying effect).

So, when the control rods are dropped into the reactor, the reactivity goes down. And the water running through the reactor also lessens reactivity. But the lower reactivity also makes the reactor itself less reactive. So, the Chernobyl reactor damped itself, even as the water and the control rods damped its reactivity.

It is typically hard for people to think in terms of exponential reduction or exponential increase. We naturally think of a linear (straight-line) reduction or a linear increase. We have trouble with self-damping and self-amplifying effects, because they are nonlinear by definition.

So, the engineers oversteered the process, and hit the 50% mark, but they were unable to keep it there. By 12:30 AM, the power generation had dropped to 1% of capacity.

Chernobyl-type reactors are not meant to drop that low in their capacity. There are two problems with the nuclear reactor running at 1% of capacity. When reactivity drops that low, the reactor runs unevenly and unstably, like a bad diesel engine. Small pockets of reactivity can begin that can spread hot reactivity through the reactor. Secondly, the low running of the reactor creates unwanted gasses and byproducts (xenon and iodine) that poison the reactor. Because of this, they were strictly forbidden to run the reactor below 20% of capacity.

In the Chernobyl control room, Dyatlov (the chief engineer in charge of the experiment), upon hearing the reactor was at 1%, flew into a rage. With the reactor capacity was so low, he would not be able to conduct his safety experiment. With the reactor at 1% capacity, Dyatlov had two options:

1. One option was to let the reactor go cold, which would have ended the experiment, and then they would have to wait for two days for the poisonous byproducts to dissipate before starting the reactor again. With this option, Dyatlov would no doubt have been reprimanded, and possibly lost his job.
2. The other option was to immediately increase the power. Safety rules prohibited increasing the power if the reactor had fallen from 80% capacity. In this case, the power had fallen from 50% capacity—so they were not technically governed by the safety protocols.

Dyatlov ordered the engineers to raise power.

Today, we know the horrible outcome of this Chernobyl chronology. It is easy for us to sit back in our armchairs, with the added benefit of hindsight, and say Dyatlov made the wrong choice. Of course, he could have followed the spirit of the protocols and shut the reactor down. However, Dyatlov did not have the benefit of hindsight. He was faced with the choice of the *surety* of reprimand and the harming of his career vs. the *possibility* of safety problems. And, we know from engineers and technical operators everywhere, safety protocols are *routinely* breached when faced with this kind of choice. Experts tend to believe that they are experts, and that the safety rules are for amateurs.

Further, safety rules are not designed so that people are killed instantly when the safety standard is broken. On a 55-mile per hour limit on a highway, cars do not suddenly burst into flames at 56 miles per hour. In fact, there is an advantage to going 56 miles an hour as opposed to 55 (you get to your destination faster). In the same way, engineers frequently view safety rules as troublesome, and there is an advantage to have the freedom to disregard them.

In fact, we experience this psychologic every day, usually without thinking about it. When you come toward an intersection, and the light turns yellow, you reach a point where you either have to go through on a yellow light, or come to a stop. Many people go through on the yellow, even though there is a greater risk. So, in a split second, we decide between the surety of sitting at a red light or the possibility, albeit slight, of a safety problem to go through the yellow light. There is a clear advantage to take the risk (as long as you aren't in an accident). While the stakes were higher at Chernobyl, the same psychologic applies.

At this point in the Chernobyl process, there were 28 control rods in the reactor—the minimum required. Increasing power would mean that even more control rods would have to be removed from the reactor. This would be a breach of protocol--the minimum number of rods was 28. Dyatlov gave the order to remove more control rods.

Toptunov, the reactor control engineer, refused to remove any more rods. He believed it would be unsafe to increase the power. With the reactor operating at 1%, and the minimum number of control rods in the reactor, he believed it would be unsafe to remove more rods. He was abiding by a strict interpretation of the safety protocols of 28 rods.

But Dyatlov continued to rage, swearing at the engineers and demanding they increase power. Dyatlov threatened to fire Toptunov immediately if he didn’t increase the power.

The 26-year-old Toptunov was faced with a choice. He believed he had two options:

1. He could refuse to increase power—but then Dyatlov would fire him immediately, and his career would be over.
2. His other choice was to increase power, recognizing that something bad *might* happen.

Toptunov looked around. All the other engineers—including his supervisors—were willing to increase power. Toptunov knew he was young and didn't have much experience with reactors. Perhaps this kind of protocol breach was normal. Toptunov was faced with that choice of the *surety* of his career ending, vs the *possibility* of safety problems. Toptunov decided to agree and increase the power.

Tragically, it would be the last decision Toptunov would ever make.

April 26th, 1:00 AM

By 1:00 AM, the power of the reactor was stable at 7% of capacity. Only 18 control rods were in the reactor (safety protocols demanded that no less than 28 control rods should always be in the reactor).

At 1:07 AM, the engineers wanted to make sure the reactor wouldn't overheat, so they turned on more water to ensure proper cooling (they were now pumping five times the normal rate of water through the reactor). The extra water cooled the reactor, and the power dropped again. The engineers responded by withdrawing even more control rods. Now, only 3 control rods were inserted in the reactor.

The reactor stabilized again. The engineers, satisfied with the amount of steam they were getting (they needed steam for their experiment) shut off the pumps for the extra water. They shut off the water, apparently only considering the effect that the water would have on the experiment—and did not consider the effect that the water was having on the reactor. At this point, with only 3 control rods in the reactor, the water was only thing keeping the reactor cool. Without the extra cool water, the reactor began to get hot. Power increased slowly at first. As the reactor got hotter, the reactor itself made the reactor hotter—the self-amplifying effect. The heat and reactivity of the reactor increased exponentially.

The engineers were trying to watch multiple variables simultaneously. The water, the steam, the control rods, and the current temperature of the reactor all were intertwined to affect the reactivity of the reactor. People can easily think in cause and effect terms. Had their only been one variable that controlled the reactivity, the results would probably have been different. However, people have difficulty thinking through the process when there are a multitude of variables, all interacting in different ways.

People are not processors of unlimited information. There is a limited amount of information with which a person can work. With the safety of hindsight, we can sit back and make a judgment saying, "they didn't think through all their information." However, this kind of linear judgment does not tell us *why* they didn't see what is obvious to our hindsight.

At 1:22 AM (90 seconds before the explosion), the engineers were still relaxed and confident. Dyatlov, in fact, was seeing his turbine safety experiment coming to a successful conclusion.

In what turned out to be a tragic irony, he encouraged his engineers by suggesting, “in two or three minutes it will all be over.”

Thirty seconds before the explosion, the engineers realized the reactor was heating up too fast. With only 3 control rods in the reactor, and then shutting off the water, the reactor was superheating. In a panic, they desperately tried to drop control rods into the reactor, but the heat of the reactor had already melted the tubes into which the control rods slid.

The floor of the building began to shake, and loud banging started to echo through the control room. The coolant water began to boil violently, causing the pipes to burst. The super-heating reactor was creating hydrogen and oxygen gasses. This explosive mixture of gasses accumulated above the reactor. The heat of the reactor was building fast, and the temperature of the flammable gasses was rising.

April 26th, 1:24 AM

Finally, the gasses detonated, destroying the reactor and the protective containment building. The control room was far enough away from the containment building to escape destruction, but the explosion shook the entire plant. Debris caved in around the control room members, and Dyatlov, Akimov, Toptunov, and the others were knocked to the floor. Dust and chalk filled the air. While they knew there had been an explosion, they hoped and prayed the explosion had not come from the reactor. Toptunov and Akimov ran over the broken glass and ceiling debris to the open door, and ran across the compound toward the containment building. There, they saw the horrifying, unspeakable sight. There was rubble where the reactor had been. They saw flames shooting up 40 feet high, burning oil squirting from pipes onto the ground, black ash falling to the ground, and a bright purple light emanating from the rubble.

Within a few minutes, fire fighters had arrived. The fire fighters, most with no protective equipment, heroically worked to extinguish the fire, hoping to prevent further damage to the three other reactors at the plant. Most of the fire fighters died from the radiation exposure.

Bryukhanov (the plant director), who was not at the plant at the time, had been contacted and told about an explosion. In the chaos, those informing Bryukhanov of the explosion still did not know the total amount of devastation. Bryukhavov, still desperately hoping that the reactor was intact, called Moscow to inform them that while there had been an explosion, the reactor had not sustained any damage.

Again, with the benefit of hindsight, we can say that Bryukhanov should have acted quicker. It's true that many lives could have been saved if he had acted differently. However, his actions are not uncommon in these kinds of situations. A common reaction is called "horizontal flight," where people retreat from the worst-case scenario, convincing themselves to believe the best-case scenario. Bryukhanov had convinced himself that the reactor was not in danger. And after all, someone from the plant had called and given an ambiguous message. Surely they would have known if the reactor had been destroyed.

April 26th, 4:00 AM

At 4:00 AM, the command from Moscow came back: *Keep the reactor cool*. The authorities in Moscow had no idea that the damage was so catastrophic.

Akimov, Dyatlov, and Toptunov, their skin brown from the radiation, and their bodies wrenched from internal damage, had already been taken away to the medical center.

At 10:00 AM, Bryukhanov, the plant director, was informed that the reactor had been destroyed. Bryukhanov rejected the information, preferring to believe that the reactor was still intact. He informed Moscow that the reactor was intact and radiation was within normal limits.

Later that day, experts from around the Soviet Union came to Chernobyl, and found the horrifying truth. The reactor had indeed been destroyed, and fifty tons of radioactive fuel had instantly evaporated. The wind blew the radioactive plume in a northwesterly direction. Belarus and Finland were going to be in the path of the radioactive cloud.

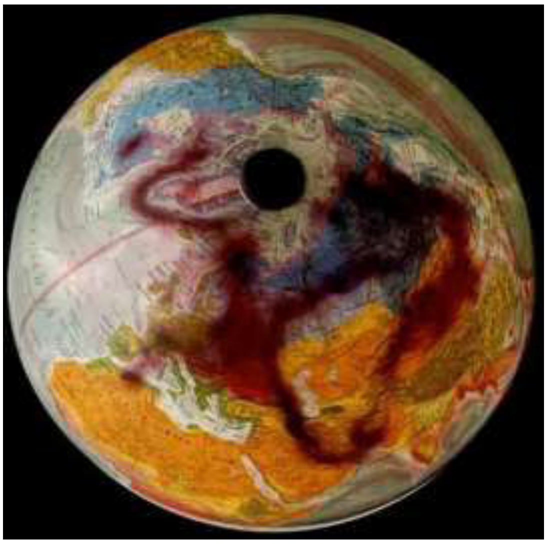
The Days Afterward

The secretive Soviet state was slow to act. Soviet bureaucracy debated whether to evacuate nearby cities, and how much land should be evacuated. They were slow in their response, slow to evacuate, and slow to inform the world of the disaster. It took over 36 hours before authorities began to evacuate nearby residents. Two days later, the nightly news (the fourth story) reported that one of the reactors was "damaged."

Within a few days, radiation detectors were going off all over the world. The Soviets continued to try to hide the issue from the world and their own residents.

Several months later, Bryukhanov was arrested, still believing that he did everything right. Dyatlov survived the radiation sickness, and was arrested in December of that year. He believed he was a scapegoat for the accident. Akimov died a few weeks after the disaster, but till the very end continued to say, "I did everything right. I don't know how it happened."

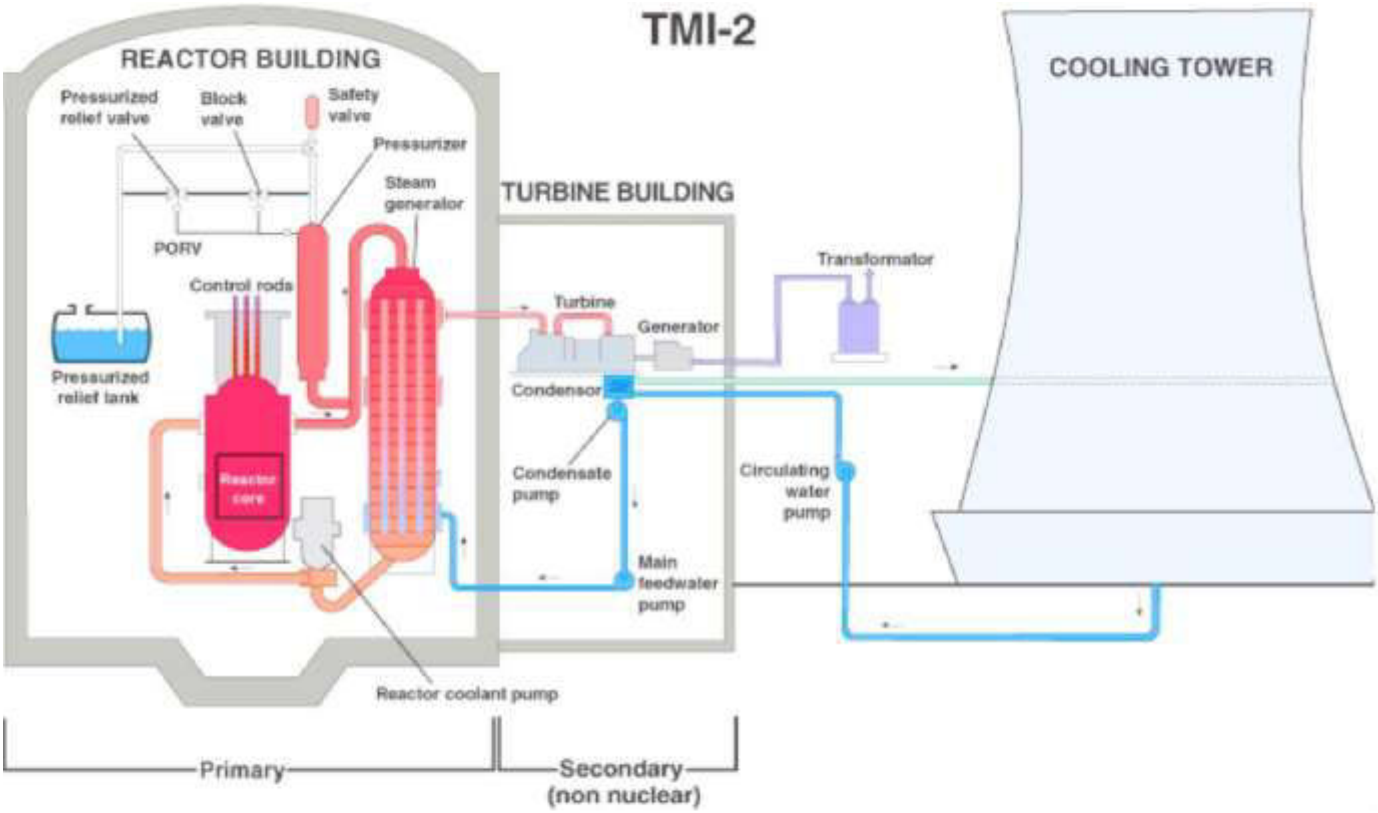
The radiation cloud on April 27th, 1986



THREE MILE ISLAND ACCIDENT

- **In 1979 at Three Mile Island nuclear power plant in USA a cooling malfunction caused part of the core to melt in the # 2 reactor. The TMI-2 reactor was destroyed.**
- **Some radioactive gas was released a couple of days after the accident, but not enough to cause any dose above background levels to local residents.**
- **There were no injuries or adverse health effects from the Three Mile Island accident.**

The Three Mile Island power station is near Harrisburg, Pennsylvania in USA. It had two pressurized water reactors. One PWR was of 800 MWe (775 MWe net) and entered service in 1974. It remains one of the best-performing units in USA. Unit 2 was of 906 MWe (880 MWe net) and almost brand new.



The accident to unit 2 happened at 4 am on 28 March 1979 when the reactor was operating at 97% power. It involved a relatively minor malfunction in the secondary cooling circuit which caused the temperature in the primary coolant to rise. This in turn caused the reactor to shut down automatically. Shut down took about one second. At this point a relief valve failed to close, but instrumentation did not reveal the fact, and so much of the primary coolant drained away that the residual decay heat in the reactor core was not removed. The core suffered severe damage as a result.

The operators were unable to diagnose or respond properly to the unplanned automatic shutdown of the reactor. Deficient control room instrumentation and inadequate emergency response training proved to

The chain of events during the Three Mile Island Accident

Within seconds of the shutdown, the pilot-operated relief valve (PORV) on the reactor cooling system opened, as it was supposed to. About 10 seconds later it should have closed. But it remained open, leaking vital reactor coolant water to the reactor coolant drain tank. The operators believed the relief valve had shut because instruments showed them that a "close" signal was sent to the valve. However, they did not have an instrument indicating the valve's actual position.

Responding to the loss of cooling water, high-pressure injection pumps automatically pushed replacement water into the reactor system. As water and steam escaped through the relief valve, cooling water surged into the pressuriser, raising the water level in it. (The pressuriser is a tank which is part of the primary reactor cooling system, maintaining proper pressure in the system. The relief valve is located on the pressuriser. In a PWR like TMI-2, water in the primary cooling system around the core is kept under very high pressure to keep it from boiling.)

Operators responded by reducing the flow of replacement water. Their training told them that the pressuriser water level was the only dependable indication of the amount of cooling water in the system. Because the pressuriser level was increasing, they thought the reactor system was too full of water. Their training told them to do all they could to keep the pressuriser from filling with water. If it filled, they could not control pressure in the cooling system and it might rupture.

Steam then formed in the reactor primary cooling system. Pumping a mixture of steam and water caused the reactor cooling pumps to vibrate. Because the severe vibrations could have damaged the pumps and made them unusable, operators shut down the pumps. This ended forced cooling of the reactor core. (The operators still believed the system was nearly full of water because the pressuriser level remained high.) However, as reactor coolant water boiled away, the reactor?s fuel core was uncovered and became even hotter. The fuel rods were damaged and released radioactive material into the cooling water.

At 6:22 am operators closed a block valve between the relief valve and the pressuriser. This action stopped the loss of coolant water through the relief valve. However, superheated steam and gases blocked the flow of water through the core cooling system.

Throughout the morning, operators attempted to force more water into the reactor system to condense steam bubbles that they believed were blocking the flow of cooling water. During the afternoon, operators attempted to decrease the pressure in the reactor system to allow a low pressure cooling system to be used and emergency water supplies to be put into the system.

Cooling Restored

By late afternoon, operators began high-pressure injection of water into the reactor cooling system to increase pressure and to collapse steam bubbles. By 7:50 pm on 28 March, they restored forced cooling of the reactor core when they were able to restart one reactor coolant pump. They had condensed steam so that the pump could run without severe vibrations.

Radioactive gases from the reactor cooling system built up in the makeup tank in the auxiliary building. During March 29 and 30, operators used a system of pipes and compressors to move the gas to waste gas decay tanks. The compressors leaked, and some radioactive gas was released to the environment.

The Hydrogen Bubble

When the reactor's core was uncovered, on the morning of 28 March, a high-temperature chemical reaction between water and the zircaloy metal tubes holding the nuclear fuel pellets had created hydrogen gas. In the afternoon of 28 March, a sudden rise in reactor building pressure shown by the control room instruments indicated a hydrogen burn had occurred. Hydrogen gas also gathered at the top of the reactor vessel.

From 30 March through 1 April operators removed this hydrogen gas "bubble" by periodically opening the vent valve on the reactor cooling system pressuriser. For a time, regulatory (NRC) officials believed the hydrogen bubble could explode, though such an explosion was never possible since there was not enough oxygen in the system.

Cold Shutdown

After an anxious month, on 27 April operators established natural convection circulation of coolant. The reactor core was being cooled by the natural movement of water rather than by mechanical pumping. The plant was in "cold shutdown".

Public concern and confusion

When the TMI-2 accident is recalled, it is often in the context of what happened on Friday and Saturday, March 30-31. The drama of the TMI-2 accident-induced fear, stress and confusion on those two days. The atmosphere then, and the reasons for it, are described well in the book "*Crisis Contained, The Department of Energy at Three Mile Island*," by Philip L Cantelon and Robert C. Williams, 1982. This is an official history of the Department of Energy's role during the accident.

"Friday appears to have become a turning point in the history of the accident because of two events: the sudden rise in reactor pressure shown by control room instruments on Wednesday afternoon (the "hydrogen burn") which suggested a hydrogen explosion? became known to the Nuclear Regulatory Commission [that day]; and the deliberate venting of radioactive gases from the plant Friday morning which produced a reading of 1,200 millirems (12 mSv) directly above the stack of the auxiliary building.

"What made these significant was a series of misunderstandings caused, in part, by problems of communication within various state and federal agencies. Because of confused telephone conversations between people uninformed about the plant's status, officials concluded that the 1,200 millirems (12 mSv) reading was an off-site reading. They also believed that another hydrogen explosion was possible, that the Nuclear Regulatory Commission had ordered evacuation and that a meltdown was conceivable.

"Garbled communications reported by the media generated a debate over evacuation. Whether or not there were evacuation plans soon became academic. What happened on Friday was not a planned evacuation but a weekend exodus based not on what was actually happening at Three Mile Island but on what government officials and the media imagined might happen. On Friday confused communications created the politics of fear." (Page 50)

Throughout the book, Cantelon and Williams note that hundreds of environmental samples were taken around TMI during the accident period by the Department of Energy (which had the lead sampling role) or the then-Pennsylvania Department of Environmental Resources. But there were no unusually high readings, except for noble gases, and virtually no iodine. Readings were far below health limits. Yet a political storm was raging based on confusion and misinformation.

No Radiological Health Effects

The Three Mile Island accident caused concerns about the possibility of radiation-induced health effects, principally cancer, in the area surrounding the plant. Because of those concerns, the Pennsylvania Department of Health for 18 years maintained a registry of more than 30,000 people who lived within five miles of Three Mile Island at the time of the accident. The state's registry was discontinued in mid 1997, without any evidence of unusual health trends in the area.

Indeed, more than a dozen major, independent health studies of the accident showed no evidence of any abnormal number of cancers around TMI years after the accident. The only detectable effect was psychological stress during and shortly after the accident.

The studies found that the radiation releases during the accident were minimal, well below any levels that have been associated with health effects from radiation exposure. The average radiation dose to people living within 10 miles of the plant was 0.08 millisieverts, with no more than 1 millisievert to any single individual. The level of 0.08 mSv is about equal to a chest X-ray, and 1 mSv is about a third of the average background level of radiation received by U.S. residents in a year.

In June 1996, 17 years after the TMI-2 accident, Harrisburg U.S. District Court Judge Sylvia Rambo dismissed a class action lawsuit alleging that the accident caused health effects. The plaintiffs have appealed Judge Rambo's ruling. The appeal is before the U.S. Third Circuit Court of Appeals. However, in making her decision, Judge Rambo cited:

· Findings that exposure patterns projected by computer models of the releases compared so well with data from the TMI dosimeters (TLDs) available during the accident that the dosimeters probably were adequate to measure the releases.

· That the maximum offsite dose was, possibly, 100 millirem (1 mSv), and that projected fatal cancers were less than one.

· The plaintiffs' failure to prove their assertion that one or more unreported hydrogen "blowouts" in the reactor system caused one or more unreported radiation "spikes", producing a narrow yet highly concentrated plume of radioactive gases.

Judge Rambo concluded: "The parties to the instant action have had nearly two decades to muster evidence in support of their respective cases.... The paucity of proof alleged in support Plaintiffs' case is manifest. The court has searched the record for any and all evidence which construed in a light most favourable to Plaintiffs creates a genuine issue of material fact warranting submission of their claims to a jury. This effort has been in vain."

More than a dozen major, independent studies have assessed the radiation releases and possible effects on the people and the environment around TMI since the 1979 accident at TMI-2. The most recent was a 13-year study on 32,000 people. None has found any adverse health effects such as cancers which might be linked to the accident.

The TMI-2 Cleanup

The cleanup of the damaged nuclear reactor system at TMI-2 took nearly 12 years and cost approximately US$973 million. The cleanup was uniquely challenging technically and radiologically. Plant surfaces had to be decontaminated. Water used and stored during the cleanup had to be processed. And about 100 tonnes of damaged uranium fuel had to be removed from the reactor vessel -- all without hazard to cleanup workers or the public.

A cleanup plan was developed and carried out safely and successfully by a team of more than 1000 skilled workers. It began in August 1979, with the first shipments of accident-generated low-level radiological waste to Richland, Washington. In the cleanup's closing phases, in 1991, final measurements were taken of the fuel remaining in inaccessible parts of the reactor vessel. Approximately one percent of the fuel and debris remains in the vessel. Also in 1991, the last remaining water was pumped from the TMI-2 reactor. The cleanup ended in December 1993, when Unit 2 received a license from the NRC to enter Post Defueling Monitored Storage (PDMS).

Early in the cleanup, Unit 2 was completely severed from any connection to TMI Unit 1. TMI-2 today is in long-term monitored storage. No further use of the nuclear part of the plant is anticipated. Ventilation and rainwater systems are monitored. Equipment necessary to keep the plant in safe long-term storage is maintained.

Defueling the TMI-2 reactor vessel was the heart of the cleanup. The damaged fuel remained underwater throughout the defueling. In October 1985, after nearly six years of preparations, workers standing on a platform atop the reactor and manipulating long-handled tools began lifting the fuel into canisters that hung beneath the platform. In all, 342 fuel canisters were shipped safely for long-term storage at the Idaho National Laboratory, a program that was completed in April 1990.

TMI-2 cleanup operations produced over 10.6 megalitres of accident-generated water that was processed, stored and ultimately evaporated safely.
In February 1991, the TMI-2 Cleanup Program was named by the National Society of Professional Engineers as one of the top engineering achievements in the U.S. completed during 1990.

TMI-1: Safe and World-Class

From its restart in 1985, Three Mile Island Unit 1 has operated at very high levels of safety and reliability. Application of the lessons of the TMI-2 accident has been a key factor in the plant's outstanding performance.

In 1997, TMI-1 completed the longest operating run of any light water reactor in the history of nuclear power worldwide - 616 days and 23 hours of uninterrupted operation. (That run was also the longest at any steam-driven plant in the U.S., including plants powered by fossil fuels.) And in October 1998, TMI employees completed three million hours of work without a lost-work day accident.

At the time of the TMI-2 accident, TMI-1 was shut down for refueling. It was kept shut down during lengthy proceedings by the Nuclear Regulatory Commission. During the shutdown, the plant was modified and training and operating procedures were revamped in light of the lessons of TMI-2.

When TMI-1 restarted in October 1985, General Public Utilities pledged that the plant would be operated safely and efficiently and would become a leader in the nuclear power industry. Those pledges have been kept.

- The plant's capability factor for 1987, including almost three months of a five-month refueling and maintenance outage, was 74.1 percent, compared to an industry average of 62 percent. (Capability factor refers to the amount of electricity generated compared to the plant's maximum capacity.)
- In 1988 a 1.3% (11 MWe) uprate was licensed.
- For 1989, TMI-1's capability factor was 100.03 percent and the best of 357 nuclear power plants worldwide, according to *Nucleonics Week*.
- In 1990-91, TMI-1 operated 479 consecutive days, the longest operating run at that point in the history of US commercial nuclear power. It was named by the NRC as one of the four safest plants in the country during this period.
- By the end of 1994, TMI-1 was one of the first two plants in the history of US commercial nuclear power to achieve a three-year average capability factor of over 90% (TMI-1 had 94.3%).
- In October 1998, TMI workers completed two full years without a lost workday injury.
- Since its restart, TMI-1 has earned consistently high ratings in the NRC's program, Systematic Assessment of Licensee Performance (SALP).
- In 2009, the TMI-1 operating licence was renewed, extending it life by 20 years to 2034.
- Immediately following this, both steam generators were replaced as TMI's "largest capital project to date"

In 1999, TMI-1 was purchased by AmerGen, a new joint venture between British Energy and PECO Energy. In 2003 the BE share was sold so that the plant became wholly-owned by Exelon, PECO's successor. It is now listed as producing 786 MWe net.

Training improvements

Training reforms are among the most significant outcomes of the TMI-2 accident. Training became centred on protecting a plant's cooling capacity, whatever the triggering problem might be. At TMI-2, the operators turned to a book of procedures to pick those that seemed to fit the event. Now operators are taken through a set of "yes-no" questions to ensure, *first*, that the reactor's fuel core remains covered. *Then* they determine the specific malfunction. This is known as a "symptom-based" approach for responding to plant events. Underlying it is a style of training that gives operators a foundation for understanding both theoretical and practical aspects of plant operations.
The TMI-2 accident also led to the establishment of the Atlanta-based Institute of Nuclear Power Operations (INPO) and its National Academy for Nuclear Training. These two industry organisations have been effective in promoting excellence in the operation of nuclear plants and accrediting their training programs.

INPO was formed in 1979. The National Academy for Nuclear Training was established under INPO's auspices in 1985. TMI's operator training program has passed three INPO accreditation reviews since then.

Training has gone well beyond button-pushing. Communications and teamwork, emphasizing effective interaction among crew members, are now part of TMI's training curriculum.

Close to half of the operators' training is in a full-scale electronic simulator of the TMI control room. The $18 million simulator permits operators to learn and be tested on all kinds of accident scenarios.

Increased safety & reliability
Disciplines in training, operations and event reporting that grew from the lessons of the TMI-2 accident have made the nuclear power industry demonstrably safer and more reliable. Those trends have been both promoted and tracked by the Institute for Nuclear Power Operations (INPO). To remain in good standing, a nuclear plant must meet the high standards set by INPO as well as the strict regulation of the US Nuclear Regulatory Commission.

A key indicator is the graph of significant plant events, based on data compiled by the Nuclear Regulatory Commission. The number of significant events decreased from 2.38 per reactor unit in 1985 to 0.10 at the end of 1997.
On the reliability front, the median capability factor for nuclear plants - the percentage of maximum energy that a plant is capable of generating - increased from 62.7 percent in 1980 to almost 90 percent in 2000. (The goal for the year 2000 was 87 percent.)

Other indicators for US plants tracked by INPO and its world counterpart, the World Association of Nuclear Operators (WANO) are the unplanned capability loss factor, unplanned automatic scrams, safety system performance, thermal performance, fuel reliability, chemistry performance, collective radiation exposure, volume of solid radioactive.

COLLECTIVE BARGAINING

Collective bargaining is a process of voluntary negotiation between employers and trade unions aimed at reaching agreements which regulate working conditions. Collective agreements usually set out wage scales, working hours, training, health and safety, overtime, grievance mechanisms and rights to participate in workplace or company affairs.[1]

The union may negotiate with a single employer (who is typically representing a company's shareholders) or may negotiate with a federation of businesses, depending on the country, to reach an industry wide agreement. A collective agreement functions as a labor contract between an employer and one or more unions. Collective bargaining consists of the process of negotiation between representatives of a union and employers (generally represented by management, in some countries[*which?*] by an employers' organization) in respect of the terms and conditions of employment of employees, such as wages, hours of work, working conditions and grievance-procedures, and about the rights and responsibilities of trade unions. The parties often refer to the result of the negotiation as a *collective bargaining agreement* (CBA) or as a *collective employment agreement* (CEA).

Different economic theories provide a number of models intended to explain some aspects of collective bargaining:

- The so-called Monopoly Union Model (Dunlop, 1944) states that the monopoly union has the power to maximise the wage rate; the firm then chooses the level of employment. (Recent literature has started to abandon this model.[*citation needed*]
- The Right-to-Manage model, developed by the British school during the 1980s (Nickell) views the labour union and the firm bargaining over the wage rate according to a typical Nash Bargaining Maximin (written as $\Omega = U^{\beta}\Pi^{1-\beta}$, where U is the utility function of the labour union, Π the profit of the firm and β represents the bargaining power of the labour unions).

3. The efficient bargaining model (McDonald and Solow, 1981) sees the union and the firm bargaining over both wages and employment (or, more realistically, hours of work).[*citation needed*]

The underlying idea of collective bargaining is that the employer and employee relations should not be decided unilaterally or with the intervention of any third party. Both parties must reconcile their differences voluntarily through negotiations, yielding some concessions and making sacrifices in the process. Both should bargain from a position of strength; there should be no attempt to exploit the weaknesses or vulnerability of one party. With the growth of union movement all over the globe and the emergence of employers' association, the collective bargaining process has undergone significant changes. Both parties have, more or less, realized the importance of peaceful co-existence for their mutual benefit and continued progress

CONFIDENTIALITY

Confidentiality is an ethical principle associated with several professions (e.g., medicine, law, religion, professional psychology, and journalism). In ethics, and (in some places) in law and alternative forms of legal dispute resolution such as mediation, some types of communication between a person and one of these professionals are "privileged" and may not be discussed or divulged to third parties. In those jurisdictions in which the law makes provision for such confidentiality, there are usually penalties for its violation.

Confidentiality has also been defined by the International Organization for Standardization (ISO) in ISO-17799 [1] as "ensuring that information is accessible only to those authorized to have access" and is one of the cornerstones of information security. Confidentiality is one of the design goals for many cryptosystems, made possible in practice by the techniques of modern cryptography.

Confidentiality of information, enforced in an adaptation of the military's classic "need to know" principle, forms the cornerstone of information security in today's corporations. The so called 'confidentiality bubble' restricts information flows, with both positive and negative consequences.[2]

Both the privilege and the duty serve the purpose of encouraging clients to speak frankly about their cases. This way, lawyers will be able to carry out their duty to provide clients with zealous representation. Otherwise, the opposing side may be able to surprise the lawyer in court with something which he did not know about his client, which makes both lawyer and client look stupid. Also, a distrustful client might hide a relevant fact which he thinks is incriminating, but which a skilled lawyer could turn to the client's advantage (for example, by raising affirmative defenses like self-defense)

However, most jurisdictions have exceptions for situations where the lawyer has reason to believe that the client may kill or seriously injure someone, may cause substantial injury to the financial interest or property of another, or is using (or seeking to use) the lawyer's services to perpetrate a crime or fraud.

In such situations the lawyer has the discretion, but not the obligation, to disclose information designed to prevent the planned action. Most states have a version of this discretionary disclosure rule under Rules of Professional Conduct, Rule 1.6 (or its equivalent).

A few jurisdictions have made this traditionally discretionary duty mandatory. For example, see the New Jersey and Virginia Rules of Professional Conduct, Rule 1.6.

In some jurisdictions the lawyer must try to convince the client to conform his or her conduct to t he boundaries of the law before disclosing any otherwise confidential information.

Note that these exceptions generally do not cover crimes that have already occurred, *even* in extreme cases where murderers have confessed the location of missing bodies to their lawyers but the police are still looking for those bodies. The U.S. Supreme Court and many state supreme courts have affirmed the right of a lawyer to withhold information in such situations. Otherwise, it would be impossible for any criminal defendant to obtain a zealous defense.

California is famous for having one of the strongest duties of confidentiality in the world; its lawyers must protect client confidences at "every peril to himself or herself." Until an amendment in 2004, California lawyers were not even permitted to disclose that a client was about to commit murder.

Recent legislation in the UK curtails the confidentiality professionals like lawyers and accountants can maintain at the expense of the state. Accountants, for example, are required to disclose to the state any suspicions of fraudulent accounting and, even, the legitimate use of tax saving schemes if those schemes are not already known to the tax authorities.

- is the right to fair process or procedures in firing, demotion and in taking any disciplinary actions against employees.
- Written explanation should be initially obtained from the charged employee and the orders are given in writing with clearly stated reasons.
- Fairness here is specified in terms of the process rather than the outcomes.

Conflict of interest: the standard view

In the introduction to Conflict of interest in the professions , Michael Davis provides what he terms 'the standard view' of a conflict of interest.On the standard view, P has a conflict of interest if, and only if, (1) P is in a relationship with another requiring P to exercise judgement on the other's behalf and (2) P has a (special) interest tending to interfere with the proper exercise of judgement in that relationship ... on the standard view, an interest is any influence,loyalty, concern, emotion, or other feature of a situation tending to make P's judgement (in that situation) less reliable than it would normally be, without rendering P incompetent.(2001: 8–9) .

That fact that a conflict of interest is a tendency is extremely important. Conflicts of interest do not always affect judgement, as P may be able to exercise their judgement impartially despite the special interest. A conflict of interest is thus different from merebias, though conflicts of interest and bias are of ten discussed together.

As Davis notes (2001: 12), a known bias can (generally) be compensated for without difficulty, since it has a predictable effect. But conflict of interest is not bias, but is rather a tendency towards bias, which means that it is both more difficult to predict the effect of conflict of interest upon judgement, and more difficult to compensate for its effect.

OCCUPATIONAL CRIME

Crimes by Employees

Although there are cases of overlap, both “crimes by employees” and “crimes by individuals” can be examples of occupational crime—crime committed in the course of a legitimate occupation for one’s own benefit. While the types of activities to be discussed in this section are executed by employees (those who work for someone else), those to be examined in “crimes by individuals” will primarily be crimes by professionals.

Edelhertz’s Typology

One attempt to delineate white collar crime is the widely cited typology and examples provided by Edelhertz (1970, pp. 73–75) (see Crime Types 6.2).

While Edelhertz had two other types of white collar crime in his classification, many of those listed in his “crimes by persons operating on an individual . . . basis” are not necessarily occupational in nature, except that the victims often happen to be organizations (business or the state). Some examples that he gives include bankruptcy frauds and violations of Federal Reserve regulations by pledging stock for further purchases, flouting margin requirements. His category of “white-collar crime as business, or as the central activity” better fits the definition of professional crime as defined in the preceding chapter. Edelhertz’s category A fits our discussion of “occupational crime,” while category B better fits our definition of “corporate crime.”

Crimes by Employees Against Individuals (the Public)

Self-aggrandizing *crimes by employees against the public* (type 2 in Crime Types 6.2) take the form of political corruption by public servants or office holders (public employees), or commercial corruption by employees in the private sector. These activities are distinguished

from corporate or organizational criminal activities of the same type by the fact that in this case the employee personally benefits from the violation.

Public Corruption

"Cigar smoke, booze, and money delivered in brown paper bags"—this is how Hedrick Smith envisions the backroom world of politics in the PBS telecast *The Power Game* (1989). The list of occupation-related crime on the part of political employees or office holders may include furnishing favors to private businesses such as illegal commissions on public con-tracts, fraudulent licenses, tax exemptions, and lower tax evaluations (Clinard & Quinney, 1973, p. 189). As an example, health inspectors in New York City ("City Inspectors," 1988) turned the Department of Health into the Department of Wealth and doubled or tripled their salaries by extorting payments from restaurants, threatening to cite them for health code violations if they did not pay up.

In 1999, eight federal food inspectors were arrested in a bribery and kickback scheme that permitted wholesalers to cheat their suppliers. The scheme involved the inspectors grading fruit and vegetables as low quality, gaining lower prices for the wholesalers who then turned around and sold the items as Grade A produce. Some of the inspectors earned over $100,000 a year in payoffs (Weiser, 1999).

Mark Twain (1899) once said, "There is no distinctly American criminal class except Congress" (p. 98). The use of public office for private gain defines political corruption. Twain was not quite accurate in his observation in that such behavior is widespread internation-ally. The Transparency International Corruption Perception Index (CPI) rates countries on the basis of seven surveys of business people, political analysts, and the general public. The CPI for the year 2006 ranged from a high of 10 (highly clean) to 0 (highly corrupt). Some selected country ranks and scores included the following:

Crimes by Employees Against Employees

While a variety of crimes like theft may be committed by an employee against another employee for personal benefit (type 5 in Crime Types 6.1), many such violations would not necessarily be occupationally related and, therefore, would not be appropriate examples for the "Occupational/Organizational Crime Grid." But one type of violation that certainly fits is the *sweetheart contract* in labor–management negotiations, which involves labor officials and negotiators secretly making a deal with management to the disadvantage of the workers whom the labor officials represent. For example, the union president and representatives might make a deal with management to take a bribe of $50,000. They then might indicate to the workers that they have examined the company books and found that management can only afford a 20 cent per hour raise rather than the 50 cents originally promised. Depending on the size of the workforce, management could save millions of dollars.

Another example is workplace violence perpetrated by a fellow employee. Such perpe-trators take out their frustrations—usually associated with loss of job—on their fellow work-ers and supervisors. While murder is the most highly publicized form of workplace violence, other forms include assaults, rapes, suicides, as well as psychological and mental health episodes. Drug and alcohol abuse may create hazardous work conditions. Hostile, intimidating, and offensive work environments may also foster sexual harassment, sexual assault, and other psychological and emotional damage.

Professional right

- Right of Professional Conscience
  - The moral right to exercise responsible professional judgment in pursuing professional responsibilities.
  - Pursuing those responsibilities involves exercising both technical judgment and moral convictions.
- Institutional Recognition of Rights
  - Having a moral right is one thing . Having it respected by others and given recognition within a corporation quite another. When engineers appeal to the basic right of professional conscience they may be arguing for its institutional recognition by employers.
  -
- Specific rights
  - Obligation to the public might in special situations require whistle-blowing, and hence engineers have a limited right to whistle-blow.
  - The whistle-blowing right becomes more precisely specified by listing conditions under which whistle-blowing is permissible.
    - Right of conscientious refusal
      - is the right to refuse to engage in unethical behavior, and to refuse to do so solely because one views it as unethical.
      - is a kind of second-order right.
- Right to Recognition
  - Engineers have a right to professional recognition for their work and accomplishments.

- Part of this involves fair monetary remuneration and part nonmonetary forms of recognition.
- Right to recognition is not sufficiently precise to pinpoint just what a reasonable salary is or what a fair remuneration for patent discoveries is.

Such detailed matters must be worked out cooperatively between employers and employees.

Employee rights

- are any rights , moral or legal, that involve the status of being an employee.
- They include some professional rights that apply to the employer-employee relationship.
- Employee rights include fundamental human rights relevant to the employment situation.
  - e.g. e.g. the right not to be discriminated against one's race, sex, age or national origin.

Right to privacy

- is the right to control the access to and use of information about oneself.
- is limited in certain situations by employers' rights.
- Only duly authorized persons can get the personal information.
  - A supervisor might suspect a worker and conduct a search in his cupboard when the worker is absent. But the supervisor is to have another officer as witness in such cases.

Right to choose outside activities

- means right to have a private life outside the job.
- There are some situations when this right can be curbed:
  - When those activities lead to violation.
  - When moonlighting.
  - When the interest of the employer is getting damaged.

Right to due process from employer

- is the right to fair process or procedures in firing, demotion and in taking any disciplinary actions against employees.
- Written explanation should be initially obtained from the charged employee and the orders are given in writing with clearly stated reasons.
- Fairness here is specified in terms of the process rather than the outcomes.

INTELLECTUAL PROPERTY RIGHTS

Intellectual property (**IP**) is a term referring to a number of distinct types of creations of the mind for which property rights are recognized—and the corresponding fields of law.[1] Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets, such as musical, literary, and artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Common types of intellectual property include copyrights, trademarks, patents, industrial design rights and trade secrets in some jurisdictions.

Richard Stallman argues that, although the term *intellectual property* is in wide use, it should be rejected altogether, because it "systematically distorts and confuses these issues, and its use was and is promoted by those who gain from this confusion." He claims that the term "operates as a catch-all to lump together disparate laws [which] originated separately, evolved differently, cover different activities, have different rules, and raise different public policy issues" and that it confuses these monopolies with ownership of limited physical things[15]

Stallman advocates referring to copyrights, patents and trademarks in the singular and warns against abstracting disparate laws into a collective term.

Some critics of intellectual property, such as those in the free culture movement, point at intellectual monopolies as harming health, preventing progress, and benefiting concentrated interests to the detriment of the masses,[16][17] and argue that the public interest is harmed by ever expansive monopolies in the form of copyright extensions, software patents and business method patents.

There is also criticism[*by whom?*] because strict intellectual property rights can inhibit the flow of innovations to poor nations. Developing countries have benefitted from the spread of developed country technologies, such as the internet, mobile phone, vaccines, and high-yielding grains. Many intellectual property rights, such as patent laws, arguably go too far in protecting those who produce innovations at the expense of those who use them.[*citation needed*] The Commitment to Development Index measures donor government policies and ranks them on the "friendliness" of their intellectual property rights to the developing world.

Some libertarian critics of intellectual property have argued that allowing property rights in ideas and information creates artificial scarcity and infringes on the right to own tangible property. Stephan Kinsella uses the following scenario to argue this point:

Imagine the time when men lived in caves. One bright guy—let's call him Galt-Magnon—decides to build a log cabin on an open field, near his crops. To be sure, this is a good idea, and others notice it. They naturally imitate Galt-Magnon, and they start building their own cabins. But the first man to invent a house, according to IP advocates, would have a right to prevent others from building houses on their own land, with their own logs, or to charge them a fee if they do build houses. It is plain that the innovator in these examples becomes a partial owner of the tangible property (e.g., land and logs) of others, due not to first occupation and use of that property (for it is already owned), but due to his coming up with an idea. Clearly, this rule flies in the face of the first-user homesteading rule, arbitrarily and groundlessly overriding the very homesteading rule that is at the foundation of all property rights.[18]

Other criticism of intellectual property law concerns the tendency of the protections of intellectual property to expand, both in duration and in scope. The trend has been toward longer copyright protection[19] (raising fears that it may some day be eternal).[20][21][22][23] In addition, the developers and controllers of items of intellectual property have sought to bring more items under the protection. Patents have been granted for living organisms,[24] and colors have been trademarked.[25] Because they are systems of government-granted monopolies copyrights, patents, and trademarks are called intellectual monopoly privileges, (IMP) a topic on which several academics, including Birgitte Andersen[26] and Thomas Alured Faunce[27] have written.

In 2005 the RSA launched the Adelphi Charter, aimed at creating an international policy statement to frame how governments should make balanced intellectual property law.

Intellectual Property Rights

Intellectual property rights is a legal concept that confers rights to owners and creators of the work, for their intellectual creativity. Such rights can be granted for areas related to literature, music, invention etc, which are used in the business practices. In general, the intellectual property law offers exclusionary rights to the creator or inventor against any misappropriation or use of work without his/her prior knowledge. Intellectual property law establishes an equilibrium by granting rights for limited duration of time.

Every nation has framed their own intellectual property laws. But on international level it is governed by the World Intellectual Property Organization (WIPO). The Paris Convention for the Protection of Industrial Property in 1883 and the 'Berne Convention for the Protection of Literary and Artistic Works' in 1886 were first conventions which have recognized the importance of safeguarding intellectual property. Both the treaties are under the direct administration of the WIPO. The WIPO convention lays down following list of the activities or work which are covered by the intellectual property rights -

- Industrial designs
- Scientific discoveries
- Protection against unfair competition
- Literary, artistic and scientific works
- Inventions in all fields of human endeavor
- Performances of performing artists, phonograms and broadcasts
- Trademarks, service marks and commercial names and designations
- All other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

Types of Intellectual Property Rights

Intellectual Property Rights signifies to the bundle of exclusionary rights which can be further categorized into the following heads-

5. **Copyright**

Copyright, one of the form of intellectual property right, offers exclusive rights for protecting the authorship of original & creative work like dramatic, musical and literary in nature. Symbolized as "©", here the term ....

Patent

A patent is termed as the exclusionary rights given by the government or the authorized authority to its inventor for a particular duration of time, in respect of his invention. It is the part of the intellectual property right ....

Trademark

The trademark or trade mark, symbolized as the â„¢ and ®, is the distinctive sign or indication which is used for signifying some kind of goods or/and services and is distinctively used across the business ....

9. **Trade Secrets**

Trade secret points towards a formula, pattern, any instrument, design which is kept confidential and through which any business or trade can edge over its rival and can enjoy economic gain. Trade secrets can be ....

10. **Utility Model**
    The utility model is the intellectual property right for protecting the inventions. It is somehow described as the statutory monopoly which is bestow upon for the fixed duration of time in exchange to the inventor for ....

11. **Geographical Indication**

    Geographical Indication (GI) signifies to the name or sign, used in reference to the products which are corresponding to the particular geographical area or somewhat related to the origin like town, region or nation.

12. **Industrial Design Rights**

    Industrial design rights are defined as the part of the intellectual property rights which confers the rights of exclusivity to the visual designs of objects which are generally not popular utilitarian. It safeguards the ....

Advantages of Intellectual Property Rights

Intellectual property rights help in providing exclusive rights to creator or inventor, thereby induces them to distribute and share information and data instead of keeping it confidential. It provides legal protection and offers them incentive of their work. Rights granted under the intellectual property act helps in socio and economic development.

Intellectual Property Rights in India

India has defined the establishment of statutory, administrative and judicial framework for protecting the intellectual property rights in the Indian territory, whether they connotes with the copyright, patent, trademark, industrial designs or with other parts.

Tuning with the changing industrial world, the intellectual property rights have continued to strengthen its position in the India. In 1999, the government has passed the important legislation in relation to the protection of intellectual property rights on the terms of the worldwide practices and in accordance to the India's obligations under the Trade Related Aspects of Intellectual Property Rights. It consists of -

3. The Patents(Amendment) Act, 1999 which was passed on 10th March, 1999 in the Indian Parliament for amending the Patents Act of 1970 which in turns facilitate to establish the mail box system for filing patents and accords with the exclusive marketing rights for the time period of 5 years.
4. The Trade Marks Bill, 1999 was passed in the India parliament during the winter session for replacing the Trade and Merchandise Marks Act, 1958. It was passed on 23rd December, 1999.
5. The Copyright(Amendment) Act, 1999 was passed by both upper house and lower house of the Indian parliament and was later on signed by the Indian president on 30th December, 1999.
6. The sui generis legislation was approved by both houses of the Indian parliament on 23rd

December, 1999 and was named as the Geographical Indications of Goods (Registration & Protection) Bill, 1999.

7. The Industrial Designs Bill, 1999 was passed in the Upper House of the Indian parliament for replacing the Designs Act, 1911.
8. The Patents (Second Amendment) Bill, 1999 was introduced in the upper house of the parliament for further amending the Patents Act 1970 and making it compliance with the TRIPS.

Along with the above legislative measures, the Indian government has introduced several changes for streamlining and bolstering the intellectual property administration system in the nation. Several projects concerning to the modernizing of the patent information services and trademark registry have been undergone with the help of the World Intellectual Property Organization/ United Nations Development Programme.

DISCRIMINATION

Discrimination is a sociological term referring to the prejudicial treatment of an individual based solely on their membership (whether voluntary or involuntary) in a certain group or category. Discrimination is the *actual behavior* towards members of another group. It involves excluding or restricting members of one group from opportunities that are available to other groups.[1] The United Nations explains: "Discriminatory behaviors take many forms, but they all involve some form of exclusion or rejection."[2] Discriminatory laws such as redlining have existed in many countries. In some countries, controversial attempts such as racial quotas have been used to redress negative effects of discrimination.

Racial discrimination differentiates between individuals on the basis of real and perceived racial differences, and has been official government policy in several countries, such as South Africa in the apartheid era, and the USA.

In the United States, racial profiling of minorities by law enforcement officials has been called racial discrimination.[3] As early as 1865, the Civil Rights Act provided a remedy for intentional race discrimination in employment by private employers and state and local public employers. The Civil Rights Act of 1871 applies to public employment or employment involving state action prohibiting deprivation of rights secured by the federal constitution or federal laws through action under color of law. Title VII is the principal federal statute with regard to employment discrimination prohibiting unlawful employment discrimination by public and private employers, labor organizations, training programs and employment agencies based on race or color, religion, gender, and national origin.

Title VII also prohibits retaliation against any person for opposing any practice forbidden by statute, or for making a charge, testifying, assisting, or participating in a proceeding under the statute. The Civil Rights Act of 1991 expanded the damages available in Title VII cases and granted Title VII plaintiffs the right to a jury trial. Title VII also provides that race and color discrimination against every race and color is prohibited.

In the UK the inquiry following the murder of Stephen Lawrence accused the police of institutional racism.

3. Weaver v NATFHE (now part of the UCU) Race/sex discrimination case. An Industrial

(Employment) Tribunal in the UK in 1987 decided that a trade union was justified in not assisting a black woman member complaining of racist/sexist harassment, regardless of the merits of the case, because the accused male would lose his job. The Employment Appeal Tribunal upheld the decision, which still stands today as the definitive legal precedent in this field. It is also known as the Bournville College Racial Harassment issue.

Within the criminal justice system in some Western countries, minorities are convicted and imprisoned disproportionately when compared with whites.[4][5] In 1998, nearly one out of three black men between the ages of 20-29 were in prison or jail, on probation or parole on any given day in the United States.[6] First Nations make up about 2% of Canada's population, but account for 18% of the federal prison population as of 2000.[7] According to the Australian government's June 2006 publication of prison statistics, indigenous peoples make up 24% of the overall prison population in Australia.[8] In 2004, Māori made up just 15% of the total population of New Zealand but 49.5% of prisoners. Māori were entering prison at 8 times the rate of non-Māori.[9] A quarter of the people in England's prisons are from an ethnic minority. The Equality and Human Rights Commission found that five times more black people than white people per head of population in England and Wales are imprisoned. Experts and politicians said over-representation of black men was a result of decades of racial prejudice in the criminal justice system.[10]

Age discrimination

Main article: Ageism

Age discrimination is discrimination on the grounds of age. Although theoretically the word can refer to the discrimination against any age group, age discrimination usually comes in one of three forms: discrimination against youth (also called adultism), discrimination against those 40 years old or older,[11] and discrimination against elderly people.

In the United States, the Age Discrimination in Employment Act prohibits employment discrimination nationwide based on age with respect to employees 40 years of age or older. The Age Discrimination in Employment Act also addresses the difficulty older workers face in obtaining new employment after being displaced from their jobs, arbitrary age limits.

On the other hand, the UK Equality Act 2010 protects young employees as well as old. Other countries go even further and make age discrimination a criminal offence.[12]

In many countries, companies more or less openly refuse to hire people above a certain age despite the increasing lifespans and average age of the population. The reasons for this range from vague feelings younger people are more "dynamic" and create a positive image for the company, to more concrete concerns about regulations granting older employees higher salaries or other benefits without these expenses being fully justified by an older employees' greater experience. Unions cite age as the most common form of discrimination in the workplace.[13] Workers ages 45 and over form a disproportionate share of the long-term unemployed – those who have been out of work for six months or longer, according to the U.S. Bureau of Labor Statistics.[14]

Some people consider that teenagers and youth (around 15–25 years old) are victims of adultism, age discrimination framed as a paternalistic form of protection. In seeking social justice, they feel that it is necessary to remove the use of a false moral agenda in order to achieve agency and empowerment.

This perspective is based on the grounds that youth should be treated more respectfully by adults and not as second-class citizens. Some suggest that social stratification in age groups causes outsiders to incorrectly stereotype and generalize the group, for instance that all adolescents are equally immature, violent or rebellious, listen to rock tunes, and do drugs. Some have organized groups against age discrimination.

Ageism is the causal effect of a continuum of fears related to age.[citation needed] This continuum includes:

- Ephebiphobia: the fear of youth.
- Gerontophobia: the fear of elderly people.
- Pediaphobia: the fear of infants or small

children. Related terms include:

- Adultism: Also called adultarchy, adult privilege, and adultcentrism/adultocentrism, this is the wielding of authority over young people and the preference of adults before children and youth.
- Jeunism: Also called "youthism" is the holding of beliefs or actions taken that preference 'younger' people before adults.

Sex and Gender discrimination

Though gender discrimination and sexism refers to beliefs and attitudes in relation to the gender of a person, such beliefs and attitudes are of a social nature and do not, normally, carry any legal consequences. **Sex discrimination**, on the other hand, may have legal consequences.

Though what constitutes sex discrimination varies between countries, the essence is that it is an adverse action taken by one person against another person that would not have occurred had the person been of another sex. Discrimination of that nature in certain enumerated circumstances is illegal in many countries.

Currently, discrimination based on sex is defined as adverse action against another person, that would not have occurred had the person been of another sex. This is considered a form of prejudice and is illegal in certain enumerated circumstances in most countries.

Sexual discrimination can arise in different contexts. For instance an employee may be discriminated against by being asked discriminatory questions during a job interview, or because an employer did not hire, promote or wrongfully terminated an employee based on his or her gender, or employers pay unequally based on gender.

In an educational setting there could be claims that a student was excluded from an educational institution, program, opportunity, loan, student group, or scholarship due to his or her gender. In the housing setting there could be claims that a person was refused negotiations on seeking a house, contracting/leasing a house or getting a loan based on his or her gender. Another setting where there have been claims of gender discrimination is banking; for example if one is refused credit or is offered unequal loan terms based on one's gender.[15]

Another setting where there is usually gender discrimination is when one is refused to extend his or her credit, refused approval of credit/loan process, and if there is a burden of unequal loan terms based on one's gender.

Socially, sexual differences have been used to justify different roles for men and women, in some cases giving rise to claims of primary and secondary roles.[16]

While there are alleged non-physical differences between men and women, major reviews of the academic literature on gender difference find only a tiny minority of characteristics where there are consistent psychological differences between men and women, and these relate directly to experiences grounded in biological difference.[17] However, there are also some psychological differences in regard to how problems are dealt with and emotional perceptions and reactions which may relate to hormones and the successful characteristics of each gender during longstanding roles in past primitive lifestyles.

Unfair discrimination usually follows the gender stereotyping held by a society.

The United Nations had concluded that women often experience a "glass ceiling" and that there are no societies in which women enjoy the same opportunities as men. The term "glass ceiling" is used to describe a perceived barrier to advancement in employment based on discrimination, especially sex discrimination.

In the United States in 1995, the Glass Ceiling Commission, a government-funded group, stated: "Over half of all Master's degrees are now awarded to women, yet 95% of senior-level managers, of the top Fortune 1000 industrial and 500 service companies are men. Of them, 97% are white." In its report, it recommended affirmative action, which is the consideration of an employee's gender and race in hiring and promotion decisions, as a means to end this form of discrimination.[18] In 2008, women accounted for 51% of all workers in the high-paying management, professional, and related occupations. They outnumbered men in such occupations as public relations managers; financial managers; and human resource managers.[19]

The China's leading headhunter, Chinahr.com, reported in 2007 that the average salary for white-collar men was 44,000 yuan ($6,441), compared with 28,700 yuan ($4,201) for women.[20]

The PwC research found that among FTSE 350 companies in the United Kingdom in 2002 almost 40% of senior management posts were occupied by women. When that research was repeated in 2007, the number of senior management posts held by women had fallen to 22%.[21]

Transgender individuals, both male to female and female to male, often experience problems which often lead to dismissals, underachievement, difficulty in finding a job, social isolation, and, occasionally, violent attacks against them. Nevertheless, the problem of gender discrimination does not stop at trandgender individuals nor with women. Men are often the victim in certain areas of employment as men begin to seek work in office and childcare settings traditionally perceived as "women's jobs". One such situation seems to be evident in a recent case concerning alleged YMCA discrimination and a Federal Court Case in Texas.[*citation needed*] The case actually involves alleged discrimination against both men and blacks in childcare, even when they pass the same strict background tests and other standards of employment. It is currently being contended in federal court, as of fall 2009, and sheds light on how a workplace dominated by a majority (- women in this case) sometimes will seemingly "justify" whatever they wish to do, regardless of the law. This may be done as an effort at self-protection, to uphold traditional societal roles, or some other faulty, unethical or illegal prejudicial reasoning.

Affirmative action also leads to white men being discriminated against for entry level and blue collar positions. An employer cannot hire a white man with the same "on paper" qualifications over a woman or minority worker or the employer will face prosecution