Fakuryu Maru (Lucky Dragon) was 80 miles to the east of Bikini Atoll, engaged in fishing. The *Fakuryu Maru* is a wooden tuna long-line boat of approximately 100 tons. When the hydrogen bomb was exploded at 3 a.m. on the morning of that fateful day, the crew of the vessel were engaged in fishing and some of the crew saw the flash of the bomb and then heard the sound of the explosion and witnessed the mushroom shaped bomb cloud. Approximately one and a half hours later white radioactive ash began to fall on the vessel and continued to fall for five hours until foot prints could be marked on the deck. According to the report of the skipper of the vessel, Captain Tsusui, the crew began to complain of headaches, nausea and itching of their bodies. In some cases the itching became almost unbearable and began breaking out in huge irregular blisters which were very painful. When the vessel reached the port of Yaizu on 14th March, all the twenty-three members of the crew had to be admitted in hospital. It was estimated by Japanese scientists that the ash on the boat had a radioactivity of 1 currie per gamma and that the total dose of radiation received by the fishermen was 270-440 roentgens per man.[12] Earlier in this chapter it was noted that a dose of 500 roentgens would kill about half of those people who were exposed to it over their whole bodies after a nuclear explosion and that even after a dose of 100 roentgens about 15 per cent of those exposed crew were affected by radiation and experienced the symptoms of radiation sickness previously described such as vomitting, diarrhoea, fall in white cells and, in some cases, ulceration of the skin and loss of hair. Although the utmost efforts were made by Japanese doctors to cure these cases, one of the patients, Aikichi Kuboyama died in the Tokyo Hospital at 6.56 p.m. on 23rd September. The medical report states that Mr. Kuboyama had been one of the serious cases since the beginning of the incident as he appeared to have received a particularly large dose of radiation. The United States authorities have maintained that Mr. Kuboyama did not die from radiation exposure but rather from a liver disease caused by blood transfusions. Japanese pathologists disagree and consider his death directly due to radiation damage. Radioactive fission products were found in his liver and

12. Refer *Research in the Effects and Influences of the Nuclear Bomb Tests Explosions*, Vol. I, pp. 425-34: Investigations of the Radioactive Contamination of the *Fakurya Maru*.

radiation injuries were detected in his bone marrow, lymph nodes, spleen and testicles.[13] Although it may be important scientifically to know whether the death of this unfortunate man was caused by the radiation or the treatment used to counteract it, it is certain that he would not have died, nor would his companions have been injured, but for the hydrogen bomb test at Bikini.

The test explosion in the Bikini Atoll also affected with radiation sickness five members of the crew of a Japanese freighter which had passed 1,200 miles outside the test area, but the members of the crew of this vessel were not as seriously affected as the crew of the *Fakuryu Maru* and none of them died.

Pollution of the sea and the fisheries around Japan

During the summer of 1954 the Japanese were like a nation battling against plague. The first horror was the return of the fishing boat, the Lucky Dragon, with its decks and its crew covered with radioactive dust from the bomb. Then came the radioactive fish. Fish is the main food of the Japanese, but no fish was consumed during the summer of 1954. Most of the fish landed in Japan during that summer was dangerously radioactive and had to be thrown away. Fish prices fell, fish markets closed and fishermen were pauperised. The Government of Japan organised scientific expeditions which went thousands of miles across the Pacific testing the water, the plankton and the fish for radioactivity. The Japanese Government set up testing stations at the five ports of Tokyo, Shiogama, Misaka, Shimizu and Yaizu in Japan and examined all fish landed there from March to November 1954. A great campaign was organised to find out where the danger lay, how the fish became contaminated and when they were dangerous and when they were safe. Fish free from radioactivity and safe for consumption were placed on sale in the fish markets. Posters appeared in shop windows saying "We do not sell radioactive fish" but no one would buy and the fishermen were ruined.[14]

13. As to the medical details regarding Mr. Kuboyama and the other fishermen affected by radiation, refer, *Reasearch in the Effects and Influences of the Nuclear Bomb Tests Explosions*, Vol. II, Part VIII; *Medical Science*, pp. 1281-1402, particularly 'Pathological findings on Mr. Kuboyama', pp. 1371-1402

14. *Ibid*, Vol. II, pp. 1251-80: Economic Aspects of the Effects of the Bikini H-Bomb experiments on Japanese Fisheries.

Contamination of the Pacific Ocean

Radioactive pollution of the sea water took place both from the immediate fall-out from the bombs and from the flow of radioactive water from Bikini lagoons. The ashes falling into the sea made the water intensely radioactive and this radioactivity was carried far and wide by the ocean currents. It was taken northwestward in the North Equatorial Current and twelve hundred miles from Bikini, two months after the last test explosion, the Sea water still had twenty times the radioactivity permissible in drinking water. Radioactivity was found five hundred miles east-north-east of Bikini, revealing a hitherto unknown easterly ocean current in this area. Radioactivity was found in the fish in these regions and also in the small floating creatures (plankton) on which fish feed. Radioactive fish first began to be landed in Japan in the middle of March 1954 and all fish with a radioactivity of 100 counts per minute were declared by the Government to be unfit to eat. Maps were made of areas where radioactive fish were caught at different times during the summer to find out about migration of the fish in relation to the spread of polluted water from the Bikini lagoons.[15]

Radioactivity of the fish

The radioactive fish were first limited to the area round the Marshall Islands but by June radioactive fish had spread westwards to the Carolines and then northwards to an area from the east of Taiwan (Formosa) to the Bonin Islands. Fish so radio active as to be discarded were caught during the month of June 1954 in a great arc of radius, 2,000 miles from Bikini. Later radioactive fish migrated west and north and radioactive tunnies were caught around Japan itself where the sea water was free from radioactivity. All fish landed at the five designated ports in Japan during the summer of 1954 were examined for radioactivity and those showing a higher radioactivity than the standard laid down by the Japanese Government were discarded as unfit to eat.[16] The following table summarises the survey of the fish landed in Japan during the summer and autumn of 1954:

15. *Ibid*, Vol. II, pp. 825-838, "Studies on the Radioactivity of Fishes caught in the Pacific Ocean in 1954."
16. *Ibid*, Vol. II, pp, 1085-94: "Radiological Survey of the Fish landed in Japan at Five Ports."

RADIOLOGICAL SURVEY OF FISH LANDED IN JAPAN AT FIVE PORTS

1954 Months	No. of boats Surveyed	No. of catches condemned	Fish landed tons	Fish Discarded tons.
March	130	2	6013	61
April	375	17	12395	34
May	179	36	9576	16
June	277	41	7792	33
July	219	19	11173	7
August	345	32	8589	66
September	280	38	6960	45
October	238	53	8677	17
November	..	74	..	17
	2052	312	71175	356

Three hundred and fiftysix tons of fish had to be thrown away as unfit for human consumption. On 31st May, 1954, the United States authorities said that they "have no evidence of extensive contamination in tunas or other fishes by the nuclear tests at Bikini Atoll." The above table, based on the investigations of Japan's most eminent scientists, proves that there was extensive contamination in the fish in the seas around Japan after the nuclear tests in the Marshall Islands.

The people of Japan eat fish as their daily food and the fishing industry occupies an important position in Japan. The landing of radioactive fish caused prices to fall, until in September 1954, they were half what they were before the Marshall Islands tests. Since most Japanese fishing boats are operated on a 'share system' where each man gets a share of the takings, it was the fishermen themselves who suffered most as a result of the calamity. The general wage level of the fishermen fell to half what it had been before the tests. The area around Bikini itself cordoned off by the U.S. Government, where no ships were allowed, contained fishing grounds where one-fifth of the total tunny fish were normally caught and were the main spawning area of tunny. The radioactive pollution of the spawning grounds resulted in radioactive fish appearing in the Pacific for several months after the tests.

The fall of radioactive rain on Japan

The explosion of nuclear weapons in the Marshall Islands resulted in the fall of radioactive rain on Japan itself. Nuclear explosions at Bikini were recorded in Japan on 1st and 27th March, 6th and 26th April, and 5th May 1954. Radioactive rain fell on Japan on 6th-11th March, 6th and 17th-18th April, and 6th and 14th May 1954. The radioactivity was greatest on the east coast of Japan and in September 1954 a typhoon struck the north coast of Japan carrying radioactive rain. In the spring of 1955 there was again an increase of radioactivity in the rain, this time 22 days after the commencement of the United States tests in Nevada. The radioactivity of the rain recorded in Japan over this period of one year was a hundred to a thousand times greater than the maximum permissible in drinking water.[17]

As the rain fell, the radioactive material became attached to the vegetation and was washed into the soil and into the ponds, rivers and rainwater tanks. This had harmful effects as in some parts of Japan rain water collected in tanks is used for drinking and washing. For instance, on 9th May 1954, it rained at Sato Cape, the southern-most point of Japan, and six days later the light-house keepers and their families in Sato Cape developed diarrhoea and headaches and their blood and urine when examined showed radioactivity. The radioactive material in the rain fell on the leaves of plants on the soil and so got taken up into the plants through their roots. Vegetables bought at Otsu City and Kyoto markets at the end of June, 1954 showed a radioactivity of about a hundred times than permissible in drinking water. The leaves of lettuce and carrot were more radioactive than the carrot itself. Much of the radioactivity could be washed off the leaves of the vegetables before eating, but some remained, and the radioactivity in the roots could not be washed out. Radioactivity was found in vegetables and plants because strontium 90 from the fall-out from the nuclear tests had settled on the plants and had also seeped into the soil.[18]

17. *Ibid*,. Vol. I, pp. 151-60: Artificial Radioactivity in rain water observed in Japan, 1954, 1954-55.
18. *Ibid*,, Vol. I, pp. 809-16: "Radioactive Contamination of plants and agricultural products in Japan covered with rain—Fall Out from H-Bombs detonated in March-May 1954 at Bikini Atoll, Marshall Islands.

Thus, in Japan in 1954, the fish, the rain, the drinking-water, the vegetables, the dust on roofs and in houses all became radioactive; they were made so by the nuclear tests carried out by the United States in the Marshall Islands in 1954.

The effects of the nuclear tests carried out by France in the Sahara

The three original nuclear powers, the United States, the Soviet Union and the United Kingdom, had not conducted any nuclear tests since they began the nuclear test ban negotiations in Geneva in November 1958 until the recent resumption in August September 1961. The United States carried out several underground nuclear tests in October, 1958, but during 1959 no nuclear tests were carried out by any country. In 1960, France began a series of nuclear tests in the Sahara desert and has carried out four tests of atomic bombs upto date. The first three tests were carried out on 13th February, 1st April and 27th December 1960 and a fourth test was conducted on 25th April, 1961. All these tests were of atomic bombs and were carried out in the Sahara desert.

The nuclear tests carried out by France in the African Sahara have had harmful effects on neighbouring African States. It is reported in the *Nature Magazine* of 23rd June 1960 that Ghana suffered harmful effects from the first atom bomb exploded by France on 13th February 1960. Research scientists in Ghana detected an increase in radiation in the samples they examined and found that the harvest, the soil, the water and even the milk were affected by atomic radiation in Ghana after the first atomic test carried out by France on 13th February, 1960.

The effects of the second and third atomic bombs tested in the African Sahara on the territory of the United Arab Republic are described in a report prepared by the Faculty of Science of the University of Alexandria. The second test was carried out by France on 1st April 1960 about 3,400 kilometres to the west of the city of Alexandria and a marked change was noticed in the air over Alexandria on 11th April 1960 "where radiation increased up and down according to the direction of the wind." The radioactive fall out on 15th April 1960 reached at its highest point nearly fifty times double of what is normal. From 27th November 1960, the radioactive fall-out continued to increase and reached its highest point over Alexandria from 25th to 28th December, 1960.

The third atomic test was carried out by France on 27th December 1960 and its effects were seen in Alexandria on the 8th January 1961. According to the report of Alexandria University, intensity changed according to conditions of weather. On 14th January 1961 its effect was several times double the normal amount. The wave of radioactive fall-out increased continually.

On 25th April 1961, France exploded her fourth atomic bomb for testing purposes in the Sahara. The bomb, described as of 'low power', was exploded from the top of a tower at the Reggane testing site in the Sahara. The official communique stated: "An atomic explosion took place today at 0500 G.M.T. on the top of a tower at the Reggane testing ground." France is also reported to have carried out underground tests at a site in the Hoggar mountains, a desolate range almost entirely denuded of vegetation in the southern Sahara.

The effects of underground nuclear tests

In 1957, the first nuclear test whose effects were totally confined underground was carried out by the United States in Nevada. A chamber six feet across was made 790 feet below the surface of a hill, by letting in to the hillside a horizontal excavation shaped corkscrew fasion, to contain the shock wave, with the bomb at the end of it. When detonated, there was the usual terrible explosion, though nobody saw it, with a momentary temperature of one million degrees and pressure of seven million atmospheres, and a suppressed pulse of radiation, including a violent shower of neutrons. In less than a tenth of a second, the chamber was puffed out like bubble-gum to 125ft. in diameter, coated inside with 800 tons of brightly glowing liquid rock. In a few minutes the temperature subsided, the lava began to run down the sides like coffee and drip from the roof, forming stalactites and stalagmites as it cooled. When solid, the lava set as a glass, and dissolved in it was 65–80 per cent of the radioactivity produced by the bomb. Gradually the heat and radioactivity leaded away, and the roof crumbled in, forming a chimney of broken and collapsed rock 400 feet high vertically above the cavity, but not reaching the surface. There was no fall-out, no movement of the soil surface, and only a relatively slight earth tremor.

Since the Rainier explosion, as the above explosion was called, there have been many underground nuclear tests in the United States, most of them entirely bottled up, radioactivity and all. On the basis of these tests, American scientists claim that it can now be planned with confidence how far to bury a bomb of a given size so that no radioactivity escapes. It is said that the general features of the underground explosion can now be predicted: what size of cavity will be made, how much energy will be generated, what temperature will be reached and how much rock will be melted. According to a statement issued on 25th September 1963, the United States has carried out 105 explosions underground. No accurate information is available regarding Soviet underground tests.

The Soviet resumption of nuclear tests in 1961

On 30th August 1961, the Government of the Soviet Union announced that it was going to resume the testing of nuclear weapons. This announcement was immediately followed by a nuclear test, which was carried out in Central Asia and resulted in the fall of radioactive rain on India, Japan and other neighbouring countries. This unilateral Soviet action terminated the unofficial moratorium on testing which was maintained since the Geneva negotiations began in November 1958 and the Government of the United States also announced that it has decided to resume the testing of nuclear weapons.

As far as is known, the Soviet Union has so far carried out about 121 atmospheric or surface tests since the first nuclear weapon was tested in Soviet territory in 1949. The new test series began within hours of the Soviet announcement that they were to resume testing. Right up to the time of that announcement, the Soviet Union was still taking part in the Geneva test-ban conference, which has been widely regarded as one of the most hopeful ways of reducing world tension and preventing the spread of nuclear tests by the conclusion of treaty banning such tests. The Soviet Union's unilateral resumption of nuclear tests effectively terminated the nagotiations and mankind was again faced with the hazards of atomic radiation as a result of the new Soviet test series. Large increases in radioactivity were recorded in Calcutta, Srinagar, Tokyo, Hiroshima and other cities of Asia as the majority of the Soviet tests appear to have been carried out in the Central

Asian region of the U.S.S.R. The Soviet tests caused further alarm in Japan, where it was reported that heavy and continuing radioactivity had been registered.

The Soviet Union conducted its first nuclear test in the new series on 31st August 1961 in the area of Semipalatinsk in Central Asia. The device tested had a substantial yield in the intermediate range and was detonated in the atmosphere. The explosion had been recorded by long-range detection apparatus in various countries and it was indicated that it was not a weapon in the 50 megaton range but was larger than the average atom bomb. The Soviet announcement on the resumption of tests had stated that Russia had projects for a series of nuclear bombs with yields equivalent to 50 million tons of T.N.T. The bomb dropped on Hiroshima had an equivalent of 20,000 tons of T.N.T.

The Soviet Union conducted another nuclear test on 3rd September in the Semipalatinsk area in Central Asia. The yield of the device was in the low kiloton range and the detonation again occurred in the atmosphere. On 5th September, the Soviet Union carried out its third nuclear test in the same area. On 6th September, the Soviet Union detonated its fourth nuclear device in an area east of Stalingrad. On 10th September, the Soviet Union carried out two nuclear tests in the vicinity of Novoya Zemlya, an island in the Arctic. This brought the number of explosions in the series to six tests in 11 days. One of the devices tested on the island had an explosive force equivalent to several millions ton of T.N.T. The Soviet Union continued to carry out further atomspheric tests in Central Asia and the Arctic during the months of September and October and on 23rd October the Soviet Union exploded a 50-megaton bomb in the Arctic island of Novoya Zemlya. The Soviet decision to resume nuclear tests was a plain reversal of their previous declaration that they would not start testing again unless the United States or United Kingdom first did so. It was a grave setback to the hopes kept alive that an agreement to ban nuclear tests might be reached at the Geneva negotiations and the world reaction to the resumption of Soviet tests was one of astonishment, alarm and distress. According to an announcement made by the United States Atomic Energy Commission on 25th September, 1963, the Soviet Union has carried out 121 atmospheric or surface tests, one underwater test and about three tests at

altitudes over 100,000 feet. No information is available regarding Soviet underground tests.

The American test series in 1962

On 2nd March 1962, the President of the United States announced that the United States would resume nuclear tests in the Pacific Ocean regions, and danger zones were established in the Pacific as from 4th April 1962 when the United States Atomic Energy Commission warned ships and planes to remain clear of a rectangular area of the high seas surrounding the British test base at Christmas Island, in the Central Pacific, and the American atoll, Johnston Island, in the mid-Pacific. Strong protests were lodged by a number of Asian countries, and particularly by Japan. In one of these Notes, Japan reserved the right to demand compensation for any losses suffered by Japanese fishermen as a result of these tests, and in another Note Japan protested against establishment of such a danger zone on the ground that it was violative of the principle of the freedom of the open sea. The United States, however, expressed the view that proper notification of a danger zone for vessels and aircraft within a portion of the high seas was in conformity with standard international legal procedures, and the test series in the Pacific Ocean commenced from 25th April 1962. The first nuclear test was carried out at 10.45 a.m. on 25th April 1962 in the vicinity of Christmas Island. This was followed by a series of nuclear tests which were carried out in the vicinity of Johnston and Christmas Islands. Most of these weapons were exploded at high altitudes, and one nuclear explosion of megaton range was reported to have been carried out 500 miles above the Pacific in the Johnston Island area in June 1962. This high altitude explosion was reported to have caused a temporary break in the earth's magnetic arc in space and sent particles of the Van Allen radiation belt cascading into the atmosphere, virtually eliminating the Van Allen Belt (i.e. the radiation belt surrounding the earth). The explosion of this hydrogen bomb at a eight of 500 miles above sea level caused a spectacular display of auroral light visible for thousands of miles. The disruption to communications from a test in the megaton range at a height of 500 miles was considerable and it was reported that trans-Pacific air traffic was grounded for some days. It was also reported that the explosion blacked out high frequency radio communication for some hours.

The United States continued to carry out nuclear tests in the Pacific Ocean region for several months. In the statement issued on the 25th September 1963, the U.S. Atomic Energy Commission announced that the United States has carried out about 170 atmospheric or surface tests, 10 tests at altitudes of over 100,000 feet, some of these actually in outer space and 6 underwater tests. Apart from these, it is estimated that the United States has carried out 105 explosions underground.

An assessment of the danger from radioactive fall-out

During 1961 and 1962 nearly two hundred atmospheric or surface nuclear tests were carried out by the Soviet Union and the United States, and it is estimated that these tests have released into the atmosphere more radioactive material than was contributed by all nuclear explosions during the previous fifteen years. Though it is possible to exaggerate the danger from radioactive fall-out, no one can seriously maintain that the danger does not exist. All radioactive fall-out is potentially harmful, and the United Nations Scientific Committee on the Effects of Atomic Radiation in its recent report published in 1962 had no hesitation in concluding that "it is clearly established that exposure to radiation, even in doses substantially lower than those producing acute effects, may occasionally give rise to a wide variety of harmful effects including cancer, leukaemia and inherited abnormalities.[19] The U.N. Scientific Committee is further of the view that "it is prudent to assume that some genetic damage may follow any dose of radiation, however small."[20] With regard to the world-wide contamination of the environment from nuclear tests, the U.N. Scientific Committee is of the opinion that the full effects of radiation exposures in human beings might not show up "for several decades in the case of somatic disease, and for many generations in the case of genetic damage.[21] The Committee states that "there are no effective measures to prevent the occurrence of harmful effects of global radioactive contamination from nuclear explosions,"[22] and comes to the conclusion that "a final cessation of

19. *Report of the United Nations Scientific Committee on the Effects of the Atomic Radiation, New York, 1962*, p. 35.

20. *Ibid.*, p. 35

21. *Ibid.*

22. *Ibid.*

nuclear tests would benefit present and future generations of mankind."[23]

Further material on the effects of nuclear tests is contained in the Report of the United States Atomic Energy Commission released on 8th May 1962. In this 700-page Report, entitled *The Effects of Nuclear Explosions* and published at the commencement of the new test series, the United States Atomic Energy Commission had made public for the first time the scientific data gained from previous nuclear tests carried out by the United States. The report estimated that 92 megatons of radioactive fall-out had been disseminated in the atmosphere by nuclear explosions conducted by the United States, Britain and the Soviet Union from 1945 to 1958. Considerable attention is devoted in the report to the U.S. nuclear test at Bikini on 1st March 1954, the effects of which exceeded official expectations and contaminated a wider area than that placed out of bounds to navigations. On this matter the report states that "the fission yield of the explosion and the height of burst, in the event of nuclear attack, are unpredictable." The report goes on to state that "consequently, it is impossible to determine in advance how far the seriously contaminated area will extend, although the time at which the fall-out will commence at any point could be calculated if the effective wind velocity and direction were known." The Commission also gives an account in its report of the visual effects of high-altitude explosions carried out in 1958 as part of the test series in Johnston Island in the Pacific Ocean. In one of these tests, a nuclear weapon was detonated at an altitude of 252,000 feet (nearly 50 miles) and in another a nuclear weapon was exploded at an altitude of 141,000 feet (nearly 27 miles). The Commission states that about a minute after the first explosion, the fireball had risen to a height of over 90 miles and was directly visible from Hawaii, over 700 miles away. As seen from Hawaii, the second explosion, referred to above, produced a bright flash in the sky above the horizon lasting for a fraction of a second and about a minute later, a greyish-white radioactive cloud was observed low on the horizon. The report discloses that the deepest underwater test carried out by the United States was the explosion of a 30-kiloton device 2,000 feet under the sea off the coast of lower California in May 1955. This test revealed the

23. *Ibid.*

devastating effects of nuclear energy when under the weight of thousands of feet of water and it was estimated that one mile from the point of detonation the pressure of 330 lbs. per square inch above normal sea pressure would have smashed the hull of a submarine.

The report of the Commission reveals that disruption of radar signals may occur as a result of ionisation from a nuclear detonation and confirms that the purpose of the high altitude tests in the Pacific in 1962 was to determine what effect an enemy's nuclear explosions would have on the early warning radar system of the United States. The report states that irregularities caused by a nuclear explosion can disrupt the radar and cluster or false echoes from ionised patches. The report, however, disputes the theory that nuclear testing has an effect on the weather and states that "the general opinion of the competent meteorologists, both in the U.S.A. and in other countries, is that apart from localised effects in the vicinity of the test area, there has been no known influence of nuclear explosions on the weather."

The United States Atomic Energy Commission acknowledges the possibility of a nuclear bomb being exploded accidentally and states in its report that the conventional high-explosive trigger device of nuclear bombs can be accidentally set off. The Commission expresses the opinion that "there is always the possibility that, as a result of accidental circumstances, an explosion will take place inadvertently", and goes on to state that "although all conceivable precautions are taken to prevent them, such accidents might occur in areas where the weapons are assembled and stored, during the course of loading and transportation on the ground or when actually in the delivery vehicle, e.g., an airplane or missile." The report discloses that "nuclear weapons contain varying amounts of highly explosive in addition to the fissionable material—the nuclear explosive" and states that it is the high explosive component (in the trigger mechanism) which comprises the main possible hazard.

The report of the United Nations Scientific Committee placed before the General Assembly in September 1962, the Report of the United States Atomic Energy Commission, released in May 1962, and the Report of the British Medical Research Council,

published in December, 1960[24] have presented the current state of knowledge of radiation exposure levels and have estimated the biological and genetic effects of atomic radiation. As the recent Soviet and American tests have, within the space of two years, released more radioactive material than was contributed by all nuclear explosions during the previous fifteen years, the danger from radioactive fall-out is now much greater than it was two years ago and it may, therefore, be the appropriate time to attempt to assess the hazards of atomic radiation in the light of the information available up to September 1963. The immediate and purely local fall-out from nuclear tests can perhaps be left out of a general evaluation of the hazards of nuclear tests as the recent Soviet and American test series have not been carried out in populated areas, and no immediate or direct damage has been reported as in the case of the earlier American tests in the Marshall Islands. It is the global fall-out from nuclear tests which now constitutes the greatest hazard. Even if the tests are carried out in areas which are not populated and even if the tests do not cause any immediate damage, every test carried out will still have harmful effects on the population of the world by adding its quota of harmful radioactive substances to the air, the land and the sea. This is so because every nuclear explosion results in the radioactive fission products being drawn into the stratosphere, and these fission products gradually spread over a large part of the world and return ultimately to the earth in the form of rain or snow. In the global, as opposed to local, fall-out from nuclear explosions, the elements which constitute a hazard to the human race are those whose rate of radioactive decay is slow enough for them to be still significantly radioactive when they return to the earth from the stratosphere. Among these by far the most pernicious are radioactive strontium, radioactive caesium and radioactive carbon.

Strontium 89 and strontium 90 each compose about 5 per cent of the fission products of an atomic bomb and it is estimated that strontium 90 has a half-life of 28 years, while strontium 89 has a half-life of only 58 days. It is, therefore, strontium 90 which is most dangerous since its radioactivity decays more slowly and it remains a dangerous source of radiation when it ultimately returns

24. *The Hazards to Man of Nuclear & Allied Radiations*, H.M.S.O. London, December, 1960.

to the earth in global fall-out from the stratosphere. Radioactive strontium from fall-out settles on plants and also seeps into the soil. That which settles on plants is the most dangerous, since it may be grazed by cattle or eaten by man. After being eaten with the food, strontium is readily absorbed into the body and becomes incorporated into the bones of the person. Strontium also becomes concentrated in milk and all cow's milk throughout the world has been found in recent years to contain increasing amounts of radioactive strontium. Since strontium is easily absorbed into the body and is incorporated in bone, it is primarily an internal hazard and the hazard from strontium is somatic. The chief danger is of cancer due to irradiation of tissue in the neighbourhood of strontium deposited in the bone and radiostrontium can also induce leukaemia. In countries, where people derive their food intake mainly from cereals and vegetables, the dietary level of radioactive strontium is likely to be high because strontium from fall-out settles mainly on plants and crops, such as wheat and rice. The gravity of the strontium hazard for Asian peoples is therefore very great and the U.N. Scientific Committee has shown that the hazard for an Asian country receiving most of its dietary calcium from rice is much greater than that for an European country in which cereals do not form the main food.

In radioactive fall-out, another dangerous element is caesium 137. Radioactive caesium composes about 6 per cent of the fission products of an atomic bomb and decays with half-life of 33 years, giving off beta—and gamma-rays. It is dangerous because caesium chemically resembles potassium, and like it is concentrated inside plants and animal tissue cells. Just as strontium enters the "food chain", so does caesium, but instead of settling in the bones, caesium is distributed through the body. Its hazard is due mainly to the fact that its radioactivity contributes to the radiation dose received by the gonads and the danger from radiocaesium is mainly genetic. By subjecting the reproductive cells to gamma-rays, radio-caesium can cause grave genetic defects in succeeding generations. It is now generally accepted that the elements of radioactive caesium in global fall-out will cause genetic damage.

It has been recently discovered that thermonuclear explosions create large amounts of a long-lived radio-active form of carbon,

carbon 14, by interaction between neutrons liberated by hydrogen bombs and the nitrogen of the air. In each megaton explosion, some 7-8 kilograms of carbon 14 are generated. The reason why carbon 14 must be regarded as a great hazard is the fact that it decays very slowly. It has been estimated that radio-active carbon has a half-life of more than 5,000 years It takes thousands of years for its radioactivity to decay and it is dangerous because all living matter contains large amounts of carbon, derived ultimately from carbon dioxide from the air. Since carbon 14 lasts so long, it has a much increased chance of getting into body constituents, including even the nucleic acid of the germ cells. The hazard is difficult to assess accurately as radioactive carbon is being steadily produced all the time by a similar action of cosmic rays, but in 1960 it was estimated that the nuclear tests already carried out had increased the amount of radioactive carbon by about 0.5 per cent. These amounts of radiocarbon have been synthesised during nuclear testing and injected into the earth's carbon cycle, specifically into the atmosphere.

Other harmful elements in radioactive fall-out are iodine 131, manganese 54, zinc 65 and cobalt 60, but these elements are relatively short-lived and therefore do not constitute as great a hazard as strontium 90, caesium 137 and carbon 14. Radioactive iodine composes about 3 per cent of the fission products of an atomic bomb. It is relatively short-lived, having a half-life of only eight days, and emits beta-rays and gamma-rays. Owing to its rapid rate of decay, iodine 131 from nuclear tests is not likely to be accumulated in damaging doses, but it is often detected in the thyroid glands of cattle soon after an explosion. It can, therefore, represent a temporary hazard in the neighbourhood of nuclear explosions. This is so because iodine cannot only be eaten or inhaled directly but is also rapidly concentrated and excreted in the milk of cattle grazing on contaminated herbage. In the form of milk it could be consumed by man in significant amounts. Iodine becomes concentrated in the thyroid gland, where, particularly in young children, it can kill the cells or cause cancer to appear if accumulated in large doses. On account of their proximity to the Soviet explosion sites in the Arctic, special attention to this danger is being given in high-altitude areas in the northern hemisphere where careful checks of radio-iodine in milk have been carried out.

Manganese 54, which has a half-life of 310 days, zinc 65 which has a half-life of 250 days and cobalt 60, which has a half-life of about 5 years, have been proved to be produced in considerable amounts by hydrogen bomb explosions. All these elements are selectively accumulated in certain tissues in plants, fish and animals, and can produce harmful effects in tissues in which they accumulate. As they are relatively short-lived, radioactive elements of this kind do not constitute a hazard in global fallout, but they may represent a temporary hazard in the neighbourhood of nuclear explosions. Of these elements, cobalt 60 is potentially dangerous as it remains sufficiently active to cause damage even after a few years. During recent years reports have appeared of another new fall-out material, namely a mixture of zirconium 95 and niobium 95, both of which are powerful beta-and gamma-ray emitters, with half-lives of 65 and 35 days respectively. They appear to have originated in the 1957-58 series of tests, and first received public notice because their presence in packaging materials, such as straws, was ruining photographic films by fogging. Particles of zirconium 95 and niobium 95 were detected in the air over Europe, and were found to become concentrated in the lungs. Because their half-lives are short, these materials soon die away once tests are stopped and they do not constitute a hazard in global fall-out.

In the global fall-out from nuclear explosions, the only elements which constitute a hazard are those, such as strontium 90, caesium 137 and carbon 14, whose rate of radioactive decay is slow enough for them to be significantly radioactive when they return to the earth from the atmosphere. The estimates of the time taken for this return to happen have recently been sharply revised. Whereas in earlier scientific discussions on fall-out the average length of time which the radioactive particles would spend in the stratosphere was reckoned at 10 years, the actual time now appears to be nearer 2 or 3 years. Consequently the radioactive materials from tests in the past five years have been and will be returning to earth sooner, and less spent, than was expected. In addition, fall-out of these materials, instead of spreading uniformally on this earth, has been found to concentrate in a band in the northern hemisphere between latitudes 30° and 45°N. Such considerations together with variations in rates of testing hydrogen bombs and the new discovery relating to the long-lived radioactive element of carbon 14, have made prediction of fall-out rates very difficu t. Any assessment of the extent of possible damage can therefore only be very rough. Strontium 90 did not exist on earth until it was produced by the explosion of nuclear weapons and its presence in human bone is the direct consequence of nuclear testing. So far as the strontium hazard is concerned, therefore, the key question which needs to be answered is whether there is a level below which radiostrontium concentration in bone is harmless. Most experts are now of the opinion that while there may be a maximum level of safety in respect of bone cancer, it is unlikely that such a level or threshold exists for the causation of leukaemia; this means that fall-out in the form of radioactive strontium will increase the incidence of laukaemia, while the possibility of increase in bone cancer is less certain. At present fallout levels, it is estimated that sufficient strontium 90 has already been released to be responsible for hundreds of new cases of leukaemia in this and the next generation. With regard to the caesium hazard, a direct linear relation between the gamma radiation dose and the probability of genetic damage is now generally accepted and most experts agree that fall-out in the form of caesium 137 will certainly cause genetic damage, which might not show up for many generations. The hazard from carbon 14 is di.f.cult to assess accurately, for the reasons already given. To sum up, it may be said, therefore, that global fall-out from nuclear tests will definitely cause genetic damage and most likely increase the incidence of leukaemia, but the possibility of an increase in bone cancer is less certain on the basis of present knowledge.

CHAPTER II

Nuclear Tests, Tortious Liability and State Responsibility

The object of this Chapter is to consider the question as to whether nuclear tests raise issues of State responsibility. The effects of the tests as apparent from scientific evidence cannot be confined to the territory of the State carrying out the experiments, and they may result in injury to the nationals and territory of other States. The scientific information on the effects of nuclear tests set out in Chapter I has clearly shown that nuclear tests result in local and global radioactive fall-out and that the biological and genetic effects of atomic radiation constitute a great hazard to the human race. The testing of nuclear weapons, therefore, raises legal problems of a new kind, because it has not been previously possible for any one nation to alter the global environment in a manner clearly harmful to other nations. The tests carried out by the United States in the Pacific Islands, the tests conducted by France in the African Sahara and the tests carried out by the Soviet Union in Central Asia and the Arctic have had harmful effects on neighbouring States. It is for consideration whether and in what circumstances a State by carrying out nuclear tests can be said to commit an international tort.

In order to ascertain whether questions of tortious liability and issues of State responsibility arise as a result of damage caused by nuclear tests, it is first necessary to examine the principles of tortious liability and State responsibility in international law with a view to determining whether these principles of international law are applicable to the situation arising out of these tests. At the outset, it will therefore be necessary to discuss and ponder over the question as to whether the accepted principles of international law relating to State responsibility and tortious liability can be applied to new situations arising out of these tests on the basis of the evidence collected in Chapter I. If the existing principles of international law are not applicable, or if such as are applicable are not adequate to meet the new situation arising out of the hazards of these tests, it will be necessary to consider whether any extensions or analogies of the existing principles of international law are

possible. Finally, it will be a matter for consideration whether international law, which has in several cases in the past met new situations by evolving new principles, could in the present case similarly attempt to counter the grave threat to which States generally are exposed by the holding of these tests by the formulation of a suitable doctrine. If the existing rules of international law are inapplicable, it may be necessary to formulate new rules of international law to meet the new situation, since nuclear tests raise legal problems of a new kind as it has not previously been possible for any one nation to alter the global environment in a manner clearly harmful to other nations. A nation or government accused of such world contamination is naturally reluctant to face the issue squarely, but now that significant harm has been proved the issue can no longer be evaded. The whole question is clearly one of utmost gravity and of the greatest difficulty, but this should not discourage any attempt to move forward along boldly constructive lines.

State responsibility and the abuse of rights.

State responsibility arises as a consequence of a breach or non-performance of an international obligation, and the State which has committed the wrongful act or omission has a duty to make reparation for the injury caused. Wherever responsibility lies, there also lies a duty to make reparation. This is the traditional view of State responsibility prevailing in the abundant legal literature on the subject. Eagleton commences his leading treatise on *State Responsibility in International Law* with the following discourse:

> "The study of the responsibility of States in international law involves an examination of the theory upon which reparation may be demanded by one state or another, and of the process by which it may be obtained. The members of the community of nations have, in practice, agreed to respect certain principles for their mutual guidance and, in doing so, it has been understood that they were thereby accepting obligations to observe the conduct prescribed. The failure to meet these obligations imposes upon the guilty State the further obligation to make reparation for the injury caused."[1]

According to Eagleton, "responsibility is simply the principle

1. Eagleton, *The Responsibility of States in International Law*, 1928, p. 3.

which establishes an obligation to make good any violation of international law producing injury, committed by the respondent State".[2] A similar view is expressed by Anzilotti in his learned work entitled "Corso di Diritto Internazionale":

> "When a wrongful act—by which is meant, as a rule, the violation of an international right—is committed, the consequence is that a new relationship comes into existence, in law, between the State to which the act is imputable (that State being under a duty to make reparation) and the State with respect to which there exists an unperformed obligation (this State having a claim to reparation). This is the only effect that the rules of interntional law, as laid down in the reciprocal undertakings of States, can attribute to the wrongful act."[3]

The rules of international law relating to State responsibility are therefore concerned with the circumstances in which, and the principles whereby, the injured State becomes entitled to redress of the damage suffered. The acts or omissions which give rise to State responsibility are of two kinds: (1) acts which affect a State by injury to the interests or rights of that State as a legal entity, and (2) acts which cause damage to the person and property of its nationals. In most cases the injured State will claim satisfaction through diplomatic channels and may be statisfied with a formal apology, but in more serious cases where there has been material loss or damage, pecuniary reparation may be necessary and the matter may have to be placed before an arbitral tribunal. State responsibility arises if the act or omission violates a rule of international law and the wrongs or injuries which give rise to State responsibility may be of various kinds. Thus a State may become responsible for breach of a treaty or of other contractual obligation or State responsibility may arise as a result of injuries to citizens of another State. Every neglect of an international duty constitutes an international delinquency and the injured State can claim redress. State responsibility may also arise as a result of an abuse of a right enjoyed by virtue of international law. "This occurs when a State avails itself of its right in an arbitrary manner in such a way as to inflict upon another State an injury which cannot be justified by a legitimate

2. *Ibid*, p. 221.

3. Anzilotti, Corso di Diritto Internazionale, 1928, p. 416.

consideration of its own advantage."[4] The International Court has expressed the view that "in certain circumstances, a State, while technically acting within the law, may actually incur liability by abusing its rights"[5] and individual judges of the court, such as Judge Azevedo, Judge Alvarez and Judge Anzilotti, have referred to this principle in their judgments.[6] Oppenheim observes that "the maxim, *sic utere tuo ut alienum non laedas*, is applicable to relations of States no less than to those of individuals; it underlies a substantial part of the law of tort in English law and the corresponding branches of other systems of law; it is one of the general principles of law recognised by civilized States which the Permanent Court is bound to apply by virtue of Article 38 of its Statute".[7] The doctrine of the prohibition of abuse of rights is, however, of recent origin in international law and the precise extent of its application is still controversial.

Very few writers on international law have examined the question of the applicability of the doctrine of abuse of rights in international relations. The question was first considered officially at the Proceedings of the Advisory Committee of Jurists in 1920 when this august body was drafting the Statute of the Permanent Court of International Justice. When Article 38 regarding the sources of international law was being discussed, Ricci-Busatti, the Italian member of the Committee, expressed the view that the principle 'which forbids the abuse of rights' was one of the 'general principles of law recognised by civilized nations' and was of the opinion that the Permanent Court should apply this principle when deciding cases referred to it. As an illustration of the doctrine he quoted the varying limits of the breadth of the territorial sea and said that in such a dispute the Court might "admit the rulings of each country in this regard, as equally legitimate insofar as they do not encroach on other principles, such as that of the freedom of the seas."[8]

In his lectures at the Hague Academy of International Law in 1921, Politis expressed the view that the doctrine of the abuse of

4. Oppenheim, *International Law*, Vol. I (1957), p. 345.

5. *Free Zones of Upper Savoy & the District of Gex;* Series A, No. 24, p. 12 and Series A/B, No. 46, p. 107.

6. Refer particularly Judge Alvarez in *Admission (General Assembly) Case*, I. C. J. Reports, 1950, p. 15.

7. Oppenheim, *op. cit*, Vol. I, (1957), pp. 346-47.

8. Ricci-Busatti, Proceedings of the Advisory Committee of Jurists, 1920, pp. 315-316

rights was of great importance for the development of international law relating to State responsibility and advocated its progressive application as one of the 'general principles of law' referred to in Article 38 of the Statute of the Permanent Court.[9] In 1933 in his treatise on *The Function of Law in the International Community*, Lauterpacht was of the opinion that the doctrine of the abuse of rights was 'one of the basic elements of the international law of torts',[10] and in a recent treatise on *The Abuse of Rights in International Law*, published in 1953, Kiss has expressed the view that the prohibition of the abuse of rights is 'a general principle of international law'.[11] Schwarzenberger, on the other hand, is of the opinion that "in the cases and situations usually mentioned in support of the recognition and applicability of the doctrine of international law, there have been no real abuse of rights but breaches of a prohibitory rule of interntional law".[12] Cheng considers the theory of abuse of rights as 'recognised in principle both by the Permanent Court of International Justice and the International Court of Justice' and is of the opinion that the doctrine is merely—an application of the principle of good faith to the exercise of rights. In his treatise on *The General Principles of Law* this author gives a comprehensive analysis of the various applications of this doctrine in practice.[13]

A survey of the jurisprudence of the International Court of Justice and the Permanent Court of International Justice clearly shows that the basic principles of the prohibition of abuse of rights have been applied in cases. In the *German Interests Case* (1926) the Permanent Court of International Justice held that "Germany undoubtedly retained until the actual transfer of sovereignty the right to dispose of her property". The treaty obligations assumed by Germany did not, therefore, directly affect her proprietory rights, including the right of alienating property. The Court added, however, that "a misuse of this right could endow an act of alienation with the character of a breach of the Treaty."[14] It follows, therefore,

9. Recueil des Cours de L' Academie de Droit International, 1925, Vol. 6, p. 108.
10 *The Function of Law in the International Community*, 1933, p. 298.
11. L'Abus de Droit en Droit International, 1953, pp. 193-196
12. Recueil des Cours de L'Academie de Droit International, 1955, Vol. 87. p. 309.
13. *General Principles of Law as applied by International Courts & Tribunals*, 1953, pp. 121-136.
14. P.C.I.J., Series A, No. 7, pp. 30-37

that a legitimate exercise of the right of alienation was compatible with the treaty obligations, while an abuse of this right, i.e. an exercise of the right contrary to the principle of good faith, would be incompatible therewith. While the *bona fide* exercise of the right would be compatible with Germany's treaty obligations, its exercise contrary to the principle of good faith would constitute an abuse of right and a breach of these obligations, i.e. an unlawful act. In the *Free Zones Case* (1932) the Permanent Court applied the same principle in a case where France was under treaty obligations to maintain certain frontier zones with Switzerland free from customs barriers. The Court, while recognising that France had the sovereign and undisputed right to establish a police cordon at the political frontier, held that : "A reservation must be made as regards the case of abuse of a right, since it is certain that France must not evade the obligation to maintain the zones by erecting a customs barrier under the guise of a control cordon".[15] The principle underlying this opinion is that international law prohibits the evasion of a treaty obligation under the guise of an alleged exercise of a right. The principle of good faith requires every right to be exercised honestly and loyally. Any fictitious exercise of a right for the purpose of evading either a rule of law or a contractual obligation constitutes an abuse of the right, prohibited by law. In 1951 the International Court of Justice, when considering the right to draw straight line bases for the purpose of delimiting the territorial sea, mentioned the 'case of manifest abuse' of this right in the *Anglo-Norwegian Fisheries Case* (1951).[16]

The doctrine of the abuse of rights has also been applied by municipal courts, arbitral tribunals and claims commissions. The Mexican-United States General Claims Commission, for example, expressed the following opinion, on the matter in the *North American Dredging Co. of Texas Case* (1926):

> If it were necessary to demonstrate how legitimate are the fears of certain nations with respect to abuses of the rights of protection and how seriously the sovereignty of those nations within their own boundaries would be impaired if some extreme conception of this right were recognised and enforced, the present case would furnish an illuminating example.

15. P.C.I.J., Series A/B, No. 46, p. 167.
16. I.C.J. Reports, 1951, p. 142.

The General Claims Commission referred to the 'worldwide abuses either of the right of national protection or of the right of national jurisdiction' and declared that:

> The present stage of international law imposes upon every international tribunal the solemn duty of seeking for a proper and adequate balance between the sovereign right of national jurisdiction, on the one hand, and the sovereign right of national protection of citizens on the other. No international tribunal should or may evade the task of finding such limitations of both rights as will render them compatible with the general rules and principles of international law. Every right of a State is, therefore, subject to such limitations as are necessary to render it compatible with its obligations under general international law.[17]

The principles underlying the doctrine of the abuse of rights may also be illustrated by the decision in the *Trail Smelter Arbitration*.[18] The question in issue was that of State responsibility for nuisance to adjacent territory as the claim related to damage done in the United States to crops, pasture lands, trees and agriculture generally as well as to livestock as the result of sulphur dioxide fumes emitted from a smelting plant in British Columbian Canada. In this case, therefore, there was, on the one hand, the right of a State to make use of its own territory, and, on the other hand, the duty of a State at all times to protect other States against injurious acts individuals within its jurisdiction. Taking into account the conflicting interests at stake and the analogous cases in municipal law, the Tribunal arrived at the following conclusion:

> Under the principles of international law, as well as of the law of the United States, no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.[19]

The Tribunal held Canada liable on the ground that there was a violation of the obligation to protect other States from injuries emanating from its territory and this violation constituted an abuse

17. *Opinions of Commissioners*, 1927, p. 23.
18. Annual Digest, 1938-40 Case No. 104.
19. Annual Digest, 1938-1940, Case No. 104.

of right, an unlawful act. While acknowledging that it knew of no previous international decision concerning air or water pollution, the Tribunal cited the decision of the Federal Court of Switzerland in *Solothern* v. *Aargau* relating to target practice[20] and the decision of the United States relating to pollution in *State of Missouri* v. *State of Illionois*.[21] The Tribunal clearly regarded the general principle of the duty of a State to protect other States from injurious acts within its jurisdiction, which it traced back to the *Alabama Claims Arbitration*, as of wider application. It is for consideration, therefore, that if a State uses its own territory for conducting nuclear tests, whether in such a case injury due to atomic radiation is as much a ground of liability as injury due to noxious fumes on the principles laid down in the *Trail Smelter Arbitration*.

International torts and tortious liability

'The breach of any obligation consitutes an illegal act or international tort' and 'the commission of an international tort involves the duty to make reparation'.[22] The terms 'international tort' and 'international illegal act' are merely synonyms for 'the breach of international obligations'. "Thus the breach of any international obligation, whether it rests on *lex inter partes* of a treaty, a rule of international customary law or a general principle of law recognised by civilised nations, constitutes an international tort".[23] An international tort may therefore be defined as an unjustified, unpardoned, imputable and voluntary breach of an international obligation. In international law, however, the law of torts is confined to very general principles and is still in a process of development. The application of the principles of tortious liability to international situations is still in the stage of debate and experiment and abounds in unsettled and controversial questions. The progress made by international tribunals in developing international application of private law concepts has been less far-reaching in respect of matters of tort than in respect of matters of property, contract, succession, evidence, procedure and damages.[24] The absence of any clearly

20. Refer Schindler, "The Administration of Justice in the Swiss Federal Court in International Disputes", 15 *American Journal of International Law*, 1921, pp. 121-174.
21. 200 U.S. 496, 521. J.B. Scott, *Judicial Settlement*, 1918, Vol. II, p. 1464.
22. Schwarzenberger, *International Law*, 1957, Vol. I, p. 562.
23. *Ibid.*, p. 582.
24. For a study of the international applications of private law concepts refer Lauterpacht, *Private Law Sources & Analogies of International Law* (1927).

settled authorities on questions of tortious liability in international law, however, need not necessarily dispose of the matter. International law, like other branches of law and perhaps more so, is constantly developing and is influenced by new principles arising out of international relations. This century has seen great technological, scientific, political, economic and social changes and if the basic principles of domestic law have undergone drastic changes, there is no reason why international law should not develop in the same manner. The general theory of tortious liability in municipal law has been adapted in modern times to the needs of an industrialised society. In English law, for instance, 'the segregation of the law of tort from other parts of law is quite modern',[25] and it was in the first quarter of the twentieth century that the great English jurist, Sir Frederick Pollock, developed a general theory of tortious liability and formulated the new principles of toritous liability which were necessary to adapt the law of torts to the needs of an industrialized society.[26] Is it possible and desirable that international law on the subject may develop in the same manner? Sir Frederick Pollock has observed that "all members of a civilised commonwealth are under a general duty towards their neighbours to do them no hurt without lawful cause or excuse'.[27] Is the international community of sovereign States a 'Civilised Commonwealth' in this respect? Is there a place in contemporary international law for 'the general principle that one must not do unlawful harm to one's neighbours,'[28] and, if so, is there an international tort involving the legal liability of a State for damage caused by nuclear tests? It is submitted that there is nothing inherently unreasonable in the conception of such an international tort as there may well be an analogy with the liability for breach of absolute duties attached to the ownership and custody of dangerous things in municipal law. The proposition that harm to one's neighbours resulting from nuclear tests might be regarded as an international tort calls for fuller consideration.

During the last decade a radical change has taken place in the geography of international law as a result of the emergence of forty independent Asian African States, and if any new principles of international law are formulated, it will be necessary to take into

25. Winfield, *The Province of the Law of Tort* (1931), p. 8.
26. Refer Pollock, *The Law of Torts* (1929), Chapter I.
27. *Ibid.*, p. 1.
28. *Ibid.*, p. 6.

consideration not only the general principles of law of European countries to which international law had recourse in the past, but also the general principles of law of Asian African countries, such as traditional Islamic law, Japanese law, traditional Chinese law and African customary law. The formal definition of the sources of international law embodied in Article 38 of the Statute of the International Court has now won world-wide acceptance and 'the general principles of law recognised by civilised nations' are universally accepted as a third source of international law. Contemporary international law may accordingly be fertilized and progressively developed by recourse to the general principles of law of the major legal systems of Asia and Africa. As Professor Milton Katz, Director of International Legal Studies at Harvard University, so wisely said :

> Public international law represents essentially a limited part of the thought, and a limited part of the diplomatic experience, of a small number of Western European countries during the past three or four centuries. It is a limited and rudimentary legal system. Why not draw also on the experience of larger and more mature legal systems of, let us say, Japan, China, the Middle East, and India. Each of these legal systems represents an immense body of experience and the traditions and values of important and ancient civilizations. We feel that the contribution of law and lawyers to a just and workable international order will be greater if all of these legal systems are taken as our sources and not just a particular one to which the term' international law' has been traditionally applied.[29]

Therefore, as Roscoe Pound enunciated, "if we are to proceed wisely in creative juristic activity in the complex society of today, we must study scientifically the legal materials of the whole world".[30]

It is clear, therefore, that in cases where neither international convention nor custom furnish a satisfactory rule of law, a rule of international law may be deduced from the general principles of law recognised by civilised nations, and these principles include the general principles of law of all the major legal systems of the world. Can we accordingly deduce a sufficient consensus of general princi-

29. *Report of International Law Conference*, held at Niblett Hall, Inner Temple, London, June 1956, p. 41.
30. *Tulane Law Review*, Vol. 5, (1930), p. 15.