XXVIII
TECMUN Jr.

United Nations Scientific Committee on the Effects of Atomic Radiation

XXVIII TECMUN Jr.

Horario de sesiones

Miércoles 18 de noviembre	
Ceremonia de Inauguración	9:00 – 10:00 h.
Receso	10:00 – 10:30 h.
Primera Sesión	10:30 – 12:00 h.
Receso	12:00 – 12:30 h.
Segunda Sesión	12:30 – 14:00 h.
Comida	14:00 – 15:00 h.
Tercera Sesión	15:00 – 16:30 h.
Jueves 19 de noviembre	
Conferencia Magistral	8:30 – 9:30 h
Receso	9:30 – 10:00 h..
Cuarta Sesión	10:00 – 11:30 h.
Receso	11:30 – 12:00 h.
Quinta Sesión	12:00 – 13:30 h.
Comida	13:30 – 14:30 h.
Sexta Sesión	14:30 – 16:00 h.
Viernes 20 de noviembre	
Séptima Sesión	8:00 – 9:30 h.
Receso	9:30 – 10:00 h.
Octava Sesión	10:00 – 11:30 h.
Receso	11:30 – 12:00 h.
Novena Sesión	12:00 – 14:00 h.
Comida	14:00 – 15:00 h.
Ceremonia de Clausura	15:00 – 17:30 h.
TECMUN GLOOM[1]	18:00 – 19:00 h.

[1] TECMUN GLOOM es una experiencia únicamente para los delegados donde habrá actividades en las que los delegados y las mesas se podrán conocer.

Secretaria General: Nuria Vidal Castillo

ASAMBLEA GENERAL

Subsecretaria General: Aiko Valeria Aguilar Jiménez

Sesión Plenaria de la Asamblea General

Presidente: Javier Márquez Saucedo

A) Medidas para controlar la creciente crisis social en Estados Unidos de América con enfoque al reciente movimiento *Black Lives Matter*

B) Estrategias para la erradicación de los combates en el territorio de Libia provocados por los grupos del Gobierno de Acuerdo Nacional y el Ejército Nacional Libio

Primera Comisión de Desarme y Seguridad Internacional

Presidenta: Daniela Mejía Salgado

A) Medidas para regular la fabricación, comercialización y el uso de armas letales autónomas (LAWS) para evitar una futura carrera armamentística a través de un marco legal a nivel internacional

B) Estrategias para evitar la militarización del océano Ártico como producto de nuevas rutas de navegación

Organización Internacional para las Migraciones

Presidente: Manuel Alejandro Rosales Portillo

A) Medidas para asegurar la integridad del pueblo migrante de Rohingya en su proceso de traslado hacia Bangladesh

B) Problemáticas de la migración norcoreana causadas por el gobierno de la República Popular Democrática de Corea

United Nations Office of the High Commissioner for Human Rights

Presidente: Germán Osvaldo Nuñez Benitez

A) Suppression from the government of the People's Republic of China upon human rights, focusing on the use of economic power, censorship, indoctrination and heavy surveillance in Xinjiang

B) Oppression of women, the LGBT+ community and civil society activists in Iran, focused on the extreme measures applied by the national penal code and the Supreme Court

Organización Mundial de la Salud

Presidente: Ángel Daniel González Jasso

A) Estrategias para una segura reactivación de la economía en países de América Latina y El Caribe ante la reciente crisis causada por el COVID-19

B) Medidas para mejorar los servicios de salud pública en Yemen a causa de la presente catástrofe humanitaria

United Nations Committee on the Peaceful Uses of Outer Space

Presidenta: Alejandra Bañuelos González

A) Measures for the regulation of space tourism and passenger safety

B) The increasing threat to the global astronomic and space observation community from the rise of satellite constellations and the number of space debris

CONSEJO ECONÓMICO Y SOCIAL

Subsecretario General: Armando Daniel Navarro Sánchez

Fondo de las Naciones Unidas para la Infancia

Presidenta: Sofía Victoria Solís Uribe

A) Estrategias para brindar apoyo y medidas adecuadas de salubridad y nutrición a niños desterrados a causa del conflicto bélico en la República Árabe Siria

B) Medidas para prevenir la existencia del matrimonio infantil forzado y sus consecuencias en las niñas con enfoque en África Occidental

Programa de las Naciones Unidas para el Medio Ambiente

Presidente: Arturo Rubio Díaz Vázquez

A) Medidas para evitar la sexta extinción masiva de fauna silvestre con énfasis en los incendios del bosque tropical de la Amazonia y el bosque de Malacura en Australia

B) Medidas para disminuir la pérdida de agua potable causadas por el fenómeno de la industria de la moda rápida en la República Popular China y la República Popular de Bangladesh

International Criminal Police Organization

Presidenta: Andrea Michelle Martínez Lozano

A) Measures to contain and dismantle the triads, the Korean criminal organizations, and groups of organized crime in the Golden Triangle

B) Strategies to prevent radical acts that involve the use of chemical and nuclear weapons by extremist groups, focusing on the Middle East

Commission on the Status of Women

Presidenta: María Fernanda Casillas Monroy

A) Measures for the attention of female victims of acid attacks due to its accessibility in the Middle East and United Kingdom with emphasis on the social consequences

B) Measures to provide opportune prevention and support for women affected by female genital mutilation as sexual repression in regions of Northern and Western Africa

Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura

Presidenta: Samaria Sánchez Ramírez

A) Acciones para garantizar un avance en materia de equidad e igualdad de género educativa ante situaciones de crisis en países de América Latina y el Caribe

B) Medidas para asegurar la libertad de expresión y estabilidad artística, como parte de la diversidad cultural, ante la pandemia de COVID-19 con enfoque en América Latina y el Caribe

United Nations World Tourism Organization

Presidenta: Rebeca Ávila Delgado

A) Measures to improve the development of alternative touristic areas in Latin American local communities and get rid of overtourism

B) Measures to reactivate the Latin American tourism sector after the global pandemic caused by the spread of COVID-19

Commission Économique des Nations Unies pour l'Europe

Presidenta:Lianny Hernández Pérez

A) Stratégies pour la protection et le placement des réfugiés Syriens en Europe pour éviter des problèmes sociaux et économiques dans l'Union Européenne, en mettant l'accent sur la République Fédérale d'Allemagne

B) Le développement des politiques pour soutenir la promotion de l'indépendance économique des femmes et l'éradication du fossé salarial dans les pays sous-développés de l'Europe du sud-est

AGENCIAS ESPECIALIZADAS Y ORGANISMOS REGIONALES

Subsecretaria General: Montserrat Olivas Ramos

Organización de los Estados Americanos

Presidenta: Paola González Zapata

A) Repercusiones sociales y políticas tras la censura de medios de comunicación en México, con énfasis en la persecución de periodistas por grupos de narcotráfico

B) El neocolonialismo como un obstáculo para el desarrollo económico de las comunidades indígenas en América Latina

Comisión de Prevención del Delito y Justicia Penal

Presidente: Victor Daniel Meza Castillo

A) Estrategias para mejorar el estado de derecho y reducir la impunidad de las autoridades latinoamericanas con enfoque en la violación de derechos humanos y la ineficacia de las garantías constitucionales presentes en los movimientos sociales
B) Medidas para erradicar las prácticas de tortura en las cárceles africanas con base en Las Reglas Mínimas de las Naciones Unidas para el Tratamiento de Reclusos

United Nations Scientific Committee on the Effects of Atomic Radiation

Presidente: Santiago Makoszay Castañón

A) Measures to ensure radiation protection in case of a nuclear reactor accident. A study based on novel information on the effects and risks of radiation exposure due to the accident at the Fukushima Daiichi nuclear power station
B) Assessment of the biological mechanisms relevant to the inference of cancer risk after exposure to low-dose radiation

North Atlantic Treaty Organization

Presidenta: Mariana Cortés Gallardo

A) Political and military measures to prevent further naval and territorial conflicts between Ukraine and Russia
B) Reaffirm diplomatic and military strategies to increase the security of Afghanistan's inhabitants facing the current terrorist attacks by the Taliban

Security Council

Presidenta: Vanessa Arroyo Jerez

A) Strategies to suppress the resurgence of the Islamic State in the Syrian Arab Republic and the Republic of Iraq
B) Prevention mechanisms against the illicit trafficking of nuclear material within the Black Sea region

International Court of Justice

Presidenta: Carolina Elizabeth Vásquez Regalado

A) Relocation of the United States Embassy to Jerusalem (Palestine v. United States of America)

B) Application of the Convention on the Prevention and Punishment of the Crime of Genocide (The Gambia v. Myanmar)

"Make the most of yourself by fanning the tiny, inner sparks of possibility into flames of achievement".
-Golda Meir.

Delegada/o, Ministra/o, Juez,

Lo peor que puedes hacer es subordinarte al contexto en el que resides. Esta es tu oportunidad de demostrarte que por medio de tu investigación, ideas, trabajo e innovación puedes y vas a cambiar al mundo. Entre más conocimiento adquieres, más te das cuenta de que la sociedad en la que vivimos está lejos de ser perfecta. Lo que necesita un mundo en crisis es a personas como tú que están dispuestas a alzar la voz en contra de injusticias, violencia, inequidad, fobias, machismo, entre muchas otras cosas. Necesita a personas que, a pesar de vivir durante una pandemia mundial, toma tres días para participar en un modelo en línea. Sé esa persona que el mundo anhela, esa persona que va siempre un paso más allá.

Este modelo es una muy pequeña representación de lo que en verdad está sucediendo alrededor del mundo y que decidimos ignorar porque vivimos en una posición de privilegio donde podemos asumir que nada ni nadie nos va a hacer daño; Sin embargo, como el último año nos ha demostrado, esto puede cambiar en cuestión de segundos. Así que aprovecha y toma ventaja de tu posición de privilegio y de todas las oportunidades que se te presentan gracias a ella. Porque si decides ignorar los problemas, te conviertes en una gran parte de ellos. Pelea con todo lo que tengas por lo que crees y sé la voz por los que son silenciados. Cualquiera puede quitarte lo que sea, menos el poder de alzar tu voz.

Delegada/o Ministra/o, Juez, es tu oportunidad de pensar fuera del estatus quo, de romper tus estándares y esos de toda la gente que te rodea, de ser tú misma o mismo, de romper o mejorar el sistema, de expresar tus ideas únicas y creativas y de salir de tu zona de confort que lo único que te está haciendo es nublarte. Sí, da miedo, pero no dejes que esos pensamientos frenen tu capacidad de expresarte; Úsalos a tu favor y véncelos, porque la falta de confianza, la duda y el miedo siempre van a ser las cosas más difíciles de sobrellevar, pero, el hacerlo genera el verdadero cambio. Espero que confíes en el modelo y en el Secretariado, pero especialmente, espero que confíes en ti, que abras tu mente, que aprendas sobre una gran variedad de temas, que salgas de este modelo con una visión completamente distinta del mundo a la que tenías antes. Quiero que salgas con la capacidad de analizar críticamente y empatizar con otras personas y situaciones para que llegues a tener la habilidad de resolver estos problemas de la mejor manera posible no solo dentro de las salas de debate, sino en la vida real.

Finalmente, quiero que aproveches el momento, tu momento. Lucha contra el problema y haz la diferencia en esa sala de debate, porque esta es una simulación del mundo real, y lo que hagas ahí dentro representa lo que haces y harás por el mundo si no permites que se quede en esas 4 paredes. Recuerda que no hay experiencias que se repitan dos veces y que la que estás a punto de vivir, te marcará de por vida. Confío en ti y en tu capacidad, porque estás aquí por una razón; porque hay una chispa en ti esperando ser encendida y puede que esta sea tu única oportunidad de hacerlo. El mundo está en las manos de ti, de la juventud; si no aprendemos a tomar ventaja de esto y hacer del planeta un mejor lugar, nadie lo va a hacer. Encuéntrate en esta experiencia y cree en ti, en lo que puedes aportar al modelo y en el gran impacto que esto tendrá en las personas, porque yo te aseguro que confío ciegamente en ti.

Nuria Vidal Castillo
Secretary General for the
XXVIII TECMUN Jr.

“Unless someone like you cares a whole awful lot, nothing is going to get better, It's not.”

-Dr Seuss, The Lorax.

Dear judges, delegates, ministers and doctors,

Welcome to another edition to the best thing that happened in my life, another edition of a model that marks paths in the life of many ones that are or were part of it, another edition of the forum where you can raise your voice and advocate for a better world, welcome to TECMUN. Thank you all for being here in the AEOR division, the most unique part that this model has. Prepare yourself to take on this new challenge. During three days in these virtual mode, you are going to be the agent of change that is going to make a difference. They are so many atrocities occurring nowadays. Crimes against humanity, genocides, war crimes and aggression happening in Sudan, Peru, Colombia, South Africa, Mexico, and all around the world, reflect what we as human beings are doing wrong. Now is the time change, to take the reins, step out of our comfort zone and do something to fix our mess up world.

“There comes a time when we hear a certain call when the world must come together as one [...]” Few people listen to this call, and fewer are the ones that answer to it. As individuals with privileges, it's our duty to attend this call, to stand for rights things and fight for it, to make a better place for both weak and strong. Maybe sometimes we feel minuscule compared to the magnitude of the atrocities or simply unable to solve them. Sometimes we feel that our voice will not be heard or that our actions aren't going to transcend and we are not going to make a change. Throughout my short life, I discover that we are the only ones that limit our potential, maybe for others we are like superheroes at the time we think we aren't enough. It's only when someone believes in us and gave us support, at that moment we recover our confidence, we open our eyes and have faith in ourselves. We start to make a change because we know we are enough and capable of it. In this moment for these three days I want to be that someone for you, you are immense to me. You just have to believe in yourself to begin the change. Take advantage of the privilege you were born with and make more people have the same opportunities that you have now. Don't let all your work on a resolution paper or an empty verdict, attend the call. I really hope you are ready to face this big challenge, becoming the responsable one of our world and reality.

Montserrat Olivas Ramos

Subsecretary for the Special Agencies and Regional Organisms

for the XXVIII TECMUN Jr

Dear Delegates,

You will always find a great quantity of events and occurrences happening around you, in your local communities, country, in the world. Sometimes you will not be able to make sense of most of them. It can honestly feel overwhelming. Nevertheless, you do not need to. I can assure you that all of the world's ailments cannot be understood and solved by one person alone. This is, however, not a problem. There are plenty of people on this planet, each one of us with a unique perspective of our reality. Each one possessing a different cultural, ideological and technical background, all of us capable of communicating. Language and communication has been one of humanity's great tools to generate incredible change. It might be one of the few feats that can distinguish us from other species. The capability to establish these channels of communication enable innovation and collaboration. We can all help solve one, or many, of the problems our current society faces from our own stands. The first step you can take towards this path of action: listen carefully, speak up, share your experiences and knowledge, propose ideas.

A Model United Nations is a great place where you can start to do that. It is your opportunity to research pressing topics, analyse and reflect upon what you find. If you are lucky, you will even have a chance to represent a country you have not heard about. Afterwards, you will have a chance to share what you have learned, learn from others, and establish a discussion towards the creation of a resolution. If you have been observant, I can assure you have identified areas of opportunity in the ways our governors and policymakers go about. Now is your opportunity to make that right for three days and try and be a catalizer for change. Get involved. Be passionate. Forget indifference. I invite you to try it at least for these three days. Beware, after TECMUN, you might care a whole lot more about the World, which can be tiring, I will not lie to you.

In UNSCEAR, you will have a chance to get yourself closer with science. You will have an opportunity to approximate yourself to the rigour by which researchers conduct themselves. Take it. If you enjoy getting to know about how the world works, welcome ;)

Santiago Makoszay Castañón

President of the United Nations Scientific Committee on the Effects of Atomic Radiation

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United Nations Scientific Committee on the Effects of Atomic Radiation Background

Established in 1955 by the General Assembly, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) is to the task of assessing and reporting levels and effects of exposure to ionizing radiation. As such, national governments and institutions rely on the Committee's scientific determinations regarding radiation risk to authorize protective measures. In order to fulfill its objectives, the General Assembly designated 27 countries to provide the scientists that will research the information submitted by Member States and both, international and non-governmental organizations. Each year the Secretariat, whose siege is in Vienna linked to UN Environment, organizes the sessions and manages the documents that will be scrutinized.

Faculties

Representing a world authority on global levels and effects of ionizing radiation, UNSCEAR reviews new information and synthesizes it in a coherent report useful for policymakers and other stakeholders. Within its mandate, the committee is requested to:

- Receive and assemble in a useful form reports on levels of ionizing radiation present in the environment, as well as reports on the effects.
- Recommend uniform standards in regards to procedures for collection and counting of radioactive material in sample analysis.
- Make yearly progress on conclusions obtained from the reports received on levels and effects of ionizing radiation in humans and their environment, as well as transmitting them for publication.

Topic A

Measures to ensure radiation protection in case of a nuclear reactor accident. A study based on novel information on the effects and risks of radiation exposure due to the accident at the Fukushima Daiichi nuclear power station

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By:Santiago Makoszay Castañón
Ximena Bretón de la Torre
Rodrigo Arroyo Oropeza

Introduction

On 11 March 2011, following a major earthquake, a 15-meter tsunami disabled the power supply and cooling of three Fukushima Daiichi reactors, causing a nuclear accident. All three cores largely melted[2] in the first three days. UNSCEAR assessed radiation exposures of the public, workers, and non-human biota that resulted from the accident at the Fukushima Daiichi nuclear power station and reported its findings, including a discussion of the associated risks and effects to the General Assembly and in a full UNSCEAR 2013 Report in April 2014. It was determined that the health-related risks associated with certain population groups are quite lower than those determined for the Chernobyl accident. However, since then there have been more research documents published that might elucidate possible effects and risks, so an overview assessment of radiation protection measures becomes increasingly relevant as well.

Since the accident took place, many measures were taken to ensure health-related safety for the population that was exposed and to address the underlying risks of ionizing radiation[3]. Some of them, such as the removal and containment of exposed surface soil, appear to have been successful in coping with the disaster. However, as more information is revealed, the measures to ensure safety and reduce risks must be reviewed, as there could be more accurate or better strategies. Moreover, the novel scientific information that is available might pinpoint new effects and risks that might not have been anticipated with the resources that were at hand. For instance, at the moment more data is present to certainly determine whether an increase in pathological phenomena[4], like thyroid cancer among young people,

[2] Severe nuclear reactor accident that results in core damage from overheating.
[3] Ionizing radiation is radiation with enough energy so that during an interaction with an atom, it can remove tightly bound electrons from the orbit of an atom, causing the atom to become charged or ionized.
[4] Involving, caused by, or of the nature of a physical or mental disease.

can be attributed to the accident. Both measures to address any existing complications, as well as preventive measures for future similar situations should be regarded.

Synthesis of UNSCEAR 2013 Report on levels and effects of radiation exposure due to the Fukushima Daiichi nuclear accident

The destructive earthquake and subsequent tsunami near Honshu, Japan led to the worst civil nuclear disaster since Chernobyl in 1986. The loss of electrical power ultimately produced severe core damage to three of the six nuclear reactors; this resulted in the release of very large amounts of radiation to the environment over a prolonged period. The Government recommended the relocation of about 78,000 people living in a 20-km radius of the power plant. In April due to the soil radiation, it was further recommended that 10,000 more people living in the north-west area of the accident were relocated. These very measures reduced by a factor of 10 the exposure that would have been otherwise been inflicted on the people living in the region.

The information reviewed by the committee at that time implied the release to the environment of iodine-131[5] and caesium-137[6] within the ranges of 100 to 500 petabecquerels (PBq)[7] and 6 to 20 PBq, respectively. These were the estimates used by the Committee to further estate implications of the accident. These estimates, however, are lower by a factor of 10 and 5 respectively to those resulting from the Chernobyl accident. The atmospheric release was also transported to the Pacific Ocean by the action of wind. Additionally, liquid discharges, amounting to 10 and 50 percent of the corresponding atmospheric discharges

[5] Iodine 131 is a radioisotope with a very short half-life of 8.02 days, making it highly radioactive.

[6] Radiocaesium, is a radioactive isotope of caesium which is formed as one of the more common fission products by the nuclear fission of uranium-235 and other fissionable isotopes in nuclear reactors and nuclear weapons.

[7] The becquerel is the SI derived unit of radioactivity.

(iodine-131 and caesium-137, respectively), were directly released to the surrounding marine bodies. Until May 2013, lower-level releases into the ocean were still ongoing.

Dose assessments were centered in those two radionuclides[8], iodine-131 presenting a half-life of 8 days, while caesium-137 has a much longer half-life of 30 years. Both the affected tissues, as well as the exposure time of the two isotopes were quite different. In the case of iodine-131, the dose was primarily delivered and accumulated for a few weeks in the thyroid gland. Contrastingly, caesium-137 was mostly deposited on the ground and inflicts exposure to the whole body over the decaying period. Consequently, the Committee's main evaluation was based on the monitoring of occupationally exposed workers' and emergency personnel's external and internal exposures. At the time of the evaluation, few direct measurements of internal exposures were available and therefore, the Committee out of necessity relied on various models to determine present and future doses among the population based on the presence and transfer of radioactive materials in the environment. According to these estimations, the effective dose to the population who resided within the evacuation zone was on average, less than 10 mSv before and during the evacuation, while the dose of radiation from naturally occurring sources is, on average, about 2.1 millisieverts (mSv) annually. The corresponding estimated average radiation absorbed by the thyroid gland was up to about 35 mGy while the annual amount absorbed from naturally occurring sources is typically about 1 mGy. Although with considerable variation among individuals, the effective dose for children was about twice that of adults, with about 80 mGy absorbed by the thyroid, about half of which was caused by the ingestion of radioactive materials in food. The radiation received by people living in districts nearby or elsewhere in Japan vary, the highest being for people living in Fukushima city where they absorbed about 4 mSv during

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the following year (about twice as much for 1-year-old infants). In case that no remediation measures are taken, the estimated lifetime effective dose for people continuing to reside in the Fukushima prefecture was of about 10 mSv; the main source being external radiation from deposited radioactive material. Variations of the average values arise from differences in habits and geographical locations. Notwithstanding, some information regarding direct measurements of internal doses was available shortly after the evaluation, and thus, the Committee considers dose values might have been overestimated. For workers involved in mitigation, contractors reported effective doses of about 12 mSv over the 19 months after the accident. From the examination of data reported on the internal exposure for the most exposed workers, the Committee confirmed they absorbed doses to the thyroid in the range of 2 to 12 Gy.

At the time when the Report was written, no radiation-related deaths or acute diseases had been observed among the workers and the general public exposed to radiation from the accident. Consequently, no discernible increased incidence of radiation-related health consequences was expected among exposed members of the public. While it is inferred by models an increased cancer risk, due to the time elapsed until the evaluation, cancers induced by radiation were indistinguishable. Particularly, an increase in the risk of thyroid cancer among children was inferred although the number of them who were severely exposed was not known. For the most exposed workers, and an increase in thyroid cancer and other thyroid disorders is expected, as well as an overall cancer risk. Due to the uncertainty arising from the statistical fluctuation of cancer, these workers were set to continue being especially examined for any radiation-related health effects. In October 2011, health agencies began with the Fukushima Health Management Survey covering the 2 million people residing in the Fukushima prefecture at the time of the accident and were set to continue for 30 years. The

survey was accompanied by the use of modern high-efficiency ultrasonography. The health effects for non-human biota were also revised by the Committee, although the significance that radiation might have was unclear because of low exposures and lack of monitoring. However, it was concluded that any effects will be restricted to a limited area were most radioactive releases, and deposition took place.

Measures to prevent and remediate the effects and risks of radiation exposure since 2011

Following the nuclear accident on 11 March, later that day the Japanese Government declared a nuclear emergency. Initially, Prime Minister Naoto Kan stated instruction for the population of approximately 1,864 people residing within a 20 kilometers radius around the Fukushima Daiichi nuclear plant to leave and be relocated. Afterward, 5,800 people more people from an extension of 10 kilometers were evacuated, and residents of neighboring areas were urged to stay inside their homes. At the possibility of a meltdown, between 150,000 - 200,000 people were evacuated by 13 March and a no-fly zone over the evacuated area was established. On 22 April, the evacuation zone was extended to an irregular zone including the area northwest of the reactors. Measures regarding the return of people to their original homes within the evacuation zone varied among districts. For instance, in the Miyakoji district residents were allowed to return in mid-August 2013 and were offered a dosimeter to monitor themselves radiation levels; this despite the range between 0.32 and 0.54 microsieverts per hour instead of the government's goal of 0.23 microsieverts per hour.

An effort to decontaminate some areas around the nuclear plant was set in place, however, claims state that radioactive waste was not collected and disposed of properly, leaving it in the natural medium. By March 2012, a gamma radiation camera prototype was presented by the Japan Aerospace Exploration Agency and the Japan Atomic Energy Agency to help in the efforts of decontamination. Overall, the disposal of debris and rubble from the

accident site demonstrated to be quite difficult. Very few municipalities reported being willing to accept take part of the debris. A year after the incident, there was a necessity of disposing of about 4.88 million tons of rubble and around 20.5 million tons was collected in Iwate and Miyagi, and stored at multiple temporary storage sites; thereafter Tokyo also agreed to accept debris. To abide by its temporary state, storage facilities built near the power plant were set to be closed after 30 years.

New information on the effects of radiation exposure since the 2013 Report

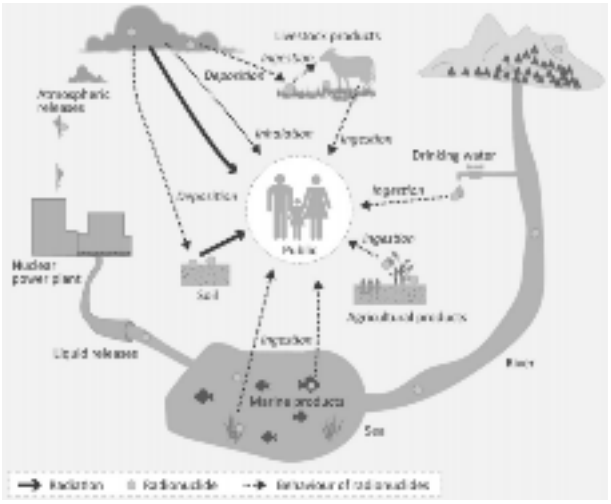
The Fukushima Daiichi accident resulted in the release of radionuclides to the environment. Since the 2013 Report, assessments of the releases have been performed by many organizations, such as WHO, ICRP, FAO, and WMO; each one using different models, which results are established in the IAEA Report (2011). The main approaches of the new findings are Releases, dispersion, and deposition in terrestrial and oceanic environments; public exposures, and health effects.

The Fukushima Daiichi Accident Report (IAEA Report) presented new estimates in the number of gases that were released to the atmosphere and into the sea in the early phase of the accident. According to established mathematical models and associated computer codes the releases are estimated to be approximately one-tenth of the releases from the accident in Chernobyl. Noble gases were a significant part of the releases such as Kr and Xe. Most of the atmospheric releases dispersed over the North Pacific Ocean fell on the oceanic surface layer, but also the direct releases and discharges into the sea at the site created highly radioactive water in the Fukushima Prefecture.

Many theoretical models have been used to estimate the dispersion pattern of activity concentrations of I and Cs in the environment and to determine the effects in air soil, seawater, sediments, and biota. Highly sensitive radiation monitoring networks detected

extremely low levels of atmospheric radioactivity and the effects of these releases on the global environmental background radioactivity were negligible. However, most of the released and discharged radionuclides that entered into the sea were transported over large distances via the North Pacific Ocean gyre or sometimes through oceanic biota.

Figure 1. Diagram of the movement of radionuclides through the ecosystem.



One of the most relevant findings was that the affected areas with the most higher levels of terrestrial deposition were transferring radionuclides to food products and other daily use items. This was caused by the radiation left in oceans and land near the Fukushima Prefecture, making that the people exposed to external and internal radiation doses. In the short term, the most significant contributors to the exposure of the public were: external exposure from radionuclides in the plume and deposited on the ground; and internal exposure of the thyroid gland, due to the intake of I. In the long term, the most important contributor to the exposure of the public will be external radiation from the deposited Cs.

Radiation exposure can induce health effects caused by the killing of cells. The severity of these effects increases with dose, and they can range from skin injuries to the collapse of vital tissues. The available information indicates that no individual received a dose at or above

threshold levels to cause acute radiation effects, eliminating any early radiation health effect. The potential for radiation effects in children and fetus is an issue of special concern, and are considered an exposed population. A prenatal effect of exposure is a term used to refer to the effects of radiation on the embryo and fetus. To manage the effects of the accident, the Fukushima Health Management created a survey to collect data that might improve obstetrical and prenatal care and to support women who were pregnant or gave birth in Fukushima Prefecture following the accident. Other arrangements are been done to lower the risk of radiation exposure.

New information on the risks of radiation exposure since the 2013 Report

New scientific sources since 2013 regarding the transfer of radionuclides in terrestrial and freshwater environments were focused on the transfer pathways of radiocaesium to food products, which had made the dominant contribution to ingestion doses after the first year. According to the studies by Lepage et al. and Matsuda et al., most radiocaesium remained in the upper 5 cm of soil, including soils used for crop production. Moreover, the studies of Uematsu et al. and Nakao et al. suggest that factors such as the amounts of micaceous clay minerals and organic matter present greatly influence the extent of binding of radiocaesium in soil. They also present evidence supporting that volcanic ash soils lower the binding of radiocaesium in soils and therefore might produce a higher uptake of radiocaesium by plants. Furthermore, new papers now suggest that the concentration ratio for brown rice may have been higher by up to an order of magnitude in the first couple of years. Contrasting with the estimation of the 2013 Report, a study by Sato et al. reported values higher by between 1.6 and 16 times of concentration ratios for different types of fruit. In the same way, research by Kusaba et al. suggest that radiocaesium deposition by adherence to bark surfaces was a greater source than deposition in soil. In the town of Okuma, Ohse et al. reported

radiocaesium concentration ratios by up to a factor of 20 for a range of crops, including eggplant, pumpkin, soybean, and cabbage, grown in highly contaminated soil. Concerning food products that were not taken into consideration in the 2013 Report, studies by Tsuboi et al. and Matsuda et al. suggest that radiocaesium concentration in freshwater bodies (affecting the intake of fish, e.g. Ayu fish) correlate to that of nearby surface soils.

With regards to the effective doses for the public population new information supports the findings of the 2013 Report, including the statement acknowledging an overestimation of values. Despite this, there is continued research necessary for the determination of effects and measures to prevent radiation exposure for the public, for instance, shielding parameters of buildings, recommended time spent outdoors, and food distribution and consumption. Differently, considerable changes have been reported in doses estimated for workers since the 2013 report although they are not expected to affect its main findings. There have also been studies that appear to challenge the Committee's estimations regarding thyroid cancer risk, though the information is largely not reliable and needs further evaluation. Likewise, a close constant revision of the Fukushima Health Survey and related research is required to re-evaluate the Committee's estimations. As for the interpretation of doses and effects in non-human biota, there is a requirement for research that takes into account the complex biological relations of biota within ecosystems.

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Topic B

Assessment of the biological mechanisms relevant to the inference of cancer risk after exposure to low-dose radiation

By: Santiago Makoszay Castañón

Introduction

It has been shown that there exist health impacts on humans related to the exposure of low-dose ionizing radiation in fields such as X-ray imaging, radiation therapy, and nuclear power. There is no clear scientific consensus regarding the health effects of low-dose radiation exposure. However, it has been shown that in some cases there is an induction of cancer, for example, secondary cancer as a long-term side effect for oncologic patients treated with radiation. Epidemiological data and research suggest that the risk resulting from exposure of healthy tissues to low dose radiation can be greater than the risk calculated from the linear no-threshold model, which poses a series of dangers. Due to this uncertain situation, greater assessment of the biological mechanisms that enable the inference of cancer in such circumstances is needed to reach conclusive determination and establish protective measures.

As such, the topic should be centered around the scientific analysis of existing data concerning the biological basis of medical inference of cancer in patients exposed to low-dose radiation. Cases of ionizing radiation resulting from medical purposes, as well as other situations presenting low-dose, should be taken into account. Ultimately specific, relevant, and useful biological mechanisms should be pinpointed in order to provide a certain guideline to the scientific and medical institutions as a basis for further research and diagnostics. Based on the scientific resolutions, the debate should also be able to yield concrete information to support whether low-dose radiation holds risks of evolving cancer. Consequently, strategies and measures could be suggested to national governments in the interest of protecting human health.

Background

Since 1993 the Committee has been assessing the biological mechanisms that underlie health risks associated with low-dose ionizing radiation, focusing on two health endpoints: cancer and heritable effects. These two are considered important not only by the Committee but also by other bodies such as the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) in the US. As such, relevant topics have been evaluated by the Committee the results of which have been estated in UNSCEAR Report of 1993, 1994, 2000, 2001, and 2006 covering: Mechanisms of radiation oncogenesis; Adaptive responses to radiation in cells and organisms; DNA repair and mutagenesis, and Biological effects at low radiation doses; Hereditary effects of radiation; and Non-targeted and delayed effects of exposure to ionizing radiation, respectively. Whilst the scientific efforts were placed towards cancer and other heritable diseases, the Committee's conclusions might be relevant to other pathologies.

Moreover, historically the Committee had defined low doses, like those of 200 mSv or less and low dose rates as 0.1 mGy/min or less for low-LET radiation, and more recently it has been agreed that they might be defined as those of 100 mSv or less. This measure is consistent with the judgments from the ICRP and the BEIR VII report. As many contemporary fields, experimental biology experiences a rapid development in novel knowledge and techniques, and therefore it is of utmost importance to continue to promote such research and assess it as part of the Committee's undertakings. Consequently, applying such breakthroughs to radiobiology has started to provide new insight into the mechanisms of radiation action. Ultimately, biological comprehension is essential for an incomplete understanding of the mechanisms of radiation action at low doses is a major contributor to the current uncertainty on low-dose risk estimates.

Some of the past judgments made by the Committee regarding radiation carcinogenesis may be summarized as follows:

- Radiation acts primarily by inducing DNA damage in somatic cells. There exist two main ways in which this can occur, by the action of direct energy deposition in DNA or through the indirect action of free radicals. Both will produce a variety of DNA lesions. However, double-strand breaks (DSB) and complex lesions[9] in DNA are likely to be most important in causing long-lived mutations.
- Systems exist to repair damage in nuclear DNA. However, no repair is completely error free, although some repair systems tend to be more error-prone than others (e.g. repair of double-strand breaks in DNA are more error-prone than single-strand breaks, as well as non-homologous end-joining DSB repair system). Therefore even the lowest doses of radiation may induce DNA damage that may be converted into DNA sequence mutations.
- Cancer develops from mutations by DNA damage in single cells. Either directly or following the accumulation of additional mutations or epigenetic changes, such cells gain growth advantages and progress to a proliferative and ultimately malignant tumour. Radiation is judged to act most commonly by inducing initiating mutations in proto-oncogenes or in tumour suppressor genes. Radiation can also induce apoptosis and influence cell-cycle checkpoints, which together can affect the outcome of radiation exposure. Most evidence suggests that DNA deletions are the major contributors to the mutations driving radiation carcinogenesis.

[9] **complex lesions in DNA:** consisting of multiple lesions in close proximity (UNSCEAR, 2012).

- It was recognized that the progression and clonal development of cancers may be subject to modulating activities including immunosurveillance, but there remains uncertainty on the impact of such processes.
- With regard to other potential risk modulating processes, notably adaptive responses to radiation, whereby small radiation exposures may serve to reduce the effect of subsequent higher dose exposures, the Committee remained cautious in drawing conclusions from the available data.

In somatic carcinogenesis, radiation-induced initiating events are but one of many steps required for tumour formation. By contrast, direct induction of mutations in the germline, where compatible with viability, will directly contribute to the burden of heritable mutations and possible heritable disease. The Committee also judged that absorbed dose is the most appropriate exposure quantity to use in assessing the health effects of ionizing radiation. In particular, when considering the effects of exposure to high-LET radiation the distribution of dose within a tissue, cell, or cell compartment becomes more important for correct interpretation of experimental results from studies of radiation action. On the other hand, the judgment of the Committee in 2006 was that non-targeted and delayed effects of radiation may be associated with radiation disease but no evidence for disease causation was found. In 2006 the Committee also provided an assessment of the effects of ionizing radiation on the immune system. The immune system could act to modify cancer risk if radiation exposure served to enhance or diminish the capacity of the body to mount an immune response against developing cancers, be they ‘spontaneous’ or radiation-induced

Next, a summary of the newer major developments in radiobiology as they relate to evaluating the risk of health effects at low doses will be presented. This with the hopes that they will function as a useful basis for identifying mechanisms influenced by cancer in

low-dose radiation environments. Furthermore, the following information attempts to provide the state of knowledge and horizon scanning to foster informed consideration of the areas of review when it comes to monitoring cancer development in such situations.

Genomic instability[10]

A long-term study of C3H mice exposed to γ-rays at low dose-rate (20–200 mGy/day) identified that indirect effects of radiation contributed to the induction of complex chromosomal aberrations in spleen cells. Transgenerational induction of chromosomal instability has also been documented in female rats irradiated with 5 Gy of X-rays. These studies provide evidence for the induction of transmissible genomic instability by radiation in mice.

A few reports suggest that genomic instability can be induced by low doses of low-LET radiation, although the data is presented without statistical analysis. By contrast, robust reports suggest that instability is not induced by doses of less than 0.1–0.2 Gy, and in some cases higher doses, of low-LET irradiation either in vivo or in vitro, except in transformed or otherwise abnormal cells. Moreover, recent reviews of the experimental literature indicate a likely threshold for the induction of transmissible instability of 0.5 Gy low-LET radiation, and recent reports confirm this conclusion. Generally, highLET radiation is considered to be more effective at inducing transmissible instability than lowLET radiation.

Comparison of the induction of instability in a DNA double-strand break repair mutant, a base excision repair mutant, and wild-type hamster cells suggested that the base excision repair pathway was most effective at preventing instability. This indicates that single-stranded breaks and/or oxidized base damage are key drivers of transmissible

[10] **genomic instability:** Persistent formation of genetic alterations (commonly mutations or chromosomal aberrations) over many postirradiation cell generations (UNSCEAR, 2012).

instability induced by radiation. Therefore the nature of directly-induced damage and a reduced ability to repair base and single-stranded DNA damage may promote instability. In addition to direct DNA damage, chromatin-based epigenetic modification has been proposed to play a role in the promotion and maintenance of transmissible instability.

To summarize, some additional data from model systems suggest that radiation can induce transmissible instability in vivo. However, the evidence base in total remains mixed. Data that provide evidence of radiation-induced transmissible instability in humans in vivo are very sparse. Some positive studies exist with high dose exposures but negative findings continue to emerge. DNA structures (telomeres specifically), the epigenetic state of chromatin, and persistent induction of free radical damage to DNA have been implicated to be of mechanistic importance. It seems likely that there are multiple transmissible instabilities that require improved functional definition and understanding of mechanisms before their importance for radiation-induced health effects can be properly assessed. The emerging consensus that a threshold dose of around 0.5 Gy of low-LET radiation exists for the induction of transmissible instability is potentially important as it strongly suggests that radiation-induced transmissible instability does not contribute to the development of health effects resulting from low doses of low-LET radiation.

Bystander effects[11] and abscopal effects[12]

Evidence for long-distance bystander communication in vivo comes from mouse shielded irradiation studies of DNA damage and DNA methylation in skin and spleen. It has also been reported to lead to changes in spleen micro-RNA expression and changes in methylation in transmissible ESTR instability, which can better be defined as abscopal effects. There is now

[11] **bystander effects:** Effect observed in non-irradiated cells surrounding cells that were directly irradiated (UNSCEAR, 2012).

[12] **abscopal effects:** A radiation effect in a non-irradiated tissue distant from the irradiated tissue (UNSCEAR, 2012).

better evidence for bystander signalling in vivo and this could conceivably modulate cancer risk. However, it has yet to be established whether bystander signalling increases or diminishes risk; there is no consensus. Reasonably strong evidence for the involvement of radical mediated signalling is available and DNA double strand break metabolism in cells responding to bystander signals must be involved. However, it should be noted that reports of studies that fail to observe bystander effects continue to appear including in vivo studies and these do not seem to suffer from obvious deficiencies in experimental design. It is also important to note that in addition to ionizing radiation, a number of other agents have been reported to induce bystander-type responses. These include ultraviolet radiation, hea, medium from cancerous cells, changes in pH, detergents and mechanical stress and treatment with TGFβ. These studies suggest that ionizing radiation-induced bystander effects reflect a general stress response. If confirmed, this then may have implications for the significance of bystander effects for low-dose radiation risk assessment in that ionizing radiation would be one of many factors affecting general stress responses. It is particularly important to establish whether bystander-mediated effects are in general risk-enhancing or risk-reducing in respect of radiation-associated diseases.

Adaptive response[13]

Establishing the robustness of adaptive responses in vivo remains important and some additional evidence is now available. Adaptive responses have been described in mice irradiated in utero and the analysis of patterns of gene expression suggests that p53-mediated responses are important. There remain few publications available on adaptive responses in vivo and the impact on health of relatively short-lived modification in radiosensitivity is not clear. Claims have been made that the growth of human cells in conditions of reduced

[13] **adaptive response:** The temporary modulation (usually reduction) by small 'priming' doses of the response to subsequent high radiation doses (UNSCEAR, 2012).

background radiation increase their sensitivity to acute higher dose exposures, which are evidence of a persistent adaptive response provided by normal levels of background radiation. In vitro studies have indicated that several systems might be involved in the induction of adaptive responses including nucleotide excision repair, non-homologous end joining , anti-oxidant defences , and core cell cycle factors such as cyclin D1.

Reactive oxygen metabolism and mitochondrial function[14]

Many of the experiments described in the literature regarding reactive oxygen and mitochondrial effects use in vitro systems where oxygen is present at ambient atmospheric concentrations. In vivo oxygen concentrations in tissues are much reduced (at 3–5% compared to 20% ambient). Cell growth and physiology is known to be affected by oxygen concentration. A recent report indicates that differentials in radiosensitivity can be affected by the oxygen environment. Before this knowledge can be fully interpreted, it will be important to establish the impact of low radiation doses on mitochondrial function and reactive oxygen metabolism under more realistic physiological conditions. Inflammatory reactions have recently been identified to play an important role in causing cellular senescence and inflammatory reactions are considered to play important roles in cancer development, in some cases promoting carcinogenesis and others protecting against it. Reactive oxygen species may reasonably be expected to be involved in the triggering and maintenance of inflammatory reactions.

[14] **mitochondrial function:** Sub-cellular organelles that are the main site of energy production. Mitochondria contain a small circular DNA molecule that encodes some of their constituent proteins (UNSCEAR, 2012).

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Preambulatory Phrases

Preambulatory Phrases are used at the beginning of every Resolution Paper in order to give context about the resolutions made for the topic. Preambulatory Phrases must be written in italics followed by a sentence that gives said context. For each Resolution Paper there must be five sentences beginning with a Preambulatory Phrase.

Affirming	Desiring	Noting with deep concern
Alarmed by	Emphasizing	Noting with satisfaction
Approving	Expecting	Noting further
Bearing in mind	Expressing its appreciation	Observing
Believing	Fulfilling	Reaffirming
Confident	Fully aware	Realizing
Contemplating	Further deploring	Recalling
Convinced	Further recalling	Recognizing
Declaring	Guided by	Referring
Deeply concerned	Having adopted	Seeking
Deeply conscious	Having considered	Taking into consideration
Deeply convinced	Having examined	Taking note
Deeply disturbed	Having received	Viewing with appreciation
Deeply regretting	Keeping in mind	Welcoming

Operative Clauses

Operative Clauses are used at the beginning of every resolution within the Resolution Paper on the debated topic. It must be written in italics and bold.

Accepts	Endorses	Notes
Affirms	Draws the attentions	Proclaims
Approves	Emphasizes	Reaffirms
Authorizes	Encourages	Recommends
Calls	Expresses its appreciation	Regrets
Calls upon	Expresses its hope	Reminds
Condemns	Further invites	Requests
Confirms	Further proclaims	Solemnly affirms
Congratulates	Further reminds	Strongly condemns
Considers	Further recommends	Supports
Declares accordingly	Further requests	Takes note of
Deplores	Further resolves	Transmits
Designates	Has resolved	Trusts