Scientific Support for the Treaty on the Prohibition of Nuclear Weapons (TPNW)

Petra Seibert[1], Ivana Hughes[2,3], Noel Stott[4], Gerardo Suarez[5], A. K. M. Raushan Kabir Zoardar[6]

(Members of the TPNW Scientific Advisory Group)

[1]University of Natural Resources and Life Sciences (BOKU) and University of Vienna, **Austria**
petra.seibert@univie.ac.at

[2]Columbia University, Chemistry, USA and [3]Nuclear Age Peace Foundation, **USA**

[4]VERTIC, Hermanus, **South Africa**

[5]Universidad Nacional Autónoma de México (UNAM), Department of Seismology, Mexico City, **Mexico**

[6]Bangladesh Atomic Energy Regulatory Authority, Dhaka, **Bangladesh**

2-min slide #1

EGU General Assembly 2024, EOS4.1, **PICO 2.3**

This presentation will also be available on the first author's web site
https://homepage.univie.ac.at/petra.seibert/files/egu2024-pico.pdf

Why Treaty on the Prohibition of Nuclear Weapons (TPNW)**?**

António Guterres, UN Secretary General, 1st Meeting of TPNW States Parties (here in the ACC!)**:**

Photo credit: Int. Campaign to Abolish Nuclear Weapons

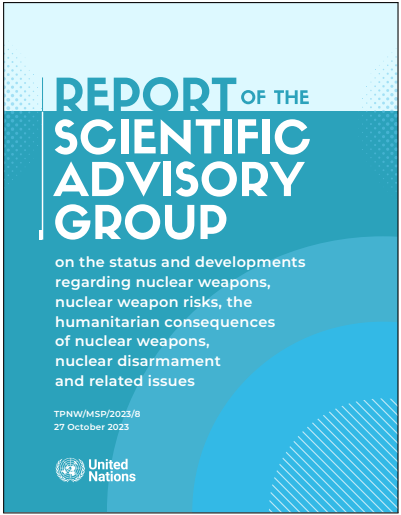
2-min slide #2

"Let's eliminate these weapons before they eliminate us."

What is the role of scientists in the TPNW implementation?

Co-Chairs of the TPNW **Scientific Advisory Group**:

The Group's Report on Nuclear Weapons:



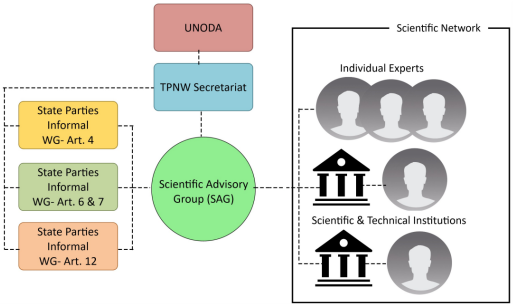
TPNW
TREATY ON THE PROHIBITION OF NUCLEAR WEAPONS

2-min slide #3

2nd Meeting of States Parties, UN New York, November 2023

A new **Scientific Network** to support the implementation of the TPNW:

Mission: ***The TPNW Scientific Network supports the goals of the Treaty on the Prohibition of Nuclear Weapons (TPNW)***



- provide expertise
- do research
- exchange results
- collaborate
- outreach to policy, media, public

TPNW
TREATY ON THE PROHIBITION OF NUCLEAR WEAPONS

2-min slide #4

through the sharing or provision of research and other science-based activities that enhance the Treaty's effective implementation or that are otherwise of relevance to the Treaty.

Overview

About the TPNW

What is the TPNW?

A legally binding, international treaty under the United Nations that includes a comprehensive set of prohibitions for nuclear-weapon-related activities, and positive obligations with respect to individuals and ecosystems affected by nuclear weapons use or testing.

What is prohibited under the TPNW?

- Develop, test, produce, manufacture, otherwise acquire, possess or stockpile nuclear weapons or other nuclear explosive devices
- Transfer nuclear weapons or control over such weapons, or receive such transfer
- Use or threaten to use
- Seek or receive any assistance
- Allow any stationing, installation or deployment
- Assist, encourage or induce anyone to engage in any activity prohibited

What are the “positive obligations” under the TPNW?

Art. 6 – Assistance to victims and environmental remediation

- adequately provide age- and gender-sensitive assistance, without discrimination, including medical care, rehabilitation and psychological support, as well as provide for their social and economic inclusion.
- areas contaminated as a result of activities related to the testing or use of NW, ... environmental remediation of areas so contaminated.
- without prejudice to the duties and obligations of any other States (the NWS)

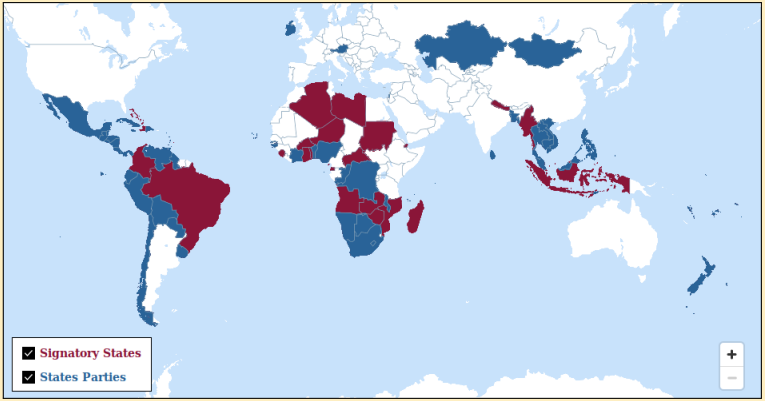
Art. 7 – International cooperation and assistance

- Cooperation among States Parties (SP)
- States Parties have right to seek and receive assistance from other States Parties
- each States Partie in a position to do so shall provide technical, material and financial assistance to States Parties affected by nuclear-weapons use or testing
- ... provide assistance for the victims of use or testing
- provided, inter alia, through the UN, international, regional or national organizations or institutions, NGOs, ICRC or national Red Cross, or on a bilateral basis
- a SP that has used or tested nuclear weapons or any other nuclear explosive devices shall have a responsibility to provide adequate assistance to affected States Parties

Membership of TPNW

Who are the members of TPNW?

- 70 States have ratified (and thus are States Parties)
- another 23 have signed



Source: https://www.icanw.org/signature_and_ratification_status

Note that some small states are not (well) visible on the map, *inter alia*

- Holy See
- Maldives
- Malta
- San Marino
- São Tomé and Príncipe
- small states in the Carribbean
- small Pacific island states

Motivation for the TPNW

Why was the TPNW initiated?

- Article 6 of Nuclear Non-Proliferation Treaty (NPT) obliges its members *to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.*
- 5 out of 9 states possessing nuclear weapons are NPT members:
  USA, Russia, China, France, UK – the so-called “Nuclear Weapon States” (NWS), however
- there are still more than 10,000 nuclear warheads on this globe, and
- the NWS have still not commenced any negotiations towards complete nuclear disarmament.
- Non-nuclear-weapon states dissatisfied with the standstill took the initiative to legally ban and outlaw nuclear weapons similar to other weapons of mass destruction (chemical and biological, for which such treaties already exist, even though those are still not completely universal).

History of the TPNW

What were the major steps towards the ban treaty?

- Nuclear Non-Proliferation Treaty Review Conference 2010: Resolution on humanitarian consequences of nuclear war accepted.
- “Humanitarian Initiative”: Conferences in Oslo (2013), Nayarit (MX, 2014), Vienna (2014), with Red Cross, science, NGOs to highlight unacceptable consequences of NWs
- 2014: “Austrian Pledge” (later Humanitarian Pledge) for a ban treaty
- 2016: Mandate by UN General Assembly for negotations
- 2017: Negotiations, led by Austria, Brazil, Ireland, Mexico, New Zealand, South Africa, Thailand and others.
- 7 July 2017: Adoption of the Treaty with 122 votes in favour
- 2017 Peace Nobel Prize awarded to the “International Campaign for Abolishing Nuclear Weapons” (ICAN)
- January 2021: Entry into force after 50th ratification

Important follow-ups

- June 2022: First meeting of States Parties, action plan passed
- March 2023: Scientific Advisory Group constituted
- November 2023: Second meeting of States Parties

Benefits of TPNW

Isn't the Treaty useless if the nuclear-armed states have not joined?

No, because

- Even though not yet universal, it has established a valid, legally binding international norm.
- The prohibition of "assistance", "encouragement", etc. already now restricts some activities that could benefit nuclear-armed states.
- TPNW states regularly refer to the Treaty in international fora and criticise nuclear armament, and thus force the nuclear-armed states and their allies to enter into a discussion on the topics raised by the Treaty.
- While the TPNW was under consideration at the UN, some NWS heavily lobbied against it, which shows that they attribute effect to the Treaty.
- The Treaty has already stimulated a lot of collaboration by like-minded states as well as with NGOs and academia.

Scientific knowledge about nuclear weapon risks

Where can I find an overview of the current scientific knowledge about risks & consequences of NWs and their use?

- 2022 Vienna Conference on the Humanitarian Impact of Nuclear Weapons
  20 June 2022, material online at
  https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/weapons-of-mass-destruction/nuclear-weapons/2022-vienna-conference-on-the-humanitarian-impact-of-nuclear-weapons/
- Report of the TPNW Scientific Advisory Group on the status and developments regarding nuclear weapons, nuclear weapon risks, the humanitarian consequences of nuclear weapons nuclear disarmament and related issues
  issued for the 2nd Meeting of States Parties on 27 Oct 2023:
  https://disarmament.unoda.org/report-of-the-scientific-advisory-group-on-the-status-and-developments-regarding-nuclear-weapons-nuclear-weapon-risks-the-humanitarian-consequences-of-nuclear-weapons-nuclear-disarmament-and-relate/
  Note that the “parliamentary version” is available in all official UN languages. An inofficial German version is available at https://www.un.org/depts/german/friesi/TPNW-MSP2023-8.pdf.
- Understanding the humanitarian consequences and risks of nuclear weapons: New findings from recent scholarship by Nick Ritchie and Mikhail Kupriyanov, 2023.
  https://www.bmeia.gv.at/fileadmin/user_upload/Zentrale/Aussenpolitik/Abruestung/Understanding_the_Humanitarian_Consequences_and_Risks_of_Nuclear_Weapons.pdf

Estimated number of nuclear warheads per country and their yield

Rounded to 10 nuclear warheads. The total number includes deployed, stockpiled, and retired warheads. Alert warheads are on weapons ready to be launched from land-based silos, mobile missile launchers, and submarines on patrol. Data from “Status of World Nuclear Forces 2023”, Federation of American Scientists.

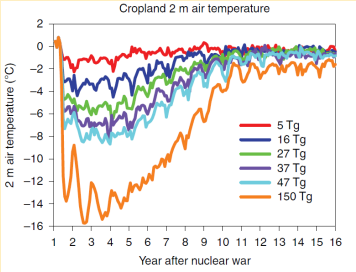
Country	Total #	On alert	To be dismantled	Trend 5 yrs	Yield (Mt TNT)
Russia	5,900	950	1,400	↑	980
USA	5,240	840	1,540	↓	860
China	410	–	–	↑	130
France	290	80	–	↓	29
UK	230	50	–	↑	23
Pakistan	170	–	–	↑	3.4
India	160	–	–	↑	4.1
Israel	90	–	–	↑	2.5
DPRK	30	–	–	↑	1.5
Total	**12,520**	**1670**	**2940**	↑	**2030**

From the SAG Report to 2MSP, see slide 8.

Consequences – Direct and nuclear winter

Adapted from Lili Xia et al., Global food insecurity and famine from reduced crop, marine fishery and livestock production due to climate disruption from nuclear war soot injection, *Nature Food*, **3**(8), 2022.

Evolution of 2 m temperature averaged over global cropland, after nuclear war



Fatalities from the bomb blasts and resulting number of people in danger of death due to famine for different scenarios

Soot (Tg)	# Nukes	Yield (kt)	direct deaths	no food > Yr 2
5	100	15	27 mill.	0.255 bn.
16	250	15	52 mill.	0.926 bn.
27	250	50	97 mill.	1.426 bn.
37	250	100	127 mill.	2.081 bn.
47	500	100	164 mill.	2.512 bn.
150	4,400	100	360 mill.	5.341 bn.

Even from a limited nuclear war (10 % of two of the medium nuclear arsenals) hundreds of millions of people might die. A full nuclear war between the Russian Federation and the United States might kill more than half of the human population on the planet!

Current research on nuclear war consequences

Two major research programmes are under way:

- The Humanitarian Impacts of Nuclear War
  - funded by the Future of Life Foundation
  - 10 sub-project by institutions in US, UK, DE, AT, most about 500 k$ funding
  - Topics include war scenarios, fire emissions, climate impact (nuclear winter), impact on ozone and UV, agricultural and food impact.
  - https://futureoflife.org/grant-program/nuclear-war-research

- Independent Study on Potential Environmental Effects of Nuclear War
  - carried out by an ad hoc committee of the US National Academies
  - sponsored by the US Department of Energy (responsible for US nuclear weapons)
  - to review source terms for nuclear war scenarios, and to review capabilities and limitations of the consequence models.
  - http://www.nationalacademies.org/our-work/independent-study-on-potential-environmental-effects-of-nuclear-war

- These studies are not related to the Scientific Advisory Group or its members. However, we anticipate that their outcome will be analysed by the SAG for the TPNW States Parties.

The TPNW Scientific Advisory Group

- Instituted by the 1st Meeting of States Parties to assist States parties in implementing the Treaty and in strengthening the credibility of the implementation process.
- 15 members nominated by States and selected through consultations
- Group was constituted in March 2023.
- Membership includes experts with background in natural science, medical science, engineering, and social science from both Americas, Europe, Africa, South and Southeast Asia.
- Meets monthly on-line, and about once or twice a year in hybrid format.
- Has been mandated to establish a network of scientific and technical institutions and experts to support the goals of the Treaty.
- Was mandated to provide a status report on relevant aspects of nuclear weapons (reference given on slide 8).
- For more information, including the complete mandate, see links on slide 15.

The planned TPNW Scientific Network

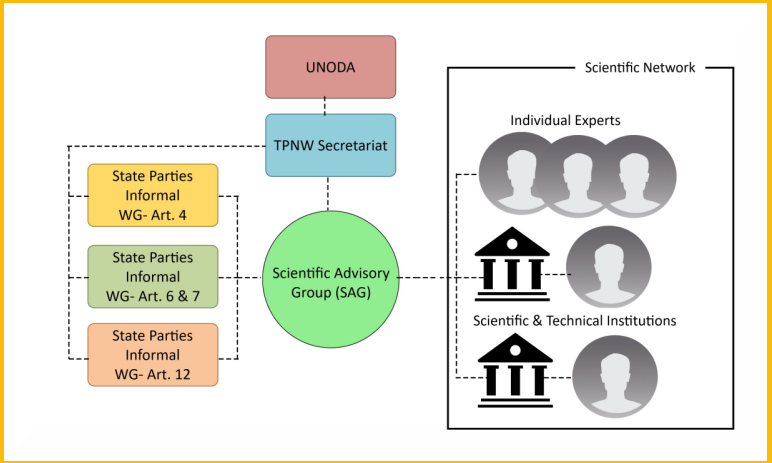
The 1st Meeting of States Parties (2022) tasked the SAG to

- identify and engage scientific and technical experts and institutions in TPNW States Parties, and
- more broadly to establish a geographically diverse and gender-balanced network of experts to support the goals of the Treaty with a view to contributing to capacity-building.

Current status:

- Mission Statement: The TPNW Scientific Network supports the goals of the Treaty on the Prohibition of Nuclear Weapons (TPNW) through the sharing or provision of research and other science-based activities that enhance the Treaty's effective implementation or that are otherwise of relevance to the Treaty.
- Procedure: A phased approach will be implemented, with collecting experiences in a limited 'Trial Network' first.
- More details will be provided in a Townhall Meeting during this EGU Conference. Please come if you are interested to participate in the Network (see next slide).

Schematic diagram of the TPNW SAG and Scientific Network



UNODA: United Nations Office of Disarmament Affairs

Informal WG: refers to informal working groups set up by TPNW States Parties for specific topics (referred to by Treaty articles).

Where can I learn more ...

... about the Treaty?

- International Campaign for Abolishing Nuclear Weapons (ICAN)
  https://www.icanw.org/
- First author's web site:
  https://homepage.univie.ac.at/petra.seibert/tpnw.html

... about the TPNW Scientific Advisory Group?

- https://www.icanw.org/tpnw_scientific_advisory_group
- https://homepage.univie.ac.at/petra.seibert/tpnw-sag.html

... about the TPNW Scientific Network?

EGU 2024 Townhall Meeting: A New Scientific Network to Support the Treaty on the Prohibition of Nuclear Weapons (TPNW)
Convener: Petra Seibert, Co-convener: Gerardo Suarez
Thu, 18 Apr, 19:00–20:00 (CEST), Room –2.91 (basement) and on Zoom