DRIVERS 2057

EXPLORE THE POSSIBLE

Drivers 2057 is a tool to explore the factors and forces that are shaping the future operating environment for international nuclear safeguards, in the run up to year 2057, when the International Atomic Energy Agency (IAEA) turns 100 years. The set includes a collection of drivers and potentially disruptive 'Uncertainties', which can and might impact the drivers and re-shape the future operating environment.

Drivers 2057 was developed for the IAEA's 2022 Symposium on International Safeguards, by experts from different contributing organizations with support from N Square Collaborative, and facilitated by the School of International Futures. The Drivers 2057 set was crafted using futures and foresight tools and methods that were applied during both online and in-person engagements leading up to the Symposium. As such, the content of this set represents a snapshot in time–a view from the present looking ahead.

Drivers 2057 can be used to explore possibilities, but it cannot help you predict *the* future. Below are some ways that you can use the Drivers 2057 set, and we invite you to create your own approach or method for getting the most out of the content.

Journey. Make your way through the Drivers 2057 set to explore a range of issues that are shaping the future operating environment for safeguards. Which driver have you come across before? How do you see these drivers shaping nuclear safeguards in the years to come?

Imagine. Use this set to surface assumptions, expose blindspots, and identify uncommon opportunities through generating a snapshot scenario. Grab 2-3 drivers that seem to have little or nothing in common and craft a story about the future. What does the world look like when dominated and shaped by these drivers? What happens to nuclear safeguards in this world?

Test. Ideate impacts (near-term) and implications (mid- to long-term) by stress-testing existing policies, plans, and strategies against individual drivers, uncertainties, and combinations between the two. How do your organization's policies, plans, and institutions stack up against various drivers and uncertainties? What drivers and uncertainties have the potential to make entire strategies obsolete?

Envision. Some drivers and uncertainties might be more preferred than others, and this set can be used to create a vision of the future for your organization. What drivers are part of your preferred future? In light of the drivers and uncertainties that are undesirable, what values, actions, and systems are needed to create a more preferred future?

Add. Critically analyse not only the drivers but the uncertainties to see what else should be included. What would you add to the Drivers 2057 set? What additional uncertainties need to be explored in relation to the future operating environment for nuclear safeguards?

Experts from different contributing organizations contributed to the development of these drivers:

- Belfer Center, Harvard University
- Breakthrough Institute
- European Safeguards Research and Development Association (ESARDA)
- Institute of Nuclear Materials Management (INMM)
- N Square Collaborative
- Nuclear Threat Initiative (NTI)
- Open Nuclear Network (ONN), One Earth Future
- Replanet
- School of International Futures (SOIF)
- Stimson Center
- Swiss Center for Positive Futures
- Third Way
- Verification Research, Training and Information Centre (VERTIC)
- Vienna Center for Disarmament and Non-Proliferation (VCDNP)
- Voices of Nuclear
- World Nuclear Association (WNA)

Set Design by:
Altimeter Design Group

WAR AND CONFLICT 3.0

GEOPOLITICS, SECURITY AND GOVERNANCE

WAR AND CONFLICT 3.0

SUMMARY

The exploitation of new and emerging technologies changes the nature of war and conflict, blurring the lines between the two and leading to reduced accountability and further ambiguity. Decreased faith in information veracity exacerbates this ambiguity. New weapons systems, and emerging technologies that can be weaponized emerge, empowering States and other actors in new ways. From doctrine to tactics to entities involved, war, terrorism and conflict are being impacted by not only technologies used for weaponry but also online spaces used for recruiting, communicating and carrying out combat and terrorism in an age of war and conflict 3.0.

KEY QUESTIONS

How will the changing technological nature of war and conflict affect the perceived utility of nuclear weapons and other weapons of mass destruction?

How might cyber shape and reshape the nature of conflict?

How might nuclear command, control, and communication systems as well as peaceful nuclear facilities be affected by cyber threats?

How can safeguards personnel and infrastructure be protected against hostile action or interference?

GEOPOLITICAL FLUX

GEOPOLITICS, SECURITY AND GOVERNANCE

GEOPOLITICAL FLUX

SUMMARY

The world transitions to a new international order, with rising economic, technological and military powers emerging alongside established world powers. There is competition for power, resources and influence in world affairs. As new powers rise, and others decline, tensions and conflicts emerge in both familiar and unfamiliar spaces. Old relationships and alliances are being put to the test and forced to ask hard questions in an age of geopolitical flux.

KEY QUESTIONS

How will the changing geopolitical balance of power affect the world nuclear order?

What opportunities and challenges will the changes bring about to arms control, disarmament, and non-proliferation?

How will the changing dynamics play out in multilateral nuclear diplomacy, including at the IAEA's policy-making organs?

How might the makeup of the IAEA's membership shift with the rise of new powers and a shifting of power balance?

How might the rise of new powers impact funding, staffing and operational capabilities of the IAEA?

REFITTING FOR PURPOSE

GEOPOLITICS, SECURITY AND GOVERNANCE

REFITTING FOR PURPOSE

SUMMARY

Established global institutions and norms created in a different era and representing the 'old' world order come under increasing strain. Their very foundations and purpose are questioned and calls for reform strengthen. Governance systems and non-governmental actors at every level face a crisis of trust in addition to the pressures of having to "do more with less." New more agile players with large resources emerge alongside, offering services previously carried out by the public sector, forcing established organizations to refit for purpose.

KEY QUESTIONS

Could the ground rules of the international system be rewritten?

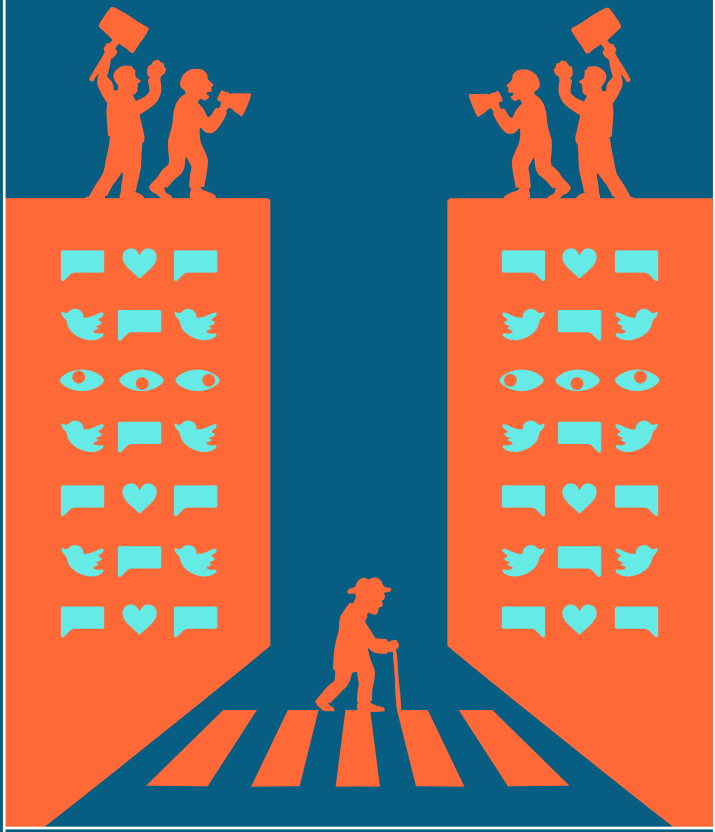
Will a shared set of principles, understandings thereof, guide States' international engagements?

How might possible changes in multilateralism affect the IAEA?

How will the emergence of new players impact intergovernmental organizations and the IAEA?

How will the Nuclear Non-Proliferation Treaty bargains continue to hold?

LIE TO ME



SOCIETY

LIE TO ME

SUMMARY

In an era where misinformation and disinformation continue to grow and wield influence across a range of contexts, there is a movement to disengage from the news and embrace one's own preferred reality. Many seek to escape from reality: the number of people without trust in traditional institutions and media actively choosing to disconnect from the news of the world grows, while others take solace in conspiracy theories and anti-establishment perspectives. Covid-19 brings issues of mistrust to the forefront, and there are bigger questions looming about the place and role of science in public discourse as many willingly whisper, "lie to me."

KEY QUESTIONS

How does rising societal level mistrust affect the global international system?

What implications does a broad loss of trust in science have on the nuclear sector as a whole?

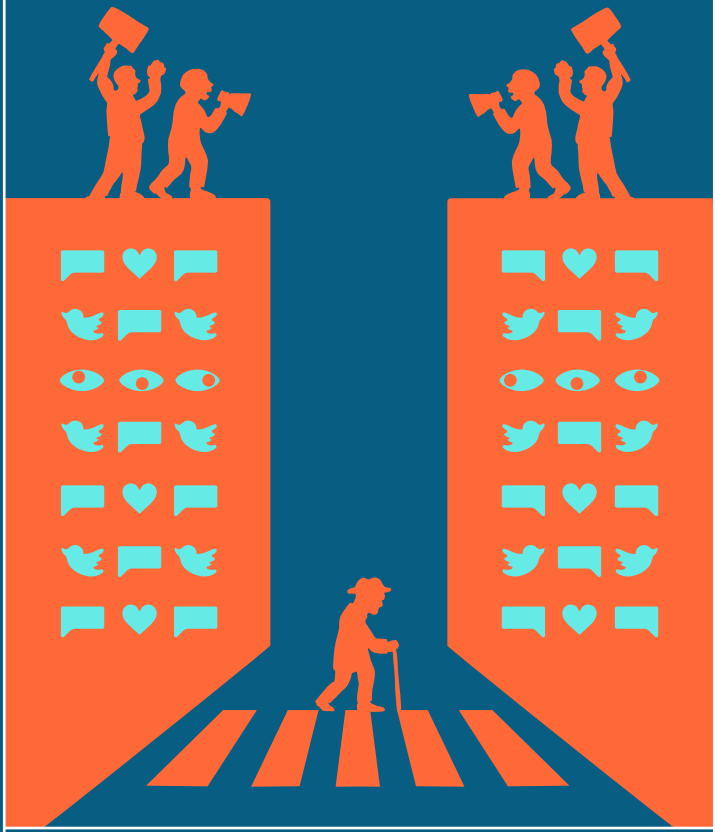
How might new and emerging mis- and dis-information tactics affect safeguards?

What is the future value attributed to independent verification in establishing facts?

What will be the impact of 'fake news' on public trust in the IAEA's findings and conclusions?

SOCIETY

SURVIVAL OF THE RICHEST



SOCIETY

SURVIVAL OF THE RICHEST

SUMMARY

Income inequality continues to grow globally, disasters and unpredictable events become more costly, especially to those who are the most vulnerable. Two decades of poverty reduction is lost. Economic inequities are brought forward in various ways as groups seek to not only remedy past injustices but also create the conditions to mitigate disasters yet to come. These disproportionately affect those on the lower end of the spectrum, while the rich still continue to survive.

KEY QUESTIONS

What is changing in how people talk and think about inequality?

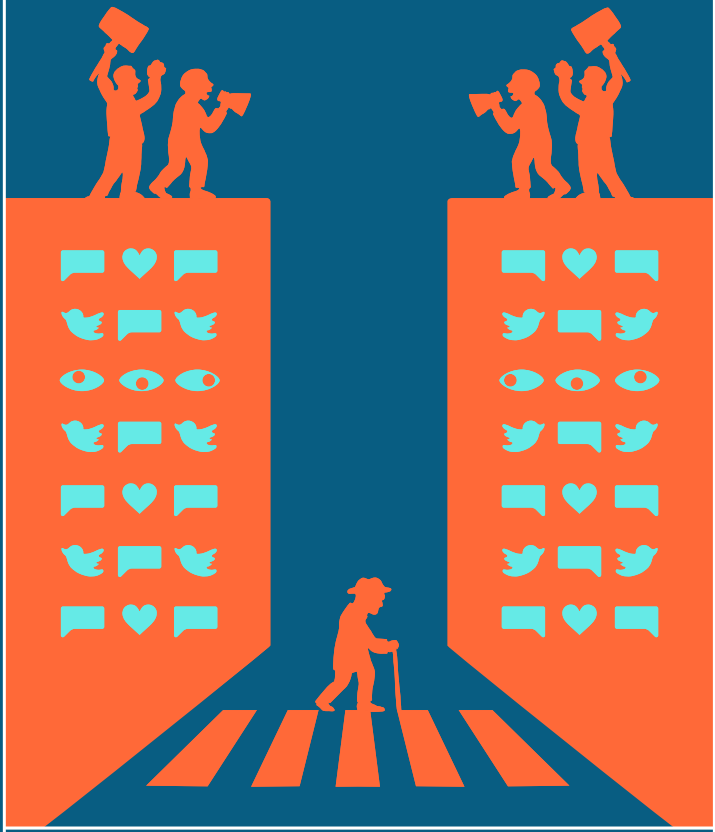
What will be the impact of growing inequality on countries' policy priorities?

What will be the IAEA's role in narrowing past and future inequality?

How will the IAEA's successes in promoting economic and social development impact its safeguards mission?

SOCIETY

IDEOLOGICAL TRIBALISM



SOCIETY

IDEOLOGICAL TRIBALISM

SUMMARY

Online spaces become a breeding ground for polarization and heightening social tensions as some seek out affiliation with communities espousing extremist and fringe views. Increasingly, these groups form across international boundaries, connecting 'tribes' with similar values and ideologies, increasing fragmentation. From the dark web to one's own social media feed, there is no shortage of spaces for one to find a convenient identity with which to align. More countries choose to abandon internet, instead creating national "State-nets," weakening online engagement and interactions as a driver of globalization.

KEY QUESTIONS

How will governments and intergovernmental organizations deal with tribalism that cross international borders?

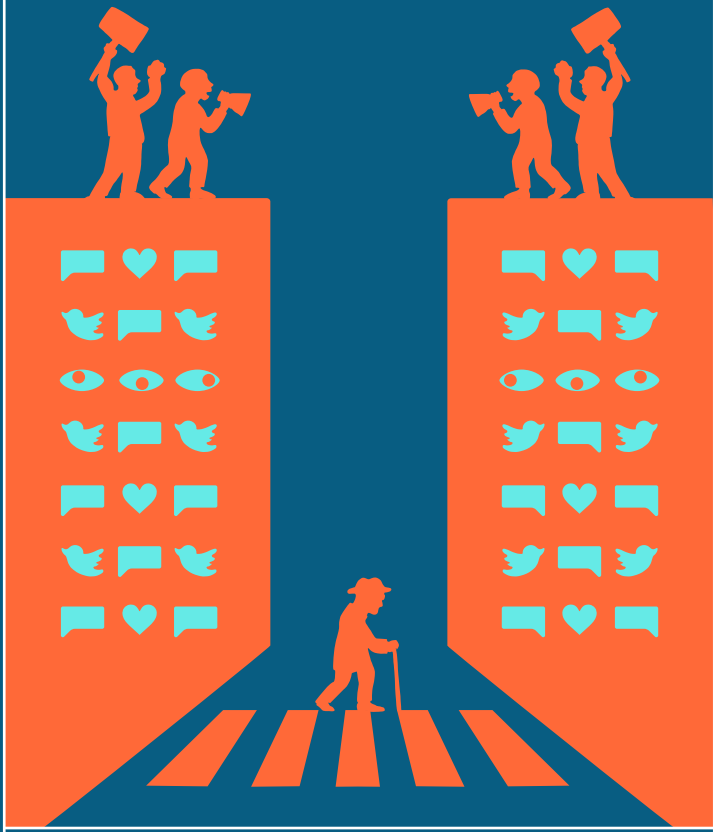
How would the emergence of cross-border tribalism affect proliferation, its funding, and the detection thereof?

How might the IAEA safeguards system need to adapt its State based approach?

How will the further integration or fragmentation of the Internet impact the IAEA's open source information collection and analysis?

SOCIETY

DEMOGRAPHIC DESTINIES



SOCIETY

DEMOGRAPHIC DESTINIES

SUMMARY

While the overall global population continues to increase, a rapid drop in fertility coupled with a longer life expectancy is creating a perfect storm of demographic disruptions. Increasing youth populations in certain parts of the world and aging populations across others are affecting urbanization, migration, and structural changes at the global, national, community and household levels. The destinies of regions, nations, communities and organizations are determined by their demographics.

KEY QUESTIONS

How might the demographic shifts change global power dynamics?

How might urbanization and demographic shifts affect energy demand; how much and what type of energy is needed?

How can and might demographic shifts affect the nuclear landscape and safeguards?

How might the shifts in demographics and cascading effects impact the IAEA workforce, governance, and policy making?

SOCIETY

UNCERTAIN ECONOMIES

ECONOMY

UNCERTAIN ECONOMIES

SUMMARY

While the world struggles to bring forward recovery strategies seeking to create a stable economic footing, the global outlook, hit by pandemics and wars, remains uncertain as various crises put pressures on markets around the globe. Deflationary and inflationary pressures as well as unprecedented monetary policies persist around the world, and long established economic truths and rules cease to apply. Uncertain economies seem to be here to stay.

KEY QUESTIONS

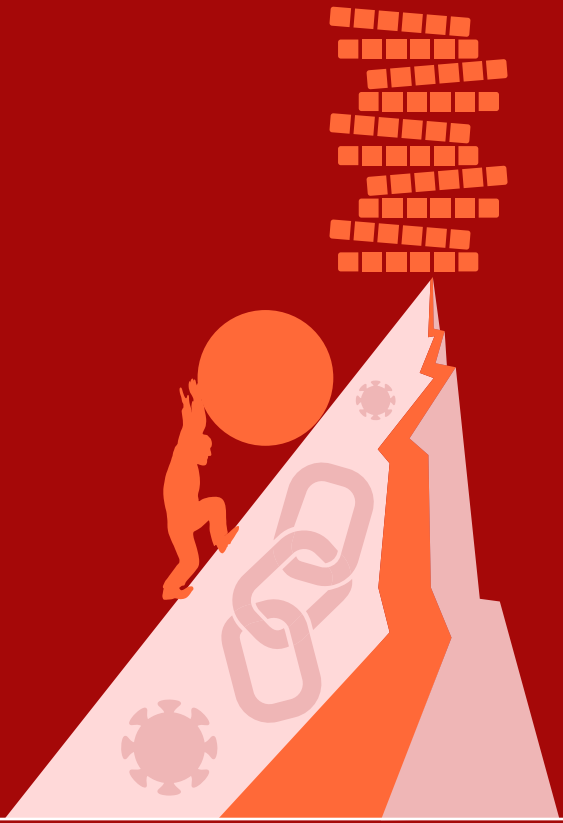
How will global economic uncertainties and hardship affect the world we currently live in?

How will an uncertain economic outlook and turbulence impact budgets and funding of international organizations, including the IAEA?

What alternatives exist for the IAEA to keep pace with global safeguarding needs beyond the current model of funding?

ECONOMY

RESHUFFLING SUPPLY CHAINS



ECONOMY

RESHUFFLING SUPPLY CHAINS

SUMMARY

Covid-19 highlights the connectedness of the global economic system's supply chains, but it also shows how it could break down. It unveils strong dependencies and associated vulnerabilities of countries in times of crisis. Compounded by conflicts, both perceptual and actual, that impact key supply chains, from technology to critical crops, the tide against globalization rises. In light of new emphasis on self-sufficiency, especially in strategic resources and assets, old supply chains are broken, and new ones are created as economic relationships between regions and States reshuffle.

KEY QUESTIONS

How might a global economic reordering shape nuclear commerce between countries?

What forces are affecting and shaping global trade networks and relationships?

How might supply chain failures enhance States' desire for developing independent nuclear fuel cycle and related capabilities?

How might the IAEA itself and its safeguards capabilities be affected by supply chain disruptions?

ECONOMY

GREEN ECONOMY

ECONOMY

GREEN ECONOMY

SUMMARY

Although climate targets continue to be just that, the green economy keeps sparking interest in using green approaches for recovery and shifting economic paradigm and practice. In spite of more awareness, greenwashing continues to be a significant challenge. Furthermore, global disagreement on questions of responsibility over climate change, and who will provide funding and resourcing remain strong. Benefits and costs are contemplated by those going green, as the world continues to struggle to find a truly global approach to going green.

KEY QUESTIONS

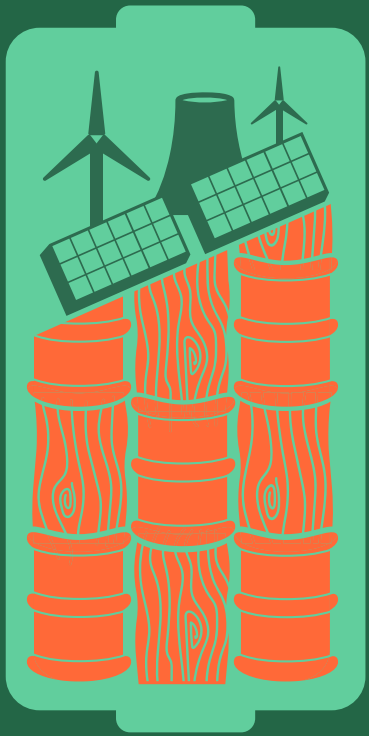
How does transition to a green economy impact the nuclear industry?

If nuclear energy does take a more prominent role, how will nuclear proliferation concerns be addressed and will safeguards as known today (2022) be sufficient?

How will the IAEA meet its growing safeguards workload?

How might a more positive outlook of nuclear impact broader support for non-proliferation and safeguards?

CLIMATE CHANGED



CLIMATE, ENERGY AND NUCLEAR

CLIMATE CHANGED

SUMMARY

Climate change intensifies: sea levels rise, forcing migration; droughts worsen, threatening food security; and severe weather events increase, risking human lives and infrastructure. Its impacts are not distributed equally. Climate change is not merely a scientific or technical challenge but one that is mired in global, national and local politics—causing divisions on how to respond. Nations face tough choices on ways to mitigate the climate crisis and its direct and indirect impacts.

KEY QUESTIONS

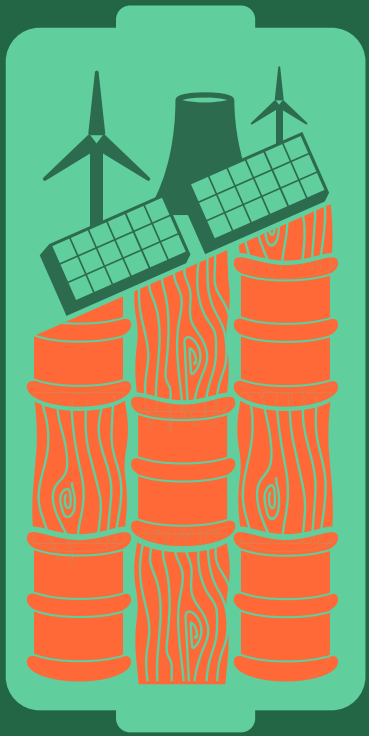
How do climate adaptation and mitigation strategies impact the demand for nuclear energy?

How do concerns about waste, weapons and safety/security influence the deployment of nuclear plants?

Will future climate change and associated downstream effects on the nuclear sector produce significant global geopolitical instability?

How will severe and unpredictable weather affect IAEA's planning/logistics for in-field activities?

SECURING ENERGY



CLIMATE, ENERGY AND NUCLEAR

SECURING ENERGY

SUMMARY

While countries seek to decarbonize their energy systems (and other sectors such as transportation), geopolitical developments significantly heighten the importance of energy security as a policy priority for nations throughout the world. Having to seek both low-emissions and secure, reliable and sovereign sources of energy limits the options countries have available, and consequently raises the profile and desirability of nuclear energy. Simultaneously, conflict and instability highlight potential vulnerabilities in nuclear energy infrastructure that must be addressed in the race to secure energy.

KEY QUESTIONS

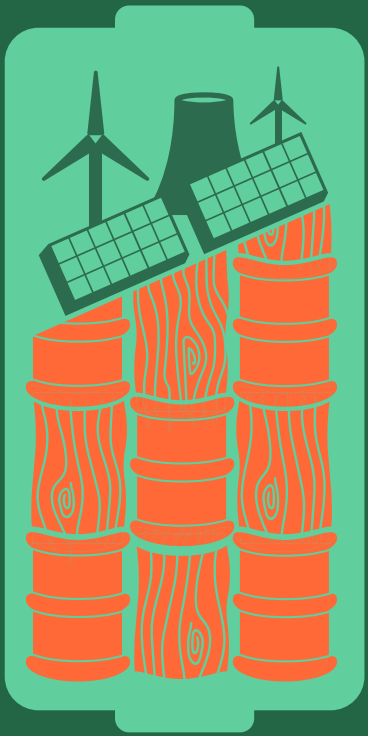
How will energy security concerns impact demand for nuclear?

How will developments in other clean energy technologies impact the demand for nuclear?

How might various national, regional and private sector energy endowments and subsidies affect nuclear power expansion?

How will new nuclear applications in industrial sectors (such as commercial maritime and uses of secondary heat) affect the regulatory and verification domains?

NUCLEAR NEXT



CLIMATE, ENERGY AND NUCLEAR

NUCLEAR NEXT

SUMMARY

Technological innovation led by both public and private entities drives the development of the next generation of nuclear technology. Nuclear fusion technology research continues to move toward operationalization. As interest in new nuclear technology grows and novel financing mechanisms and fuel and technology supply arrangements are offered, licensing and regulation must keep pace. Non-power applications bring new actors into the sector and technological breakthroughs drive new cooperative and strategic relationships.

KEY QUESTIONS

How can the enhanced passive safety benefits and affordability of new reactor technologies move the needle on public/social acceptance and expanded deployment?

How will the IAEA and State regulatory bodies adjust to larger numbers and broader diversity of reactor types, and wider geographical and more remote distribution of reactor sites?

How will the operationalization of fusion disrupt the current paradigm of energy distribution and generation?

How would the regulatory interfaces and verification roles and responsibilities evolve/cope with fusion?

How will floating reactors influence governance, verification and onshore and offshore infrastructure?

WEB 3.0

EMERGING TECHNOLOGY

WEB 3.0

SUMMARY

The leap from Web 1.0 to Web 2.0 ushers in a range of new back-end and front-end technologies, and Web 3.0 heralds the advent of new virtual spaces as well as new threats. From quantum computing to the Internet of Things, the growth of Web 3.0 creates new opportunities for hackers, trolls, and manipulation but also the promise of greater connectedness and computing power.

KEY QUESTIONS

Who are trusted partners in the Web 3.0 era?

What might be some new opportunities for enhanced Safeguards analysis using Web 3.0 technologies?

What opportunities might emerge for virtual site inspections?

What might the new vulnerabilities and/or opportunities be in utilizing and securing data?

INFORMATION OVERLOAD

EMERGING TECHNOLOGY

INFORMATION OVERLOAD

SUMMARY

Data is more abundant and important than ever, fueled by new types of sensors and the Internet of Things. Systems that can track, train, and target using various data sets are used and enhanced further by a range of actors for various strategic objectives. Petabytes of information per second are generated, and it becomes increasingly clear that machine learning and machine thinking will be necessary to gain an advantage in a world of data and in an age of information overload.

KEY QUESTIONS

How will organizations keep up with the growing complexity of data collection, processing and analysis?

What must organizations do to compete for top talent in data management and analysis fields?

Will there be key insights locked behind datasets or proprietary analysis software?

What processes and practices can be taken over by machines; what is the optimal balance between humans and machines?

BEYOND HUMAN

EMERGING TECHNOLOGY

BEYOND HUMAN

SUMMARY

Humans have always used technology to enhance what we are able to do, and a new generation of wearables, prosthetics, robotics, and even genetic engineering technologies leads to a revolution in how we think about ourselves and our bodies. As more powerful and consuming tech emerges, ethical and even existential questions grow as we face a future where we may become beyond human.

KEY QUESTIONS

How might new and emerging technologies reorient the limits of our bodies and brains?

What conversations can and must be had on the ethical aspects of using technologies that augment humanity?

What effects will emerge from the arrival of augmented workers entering safeguards and/or the nuclear sector?

How might the next generation of wearables shape safeguards implementation?

From robotics to genetic engineering, what do safeguards look like in a world where humans can do things that were once thought to be superhuman?

EMERGING TECHNOLOGY

UNCERTAINTIES & DISRUPTORS

DO YOU HAVE MORE MASKS?

Covid-19 was a wakeup call for many, but it also pointed towards serious issues in combating global health challenges. What happens next time a pandemic (or other mass disruptive event) affects verification and nuclear operations?

WHO TURNED OFF THE LIGHTS?

From extreme weather to conflict and cyberattacks to solar storms, infrastructure, and electric grids in particular, are increasingly vulnerable. What is it going to take to keep the lights on in the future?

UNCERTAINTIES & DISRUPTORS

CAN THEY REALLY BE TACTICAL?

Tactical nuclear strikes would break a decades long taboo and raise challenges that border on the unthinkable. What happens in a future where nuclear weapons are used?

WHAT IF IT MELTS DOWN?

How would a serious nuclear accident affect the future of nuclear power, and responses to climate change? What would be the impact to the fuel cycle and downstream, the nuclear nonproliferation regime and safeguards?

UNCERTAINTIES & DISRUPTORS

SHOULD WE MOVE NOW?

From increasing storm surges to coastal erosion and droughts to flooding and fires, climate migration is here to stay. What happens in a future where millions, if not billions, decide to move?

WHERE IS OUR MONEY?

Economic uncertainty might be here to stay, and some are looking at new economic paradigms. How might our economies and thereby societies be revolutionized?

UNCERTAINTIES & DISRUPTORS

WHO WILL PLAY BY THE RULES?

A decline of the international rules-based order could lead to a new paradigm or complete chaos. What does a world without those rules look like?

WILL E-MONEY GO MAINSTREAM?

Experiments with digital currencies are moving from the fringe to the mainstream as governments trial e-money. How might new electronic forms of value sharing affect nuclear cooperation and trade and create broader kinds of change?