

## D.4. ASSESSING GLOBAL CATASTROPHIC RISK

Discussion concerning global catastrophic risk is in preparation. See preliminary notes in Panels A and B below.

### PANEL A: POTENTIAL GLOBAL CATASTROPHIC EVENTS AND SITUATIONS

#### I. EVENTS AND SITUATIONS DRIVEN BY NATURAL EXTRATERRESTRIAL PHENOMENA

- a. Lethal gamma radiation discharge from massive supernovae or explosions of micro-black holes.
- b. Collision with large mass and/or high velocity comet or asteroid that crosses earth's orbit.

#### II. EVENTS AND SITUATIONS DRIVEN BY NATURAL TERRESTRIAL PHENOMENA

- a. Geophysical:
  - Super-volcanism: a) massive release of continental scale flood basalts; b) massive release of sulfate particles into the stratosphere causing volcanic cooling.
  - Collapse of large coastal volcanoes and resulting mega-tsunamis.
  - Reversal of the polarity of Earth's magnetic field.
- b. Biological: massive pandemics of great virulence and contagion.

#### III. ANTHROPOGENIC EVENTS AND SITUATIONS

- a. Intentional harm: warfare/terrorism/psychopathy
  - Extensive military use of nuclear weapons; nuclear terrorism
  - Extensive military use of biological weaponry using synthetic biology/nanoscale/genetic elements; bioterrorism
  - Sustained global mass violence driven by religious or secular fanaticism
- b. Unintentional harm:
  - Accidental escape or release of massively harmful agents using synthetic biology/nanoscale elements
  - Unanticipated mass harmful impacts of intentional use of agents using synthetic biology/nanoscale/genetic elements
- c. Civilizational collapse from:
  - Exhaustion of vitally important natural resource stocks and/or sinks
  - Climate change/global warming of 2, 4, 6, 8 ...°C.
  - Thermal pollution [see *Attachment D.3*, Box D.3-3.]
  - Inherent instability of large complex systems [See Hayes (2004; Section II.A.4)]
  - Massively destabilizing growth of inequality; genetically engineered human speciation
  - "Perfect storm" of random destabilizing economic situations and events, including random poor policy responses
  - Mass cultural/spiritual error or exhaustion

#### IV. HIGHLY UNLIKELY EXOTIC EVENTS AND SITUATIONS

- a. The Singularity
- b. Engulphment by a micro- or other black hole
- c. Very high-energy particle accelerator catastrophe that
  - collapses a metastable vacuum
  - ignites the atmosphere
  - creates a new "Big Bang"
  - creates "strangelets" that transform common matter into strange matter
- d. Extermination/Enslavement by robots and/or artificial intelligence
- e. Invasion or other lethal violence by hostile aliens

#### V. EVENTS AND SITUATIONS THAT ARE HIGHLY LIKELY BUT ARE VERY DISTANCE IN TIME

- a. Holocene interglacial concludes and glaciation resumes. (3K-30K years before onset of impact on human civilization)
- b. Star *Gliese 710* passes w/in 77 light-days of Earth, traverses the Ort Cloud and triggers ~ 10 comets/yr for ~ 3-4 million years, with a high likelihood of 1 or more hitting Earth (1.35 million years).
- c. Expansion of the Sun to red giant status, followed by collapse (2-3 billion years before onset of impact on earth)
- d. Entropic heat-death of the universe (40-100 billion years?)

#### VI. UNKNOWN UNKNOWNNS - ??

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**SOURCES:** Wagner & Weitzman (2015), IPCC (2014), Brockman (2014), Bostrom & Crickovic (2008), Smil (2008), Martin (2006), Ikle (2006), Hayes (2004), Rees (2003), Trainer (1996), Leslie (1996), Garrett (1994), Asimov (1979), Berski (2016).

## PANEL B: CHARACTERIZATION OF LEVELS OF GLOBAL CATASTROPHIC IMPACT

For this exercise, imagine that global development proceeds along our business-as-usual scenario, roughly as described in *Attachment B.2*. By 2100 population is 10 billion, per capita output is \$50,000 (1990 US\$) and ACC is just under 4°C and rising. In 2100 a catastrophic event or situation is triggered. Types and degrees of global impacts that might follow include:

I. Life on earth is extinguished over not more than 1-2 human generations (30-60 years):

- a. All life is extinguished, with no possibility of re-emergence
- b. All life is extinguished, but re-emergence is a possibility
- c. All human life on earth is extinguished, with no possibility of re-emergence
- d. All human life on earth is extinguished, but re-emergence is a possibility

II. A large portion of the human population is extinguished over not more than 1-2 generations:

- a. 99.9 % of humans are extinguished: 10,000,000 survive
- b. 99.0 % of humans are extinguished: 100,000,000 survive
- c. 90.0 % of humans are extinguished: 1,000,000,000 survive
- d. 50.0 % of humans are extinguished: 5,000,000,000 survive
- e. 20.0 % of humans are extinguished: 8,000,000,000 survive

III. Collapse of advanced industrial civilization over not more than 1-2 generations:

- a. 90% collapse of per capita output: \$ 5,000 / yr per capita output continues
- b. 70% collapse of per capita output: \$ 15,000 / yr per capita output continues
- c. 50% collapse of per capita output: \$ 25,000 / yr per capita output continues
- d. 30% collapse of per capita output: \$ 35,000 / yr per capita output continues
- e. 20% collapse of per capita output: \$ 40,000 / yr per capita output continues

IV. After a period of contraction to one of the levels shown in III above, per capita output (GDP), which grew over the second half of the 20<sup>th</sup> century at a rate of about 2% per year, now grows at an annual rate of: a. 0.0%; b. 0.5%; c. 1.0%; d. 1.5%

For this exercise, suppose we define as *globally catastrophic* any situation or event that:

- \* causes the premature death of 20% or more of the human population over 30-60 years; *and/or*
- \* causes global per capita economic output to decline by 20% or more over 30-60 years; *and/or*
- \* causes per capita economic growth to stabilize at 0.0%/yr over 30-60 years, with no possibility of recovery.

**PRELIMINARY COMMENTS** (Alternative scenarios and a fuller analysis re in preparation.)

1. Although the harm generated by any of the events and situations listed in Panel A would clearly be immense, it is unclear how many would likely be globally catastrophic as defined at the bottom on Panel B.

2. Note that even under conditions of extreme economic collapse (e.g., of 90% of per capita GDP, taking us from \$50,000/yr to \$5,000/yr in 1-2 generations) humanity would still technically be as well off economically as we were in 1985, when per capita GDP was ~ \$4,400 (PPP, 2016 INT\$). Questions involving relative well-being over time remain germane and difficult.

3. It is not obvious that ACC of 3°C or less would pose a high risk of generating global catastrophic events as here defined. Of course, with every increment of increased warming the likelihood of such events increases as well.

4. A case can be made that the likelihood of global catastrophic events resulting from the unintended release of unintentionally lethal and virulent forms of synthetic biology/nanoscale/genetic agents is low. However, see note 5, following.

5. A case can be made that the single greatest globally catastrophic danger facing humanity involves the design, engineering and intentional use of synthetic biology/nanoscale/genetic agents to cause catastrophic harm.

6. **Techno-Progressive World** is the scenario most at risk of globally catastrophic events, and it lacks the collective institutions needed for effective prevention or amelioration. **Balanced Equitable World** avoids many but not all globally catastrophic risks; it is, however, the most well-positioned to take pro-active steps towards prevention and amelioration. **Green Sustainability World** is the scenario least likely to face globally catastrophic events, but it is not well-positioned to address such events as might happen nonetheless (e.g., large asteroid impact).

#### **ADDENDUM / COMMENT [August 2018]**

A note on the manner in which discussion of global catastrophic risk, including introduction and popularization of the term *existential risk*, has been shaped and largely dominated by the transhumanists and other techno-utopians will be included in the final working paper. The transhumanists and techno-utopians have come to play a social role regarding the danger of new technologies analogous to that played by the environmental community regarding ecological danger. The critical difference is that the environmentalists are sincere whereas the transhumanists are building a Trojan Horse. By taking a vocal role on “warning humanity about the dangers of technology” they are able to discourage real opposition to the techno-agenda itself from gaining a foothold while promoting their core framing message that the technological transformation of humanity is inevitable but we want to make sure it happens safely rather than harmfully.