



## Environmental Engineering Scenario Builder for HydroPower Plants (HPP's)



Bring on tomorrow

RISK SUMMARY

# Legislation

The licensing and regulation of hydropower necessarily strikes a balance between promoting renewable, low-carbon energy, as well as protecting river ecosystems and people's livelihoods.

Some of the key European Directives concerning hydroelectric power plants include the:

- Environmental Impact Assessment (EIA) Directive 2014/52/EC
- Renewable Energy Directive 2009/28/EC
- Water Framework Directive (WFD) 2000/60/EC
- Habitats Directive (92/43/EEC)
- Directive on the Assessment and Management of Flood Risks 2007/60/EC
- Environmental Liability Directive (ELD) 2004/33/EC.

Monitoring and Permit requirements in member states vary, however environmental aspects may include:

- Abstraction Permit, for water abstraction or diversion
- Impoundment Permit – for construction of a dam, weir or modification to existing structures
- Permits for fish disturbance and migration
- Flood Defence Permits



# Nature of Potential Environmental Losses

This Information Sheet considers environmental risks that may arise from the operation, upgrade and decommissioning of a hydropower plant. It does not consider construction risks.

Dammed reservoirs are used for multiple purposes, such as agricultural irrigation, flood control, and recreation, so not all environmental impacts associated with dams may be directly attributed to hydroelectric power.

# Operational Risks

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Potential environmental risks arising from HPP operations may be summarised as:

- Water management
- Water quality
- Migratory species and biodiversity
- Geomorphological/Structural
- Human



# Repair, Upgrade And Decommissioning Risks

When a hydro plant reaches the age of approximately 30 to 40 years, it is screened for possible improvements in the equipment and components. Hydro plant machinery deteriorates with age and will eventually fail, principally due to thermal, electrical and mechanical degradation of insulation materials used in the windings and elsewhere, and erosion, corrosion and hence fatigue in turbine components.

Regular repair, maintenance and replacement of damaged or obsolete equipment is needed to maintain the original level of service. Upgrades and redevelopment may include new powerhouses and structures, modifications to reduce environmental impacts through the introduction of fish-friendly turbines, or improving safety to cope with exceptional floods or earthquakes.

Older dams with hydropower facilities were often developed without due consideration for environmental impacts such as migrating fish. Many of these older plants require refurbishment to allow both upstream and downstream migration capability, others may be decommissioned.

Decommissioning of large dams has in the past required the use of explosives, barges, demolition and excavation plant/machinery.

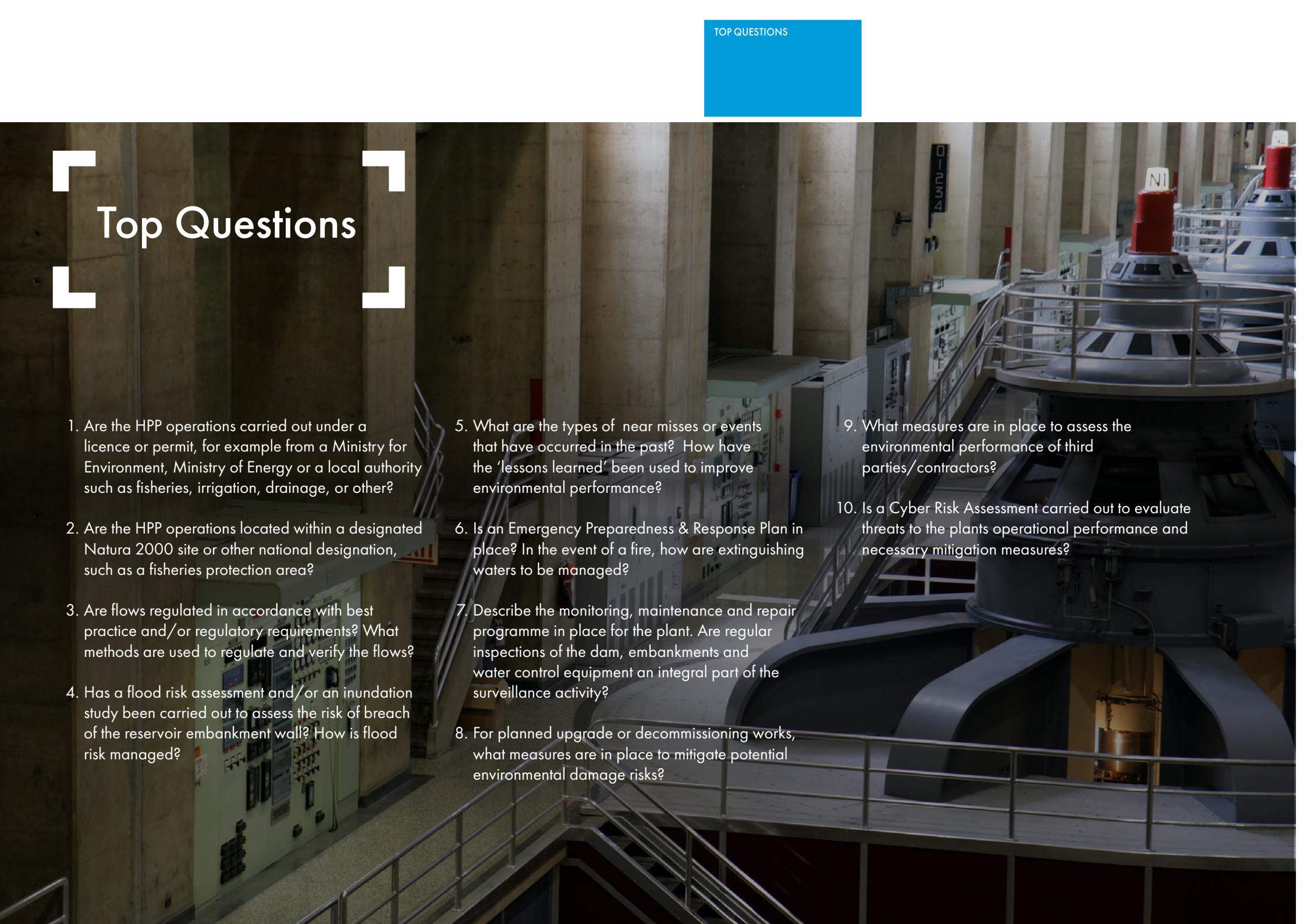
Repair, maintenance, upgrade and decommissioning activities require careful management to reduce potential environmental impacts associated with:

- Water flow variations caused by the works
- Disturbance of terrestrial and aquatic habitat caused by the use of barges, demolition equipment and other machinery
- Vehicle fuel storage and handling
- Materials management risks associated with the use of chemicals, grouting and fillers, removal of concrete structures, sediment and debris management, vegetation removal, and equipment decommissioning
- Mobilisation of boulders, debris and sediment during dam removal works.

# Types of Events

REGION	SOURCE	SUMMARY EXAMPLES	DAMAGE
Europe	Penstock Rupture	<p>The failure was due to several factors including poor strength of rock at the rupture location.</p> <p>The flow rate through the rupture was in excess of 150 m<sup>3</sup>/s.</p>	<p>The rapid release of a very large quantity of high pressure water destroyed approximately 100 hectares of pastures, orchards, forest, as well as washing away several chalets and barns. Three people were killed.</p> <p>ELD (biodiversity), property and fatality/bodily injury.</p>
Europe	Canal wall breach	A breach in the wall of a man-made water system connecting to a HPP resulted in materials (stones, trees and soil) being carried downstream.	ELD (water and biodiversity) and property damages.
Europe	Poor water management	Incorrect control of water release downstream of a HPP resulted in abnormally low flow downstream; causing the death of fish and plant species.	ELD biodiversity damage.

# Top Questions

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1. Are the HPP operations carried out under a licence or permit, for example from a Ministry for Environment, Ministry of Energy or a local authority such as fisheries, irrigation, drainage, or other?
  2. Are the HPP operations located within a designated Natura 2000 site or other national designation, such as a fisheries protection area?
  3. Are flows regulated in accordance with best practice and/or regulatory requirements? What methods are used to regulate and verify the flows?
  4. Has a flood risk assessment and/or an inundation study been carried out to assess the risk of breach of the reservoir embankment wall? How is flood risk managed?
  5. What are the types of near misses or events that have occurred in the past? How have the 'lessons learned' been used to improve environmental performance?
  6. Is an Emergency Preparedness & Response Plan in place? In the event of a fire, how are extinguishing waters to be managed?
  7. Describe the monitoring, maintenance and repair programme in place for the plant. Are regular inspections of the dam, embankments and water control equipment an integral part of the surveillance activity?
  8. For planned upgrade or decommissioning works, what measures are in place to mitigate potential environmental damage risks?
  9. What measures are in place to assess the environmental performance of third parties/contractors?
  10. Is a Cyber Risk Assessment carried out to evaluate threats to the plants operational performance and necessary mitigation measures?

# Web Links and References

[European Commission Energy Research & Innovation](#)

[EuroStat Hydropower Data](#)

[Eurostat Progress on Renewables](#)

[International Energy Agency](#)

[International Energy Agency Collaboration Programme](#)

[Stream Map HYDI Database](#)

[British Hydropower Association](#)

[Pumped Storage Plants](#)

[International Rivers NGO](#)

[International Rivers, NGO on Dam Removal](#)

[Hydropower Reform Coalition US NGO](#)

[The La Gótera Dam Removal Project 2011, Spain](#)

[The Robledo Dam Decommissioning 2013, Spain](#)

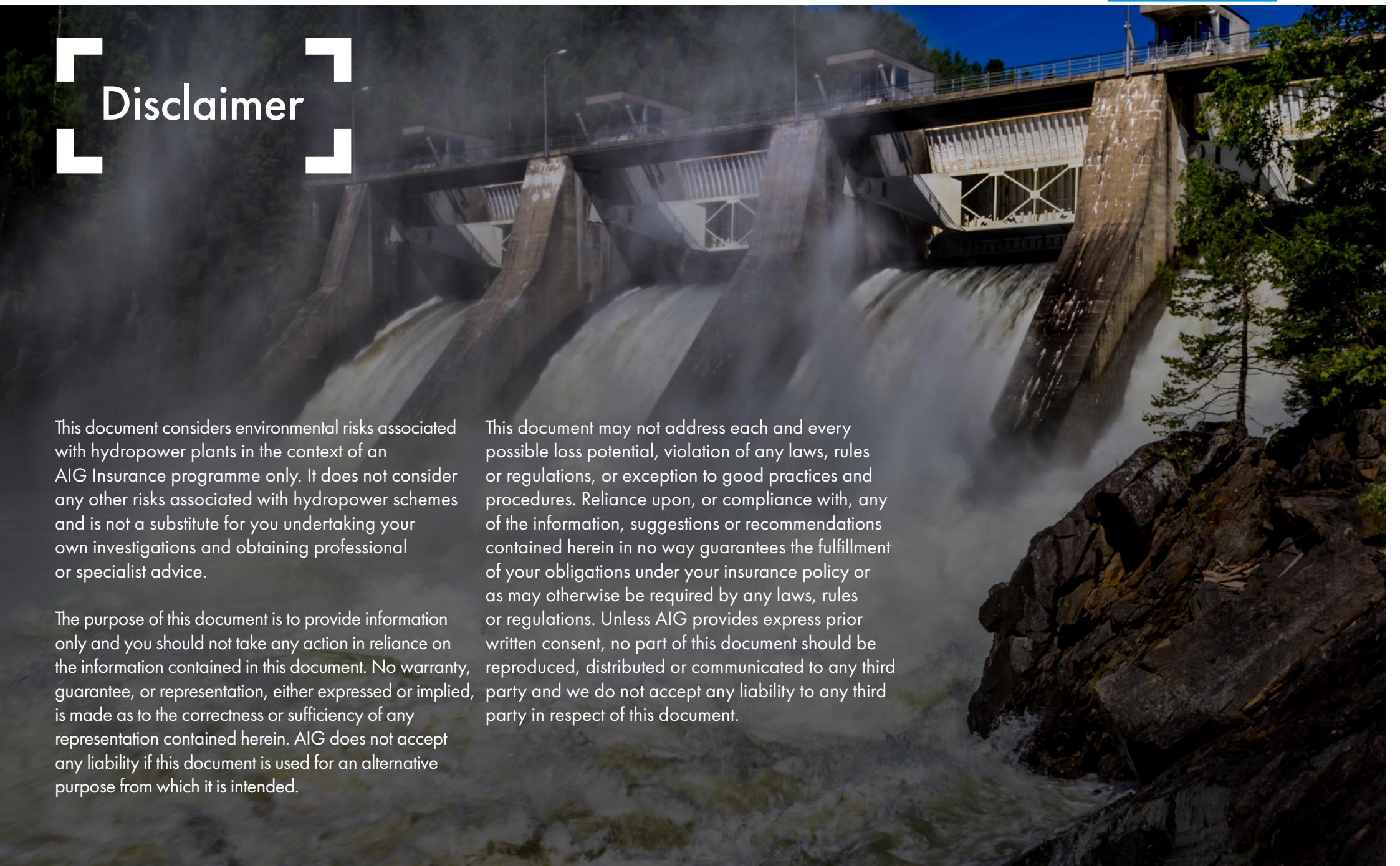
[The Economist](#)

# Disclaimer

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