IRSN PRESENTATION

IRSN IS THE FRENCH PUBLIC EXPERT ON NUCLEAR AND RADIOLOGICAL RISKS

[**NUCLEAR SAFETY AND SECURITY**]

[**PROTECTION OF THE POPULATION AND THE ENVIRONMENT**]

[**NUCLEAR AND RADIOLOGICAL EMERGENCY RESPONSE**]

Reactors, fuel cycle, waste management, transport of radioactive materials, radioactive sources.

Against the risks associated with ionizing radiation.

Operational support capacity.

Diagnosis of digital transformation in the nuclear industry

▌The nuclear industry is investigating and using more and more:
- digital approach
- artificial intelligence applications
- data analyzes
- …

[more and more exchanges with industrialists on innovative projects (digital twins, etc.)]

▌These innovative areas are **also already opportunities** for improved IRSN works, especially <u>assessment of safety provisions</u>

Obviously, the safety demonstrations, but also the safety provisions, will evolve … Our expertise will therefore also evolve.
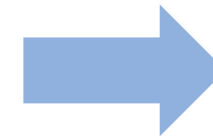
A very complex subject

▌A lot of subject and technologies, news skills and knowledge, with different safety isssues

➡ **a pragmatic systemic approach is required**

▌Key aspects :

Data governance
Assessment tools
Core business Knowledge & skill
Integration with existing systems

Technical requirements
Assessment process
Regulatory
System security ...

➡ **Need a nuclear activities framework aligned with safety demonstrations and <u>assessments requirements.</u>**
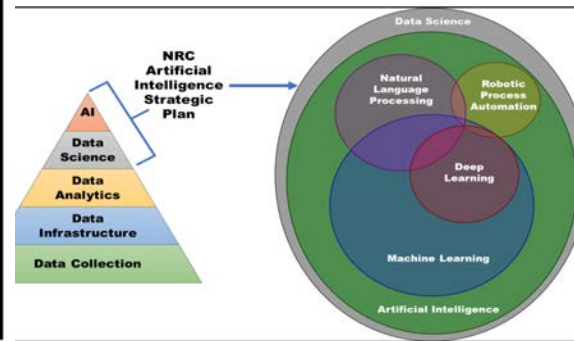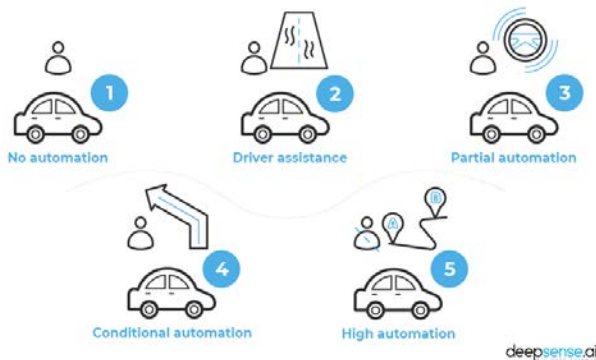
Example:

Figure 1 Artificial Intelligence Hierarchy and Relationship with the NRC AI Strategic Plan (adapted from [5] and [6])

Table 1 Notional AI and Autonomy Levels in Commercial Nuclear Activities

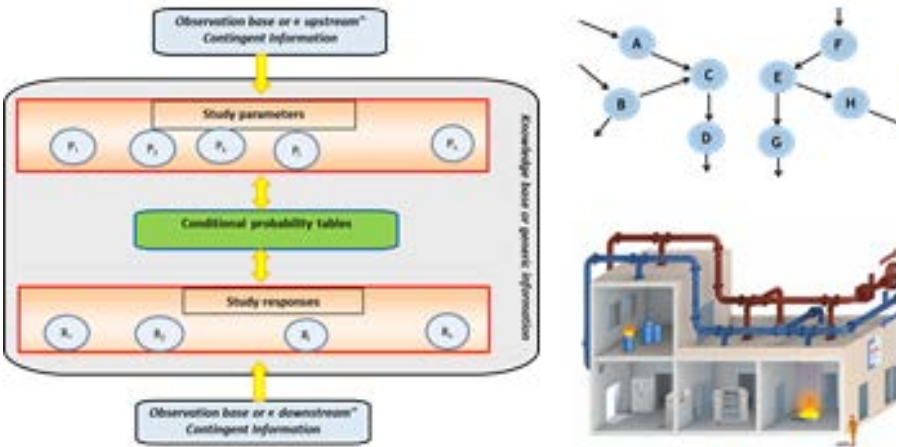| Notional AI and Autonomy Levels	Potential Uses of AI and Autonomy in Commercial Nuclear Activities
Level 1: Insight (Human decisionmaking assisted by a machine)	AI integration in systems is used for optimization, operational guidance, or business process automation that would not affect plant safety/security and control
Level 2: Collaboration (Human decisionmaking augmented by a machine)	AI integration in systems where algorithms make recommendations that could affect plant safety/security and control are vetted and carried out by a human decisionmaker
Level 3: Operation (Machine decisionmaking supervised by a human)	AI and autonomy integration in systems where algorithms make decisions and conduct operations with human oversight that could affect plant safety/security and control
Level 4: Fully Autonomous (Machine decisionmaking with no human intervention)	Fully autonomous AI in systems where the algorithm is responsible for operation, control, and intelligent adaptation without reliance on human intervention or oversight that could affect plant safety/security and control

Example of projects under development at IRSN

▌Objective: **use AI to support expertise**

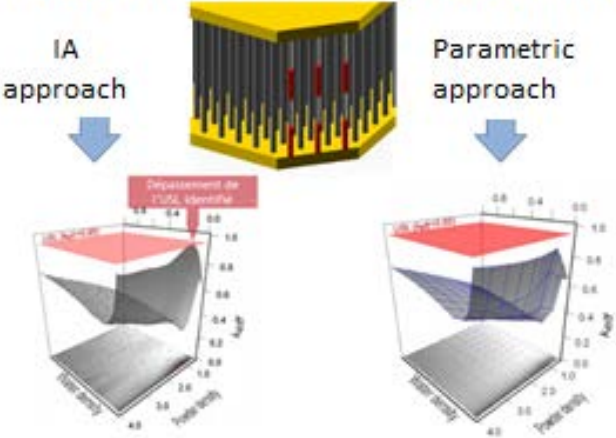▌Diverse application areas and AI technologies :
- assessment tools,
- external and internal data,
- expert system
- …

NRC/IRSN collaboration
STC Sheet n° 1

Fire expert system (Bayesian network)

Criticality optimum research (Kriging algorithm)

IA approach

Parametric approach

Natural Langage Processing (NLP), Machine Learning, Dataviz… for helping experts

IRSN general requirements for AI assessments tools

Explainability and Trust

- Ability to explain AI model results in a comprehensible manner.

- Confidence in model results and predictions to make informed decisions.

- The data / model used should align with the physical principles or accurately reflect the real characteristics of the nuclear industrial process.

- A rigorous validation of the models must be conducted to ensure their accuracy.

Robustness and Reliability: ensuring consistent and relevant results

- Ability of AI models to maintain performance and accuracy in unforeseen situations or changing conditions.

- Access to high-quality and sufficient data to train and evaluate AI models.

- Establishment of effective management processes to audit, update and maintain AI models throughout their use.

Accountability and Coherence: aligning AI Data and techniques with our missions

- Ensure that the choices of AI techniques are consistent with our missions of assessment.

- Benefit the necessary data aligned with our missions of TSO : *no more, no less* => Dataminization and data accountability

IRSN's requirements align with wider initiatives to master AI's technical application, including the ongoing regulatory development in Europe - particularly the AI Act.

IRSN

The EU AI Act : a risk-based approach

Objective: Establish rules based on the level of risk associated with AI.
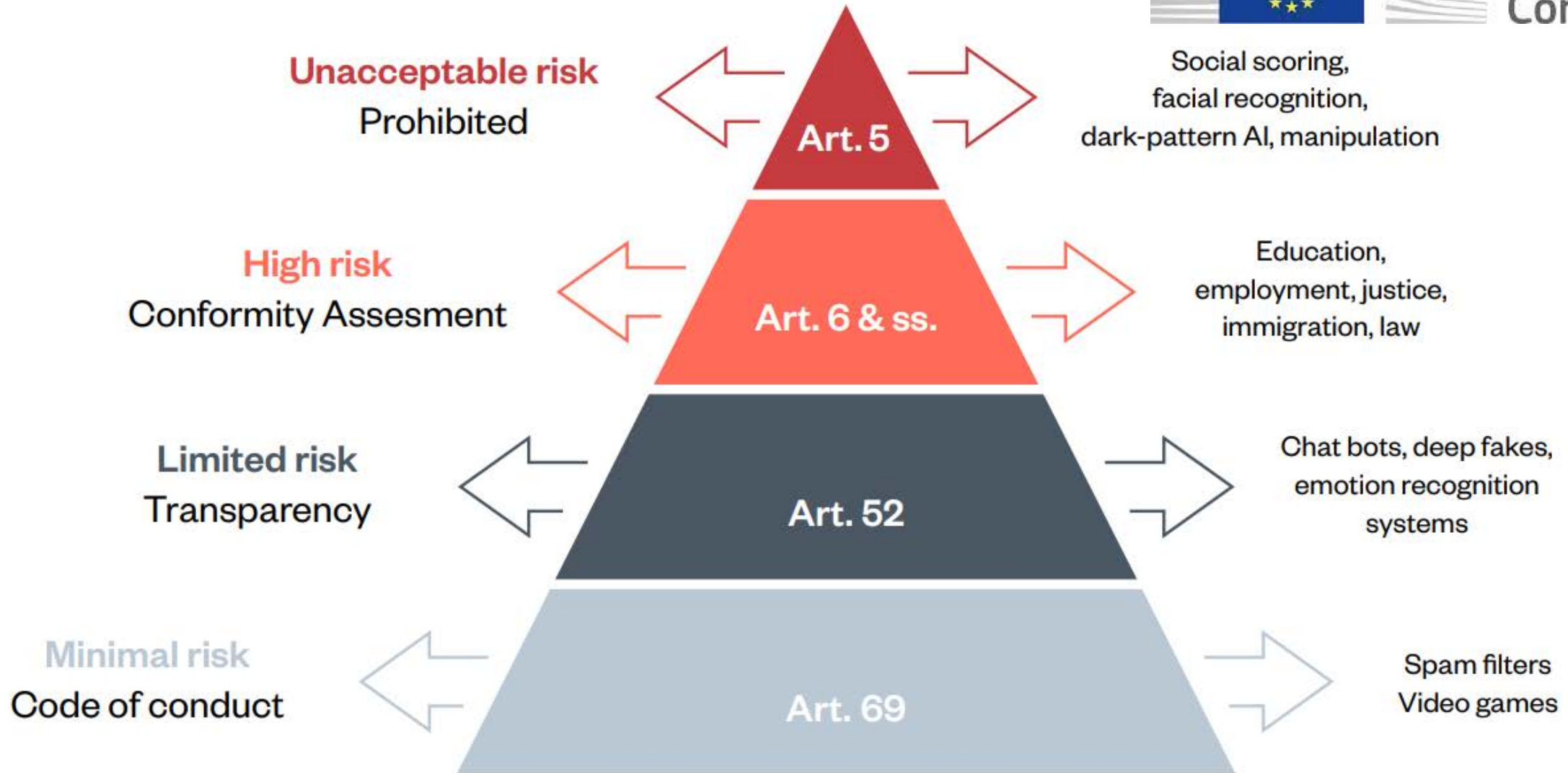
❑ **Key Points:**

- ▪ **Unacceptable Risk**: Some AI systems are deemed unacceptable due to their potential threat to individuals or society. This includes cognitive manipulation, social scoring, and real-time facial recognition.

- ▪ **High Risk**: High-risk AI systems are subdivided into two categories : safety component, autonomous AI systems.

- ▪ **Limited Risk**: AI systems with limited risk must meet minimum transparency requirements, enabling users to make informed decisions. Users must be informed when interacting with such systems, including deepfakes.

Essential requirements for high-risk AI

Two main categories of high-risk AI systems:

▌AI systems intended to be used as **safety component** of products that are subject to third party conformity assessment: this mainly concerns AI systems used in security components

▌**Autonomous AI systems**, including robots, used in **critical environments**, where failure could have serious consequences.

The EU AI Act : a risk-based approach

Unacceptable risk
Prohibited
Art. 5
Social scoring, facial recognition, dark-pattern AI, manipulation

High risk
Conformity Assesment
Art. 6 & ss.
Education, employment, justice, immigration, law

Limited risk
Transparency
Art. 52
Chat bots, deep fakes, emotion recognition systems

Minimal risk
Code of conduct
Art. 69
Spam filters
Video games

Source : The EU AI Act: a summary of its significance and scope, Lilian Edwards

Essential requirements for high-risk AI

The law requires suppliers of high-risk AI systems to carry out a prior conformity assessment before placing them on the market (Articles 16 and 43) :

▌ **Requirements include data and data governance, technical documentation, record retention, transparency, human oversight, and robustness, accuracy and security.**

▌ Suppliers must have a **risk management system** in place that documents and manages risks throughout the life cycle of the AI system, including under conditions of "reasonably foreseeable misuse".

▌ Data rules aim to ensure **the quality of the data used to build AI systems**, including by ensuring that training packages are relevant, representative, error-free and complete.

▌ **Human monitoring** should enable people to effectively supervise the AI system, detect anomalies, prevent bias, and correctly interpret results

Conclusions and perspectives

▌ Each Member State will have **to designate one or more competent national authorities responsible for monitoring the application and implementation of this Regulation**.

▌ **These regulatory considerations include the general technical requirements relating to IRSN's nuclear safety expertise.**

▌ **This context will be regulatory and it will be necessary to comply with it**. It will require us to identify the areas where we need to be vigilant. Moreover, it can stimulate our thinking and enrich our requirements (a source of inspiration).

▌ It will be necessary **to take ownership and implement regulatory principles**, particularly for high-risk systems, particularly at IRSN, for the development of its tools.

▌ In addition, the use by nuclear operators of tools using high-risk AI in safety demonstrations or in systems impacting the safety of installations will have to be subject to a **compliance application and assessment, for which we must continue our efforts to prepare in terms of resources and skills**