



EFSA's role in assessing emerging technologies

OVERVIEW

- What is EFSA ?
- How does EFSA identify emerging technologies ?
- Examples of some of the issues identified
- EFSA's work on
 - New Plant Breeding Techniques
 - RNA Interference (RNAi)





WHAT IS EFSA ?

EFSA is the keystone of EU risk assessment regarding food and feed safety. In close co-operation with national authorities and in open consultation with its stakeholders, EFSA provides independent scientific advice and clear communication on existing and emerging risks

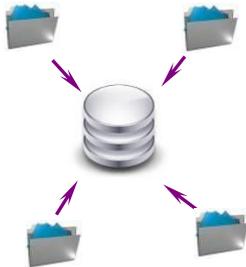
EMERGING RISKS

Article 34

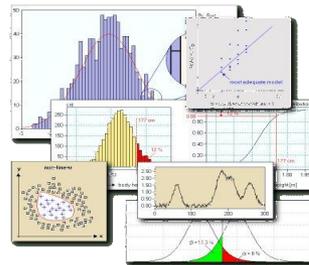
Identification of emerging risks

1. The Authority shall establish **monitoring** procedures for systematic searching for, **collecting**, **collating** and **analysing** information and data **with a view to the identification of emerging risks** in the fields within its mission.

Collecting and
collating



Analyse and
filter



sharing

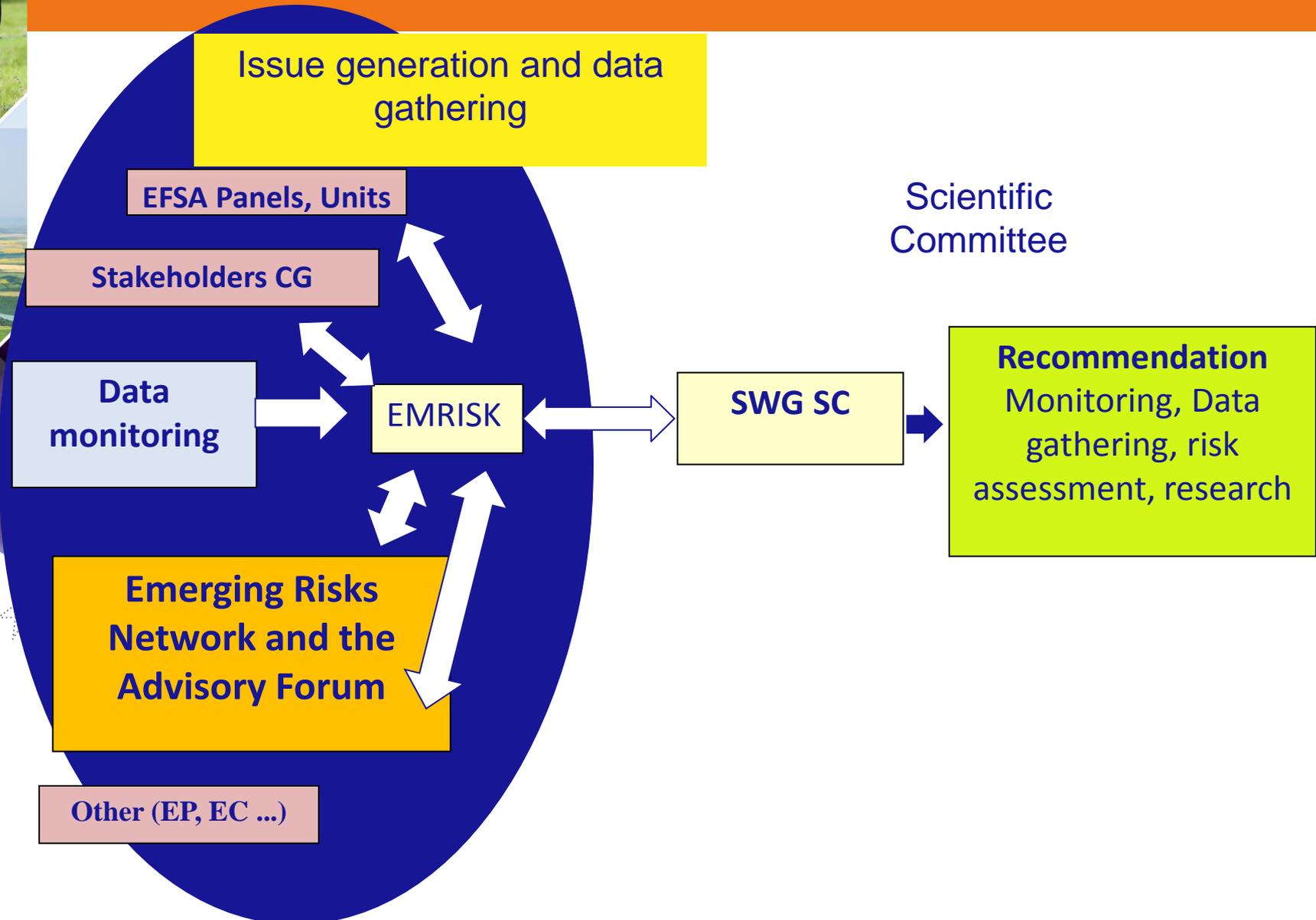
WHAT DO WE HOPE TO ACHIEVE ?

Early identification of new problems (not necessarily incidents or crises), to better anticipate risk assessment needs:

- Research
- Data generation (and methods for doing this)
- Risk assessment methodology development



A NETWORKING PROCESS



EMERGING TECHNOLOGIES

- Synthetic Biology
- Animal Cloning
- Garage GMO

..... and related issues;

- Omics Technologies
- Human biomonitoring
- Climate change on mycotoxin production in European cereal crops
- Food prices, and trends in food trade
- Bee Health
- Non-monotonic dose response
- Chemical mixtures

EFSA'S WORK ON NEW PLANT BREEDING TECHNIQUES

European Commission Mandate on New Plant Breeding Techniques (2011)

Objective:

- To assess the adequacy of **EFSA guidelines** to perform a risk assessment of plants developed through **8 techniques**
 - Determine whether there is a need for new guidance or to modify the existing guidance on risk assessment

Out of scope:

- The EFSA GMO Panel was **not** mandated to conclude on the regulation (or not) of these NPBT → **this is for risk managers to decide**

EFSA'S WORK ON NEW PLANT BREEDING TECHNIQUES

1. Oligonucleotide-Directed Mutagenesis (ODM) ✕
2. Zinc Finger Nuclease technology (ZFN) ✓
3. Cisgenesis (comprising cisgenesis and intragenesis) ✓
4. Grafting ✕
5. Agro-infiltration ✕
6. RNAdependent DNA methylation via RNAi/siRNA ✕
7. Reverse breeding ✕
8. Synthetic biology ✕

✓ Completed
✕ Not started yet



CIS AND INTRAGENESIS

- All elements introduced into the recipient organism are derived from the same species or a crossable species

Cisgenesis

- Gene remains intact - native promoter, coding sequence, introns and terminator in the normal sense orientation

Intragenesis

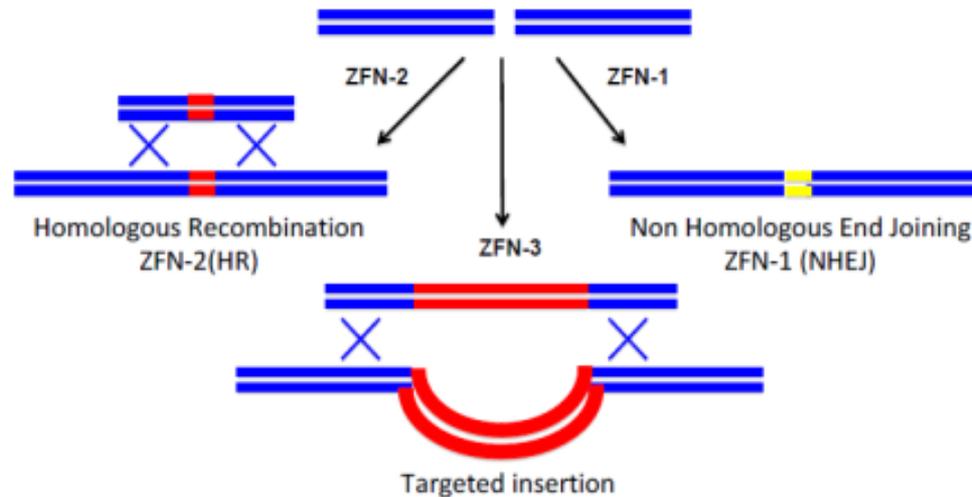
- Reorganised, full or partial coding region, promoter or terminator from another gene of the same species or crossable species. Arranged in sense or antisense orientation



ZINC FINGER NUCLEASE (ZFN) TECHNOLOGY

Classification of ZFNs according to a report by the EC Working Group on NPBT

- ZFN-1 Site specific random point mutation
- ZFN-2 Site specific desired point mutation
- ZFN-3 Site specific insertion/deletion of DNA stretch



CONCLUSIONS ON CIS-/INTRAGENESIS AND ZFN-3

- Scientific opinions adopted in 2012, published in the EFSA Journal (<http://www.efsa.europa.eu/en/efsajournal>)
- **Conclusions on cisgenesis/intragenesis and ZNF-3**
 - the Guidance documents are applicable for the evaluation of food and feed products, for performing an environmental risk assessment and do not need to be developed further.
 - It can be envisaged that on a case-by-case basis lesser amount of data is needed for the risk assessment.

EFSA'S WORK ON RNA INTERFERENCE (RNAI)

EFSA organised an international workshop on RNAi-based GM Plants (Brussels, June 2014) with the aim to:

- Update our knowledge on the biology on RNAi mechanisms in plants, mammals and invertebrates
- Explore current and future RNAi-based applications
- Identify issues unique to RNAi-based GM plants and their risk assessment

The workshop included 3 Break-out sessions focusing on the three main areas of the GMO risk assessment: Molecular Characterisation, Food and Feed Safety, Environmental Risk Assessment

BREAK-OUT SESSIONS: SELECTED DISCUSSION TOPICS



Molecular Characterisation	Food & Feed safety Assessment	Environmental Risk Assessment
Composition of the siRNA pool from dsRNA breakdown	Exposure pathways and barriers of exposure (uptake from the gut)	Role of bioinformatics in informing the species selection
Minimal target match & Bioinformatic tools to detect off-targets	Possible toxicological and allergenicity properties of RNAi molecules	Resistance evolution to the target insect pests
Mechanistic conservation of RNAi mechanisms across species	Additional compositional endpoints to be considered	Fate of dsRNA/siRNA in environmental matrices

OUTCOME OF RNAI WORKSHOP DISCUSSION

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- Molecular characterisation and comparative analysis should remain the basis of RA to identify potential safety relevant intended and unintended changes in the RNAi-based GM plant
 - Bioinformatic analyses could play an important role in informing the RA, but more research is needed on interaction between sRNAs and target sequences, and on genomes of target and non-target species
 - Based on the toxicological and pharmacokinetic profile of RNAi molecules, oral toxicity studies with purified RNAi molecules were not considered relevant
 - Event report summarising discussions available on EFSA's webpage (<http://www.efsa.europa.eu/en/supporting/doc/705e.pdf>)
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Questions ?

