ENSREG Post-Fukushima National Action Plans Workshop

Belgium Updated NAcP Report

FANC
federal agency for nuclear control

Welcome in Belgium !

FANC
federal agency for nuclear control

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- NAcP Overview
- Stress Tests National Action Plan - Progress
- Response/clarifications to 2014 comments on Belgium NAcP
- Challenges and Good practices

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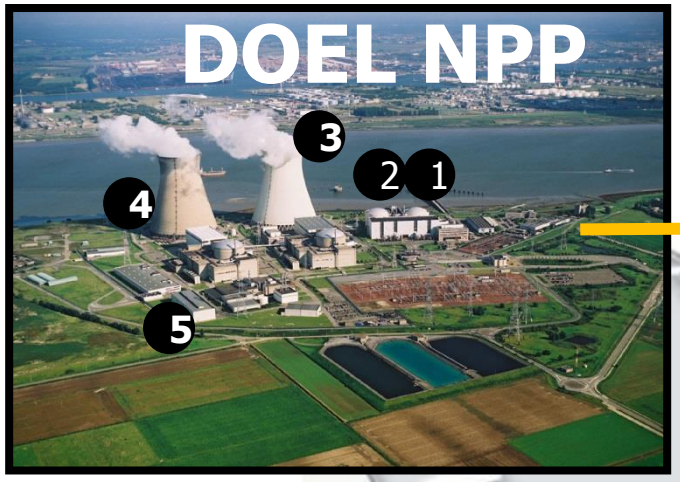
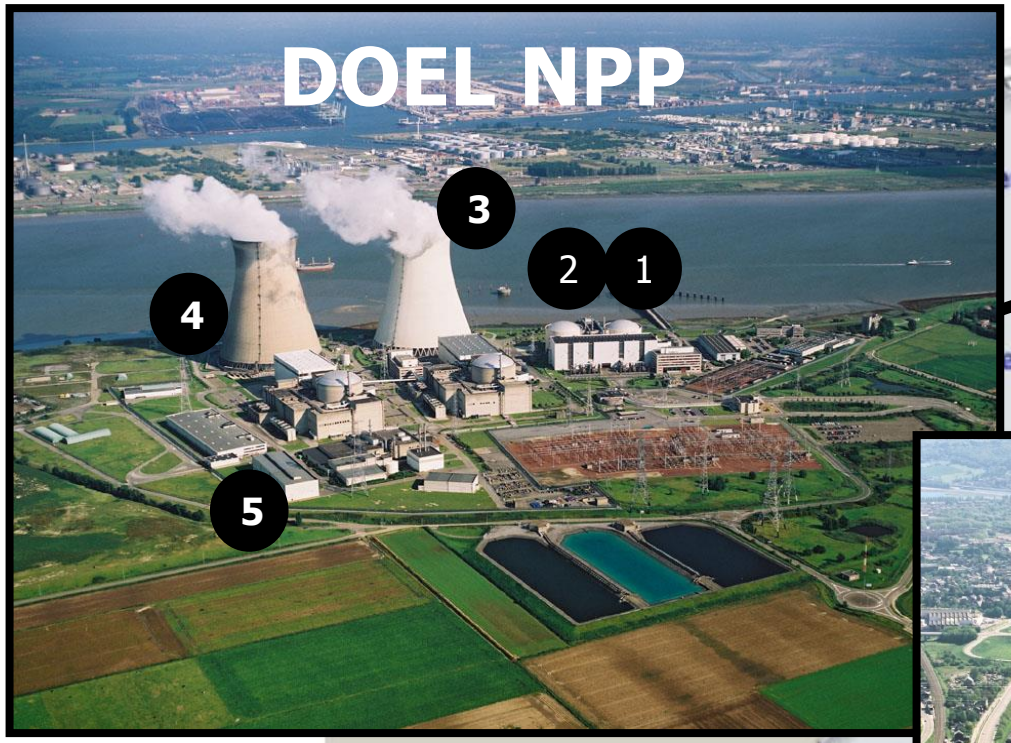
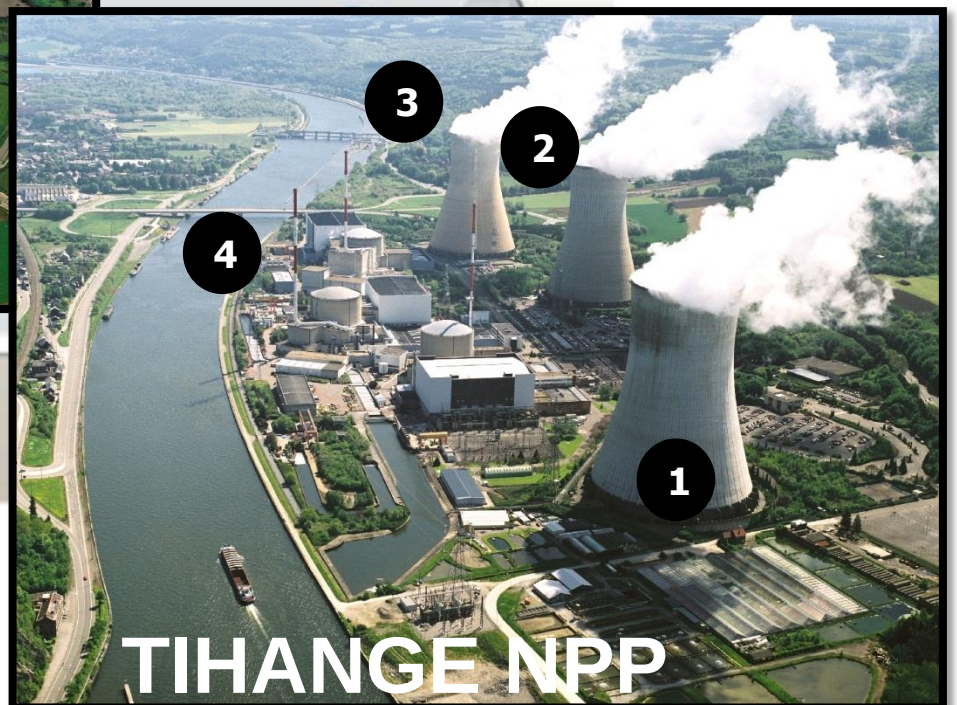
WELCOME IN BELGIUM



WELCOME IN BELGIUM

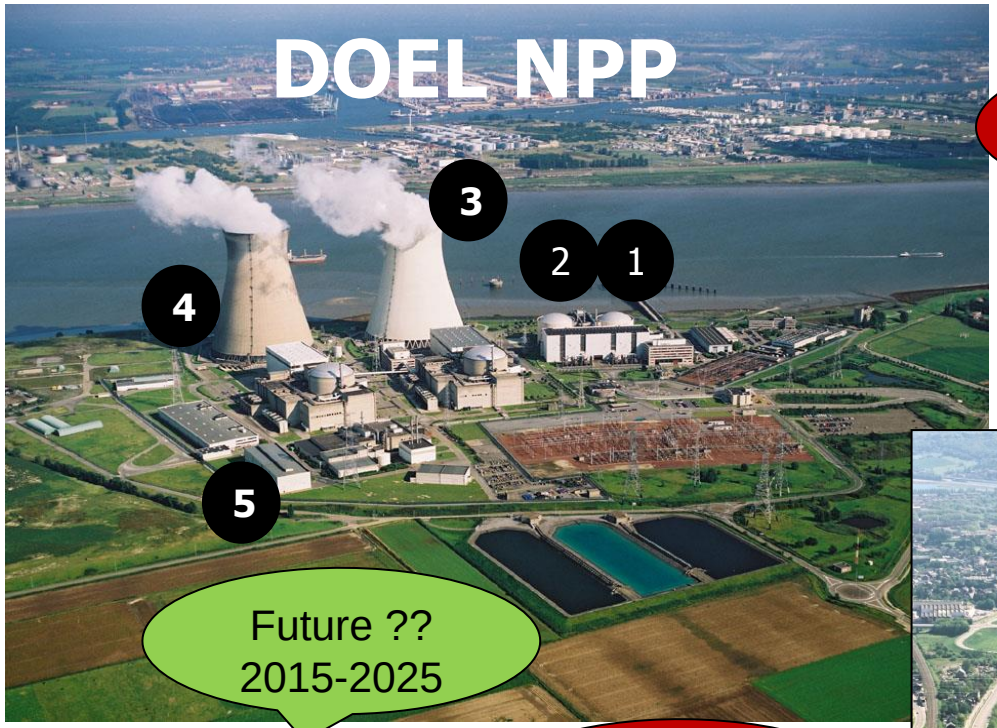
Belgium NPP's





1. Introduction – Challenges in Belgium

Belgium NPP's



Future ??
2015-2025

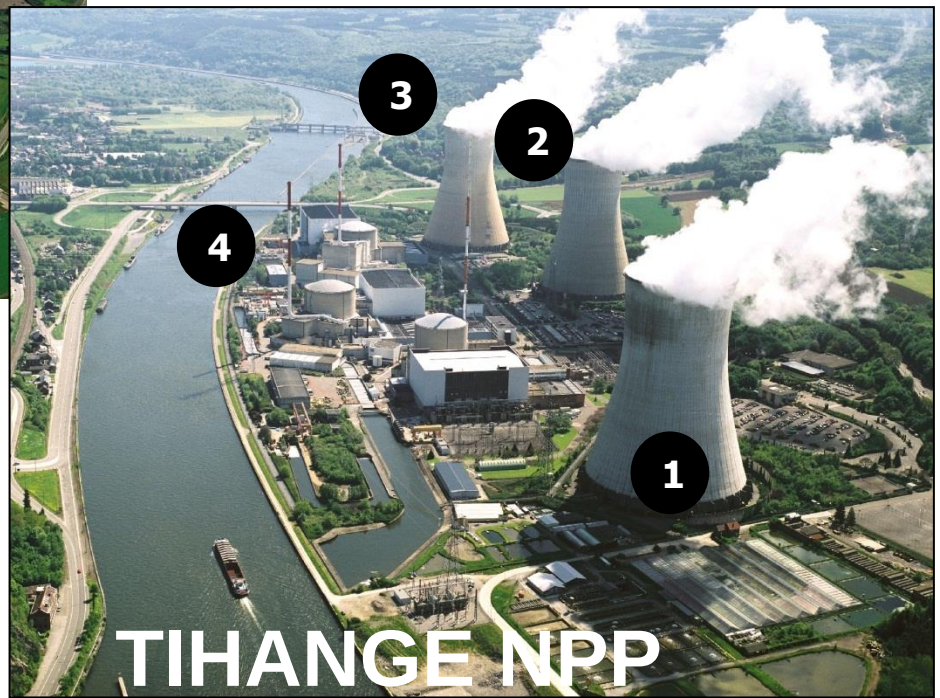
RPV issue
Flaked

1. Doel 1 - 433 MW (1
2. Doel 2 - 433 MW (19
3. Doel 3 - 1006 MW (1982)
4. Doel 4 - 1040 MW (1985)
5. Spent Fuel storage SCG

LTO
2015-2025

RPV issue
Flaked

1. Tihange 1 – 962 MW (1975)
2. Tihange 2 – 1008 MW (1983)
3. Tihange 3 – 1054 MW (1985)
4. Spent fuel storage: DE building



1. Introduction – Current situation: Doel 3/Tihange 2

RPV issue in Belgium – flaked RPV (Q312, 912)

- 2012 : several thousands indications of hydrogen flakes have been found in the RPVs of Doel 3 and Tihange 2

  The two reactors were shut down

- By the end of 2012, Electrabel presented a Safety Case on the issue
- In May 2013, the two reactors were authorized to restart pending on the realization of mid-term actions before their next outages

- In March 2014, Electrabel decided to shut down the two reactors following an unexpected results of one of these mid-term actions

  (irradiation tests on representative material)

- In 2015, The licensee Electrabel is still carrying on the safety demonstration of these two nuclear reactors.
- No decision yet on the future of these two reactors.

1. Introduction – Current situation: Doel 3/Tihange 2

Impact on the Stress Tests Belgium NAcP

- Almost zero impact on the implementation of NAcP
  - Most actions concern the Site and not the units separately
  - Safety Authorities have accepted few actions to be delayed pending on the future decision on the operability of these two units
    - Purchase of mobile pumps and mobile diesels
- Impact on the closure of actions (Commissioning pending on restart)

1. Introduction – Current situation: Tihange 1

Tihange 1 – LTO confirmed for 2015-2025

- LTO outages: 2014/2015/2016

- Impact on the Stress Tests Belgium NAcP
- Stress Tests NAcP Actions concerning Design Upgrade of Tihange 1 have been included in the LTO Action Plan
  - More convenient for the licensee project management
  - Removed from Stress Tests NAcP -> added to LTO NAcP
  - Whatever the project name, the implementation of all actions is continuously followed by the Belgian Safety Authorities

1. Introduction – Current situation: Doel 1/Doel 2

Doel 1/2 – Future? (Q354,313, 888, 183, 593, 647, 660, 663, 640,)

2012	Study for a possible LTO for Doel 1 and Doel 2
2012	Political decision – Definitive shutdown
2014	Political decision : In order to guarantee the power supply in Belgium during the forthcoming winters, a possibility exists for Doel 1 and Doel 2 to enter a LTO program
15/02/2015	(Definitive) Shut-down of Doel 1 after 40 years of operation
21/04/2015	On going discussions: • Licensee : feasability study/ cost evaluation/ preparation of Action Plan • FANC: minimum requirements – evaluation of Action Plan • (Financial) Discussion : Government/Licensee => Law to be modified
(15/12/2015	(Definitive) Shut-down of Doel 2 after 40 years of operation)

- Impact on the Stress Tests Belgium NAcP

1. Introduction – Current situation: Doel 1/Doel 2

- Impact on the Stress Tests Belgium NAcP

- In 2012, following the decision of the Belgian government to definitively shut down Doel 1 and Doel 2 in 2015 after 40 years of operation, the Stress Test NAcP has been adapted for these two units. Most actions not quickly implementable or necessary for the dismantling were suppressed.
- In case of a decision for a LTO, FANC requires as prerequisites the implementation of all action plans lightened or removed consecutively to the shut-down decisions (including the stress tests National Action Plan)
- Every action of the NAcP originally planned for Doel 1 and Doel 2 has to be implemented. The only modification potentially authorized by FANC should be deadline revisions.

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  - Follow-up by Safety Authorities
  - NAcP Status
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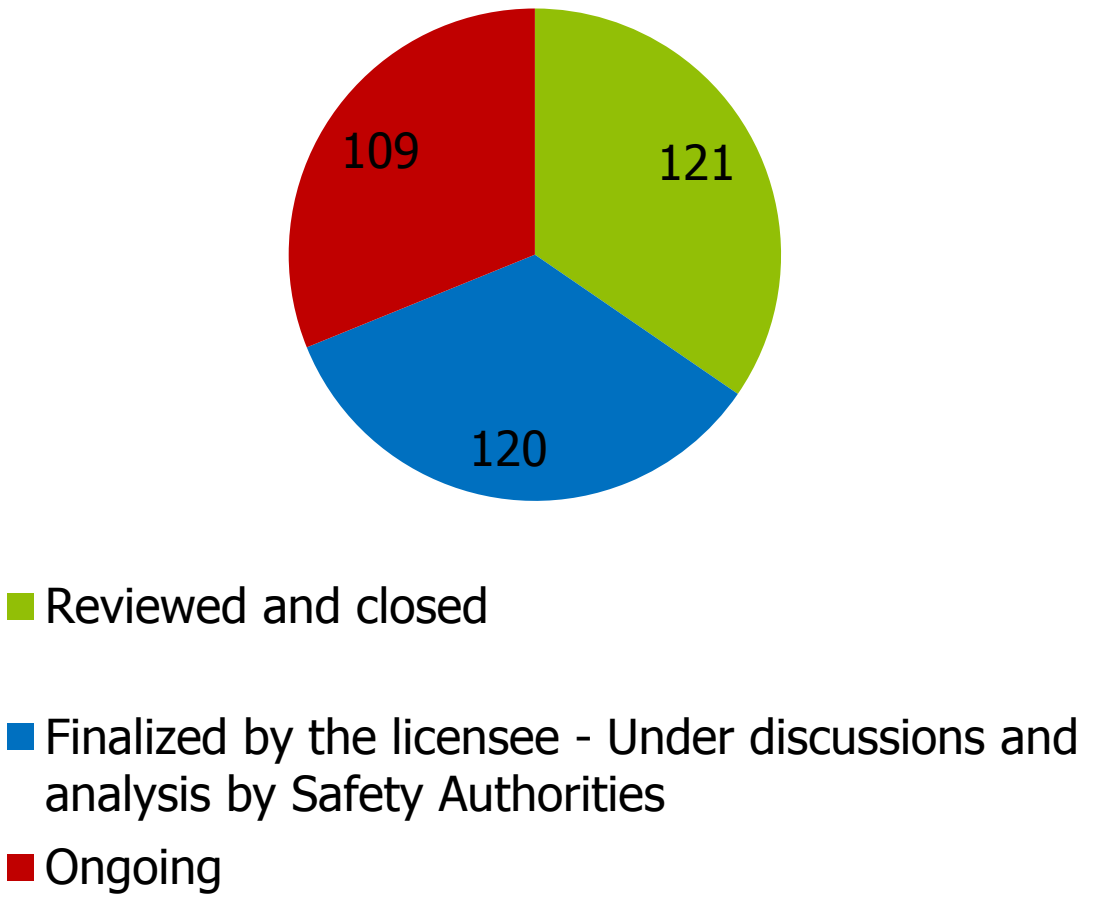
2. Stress Tests National Action Plan – Belgium

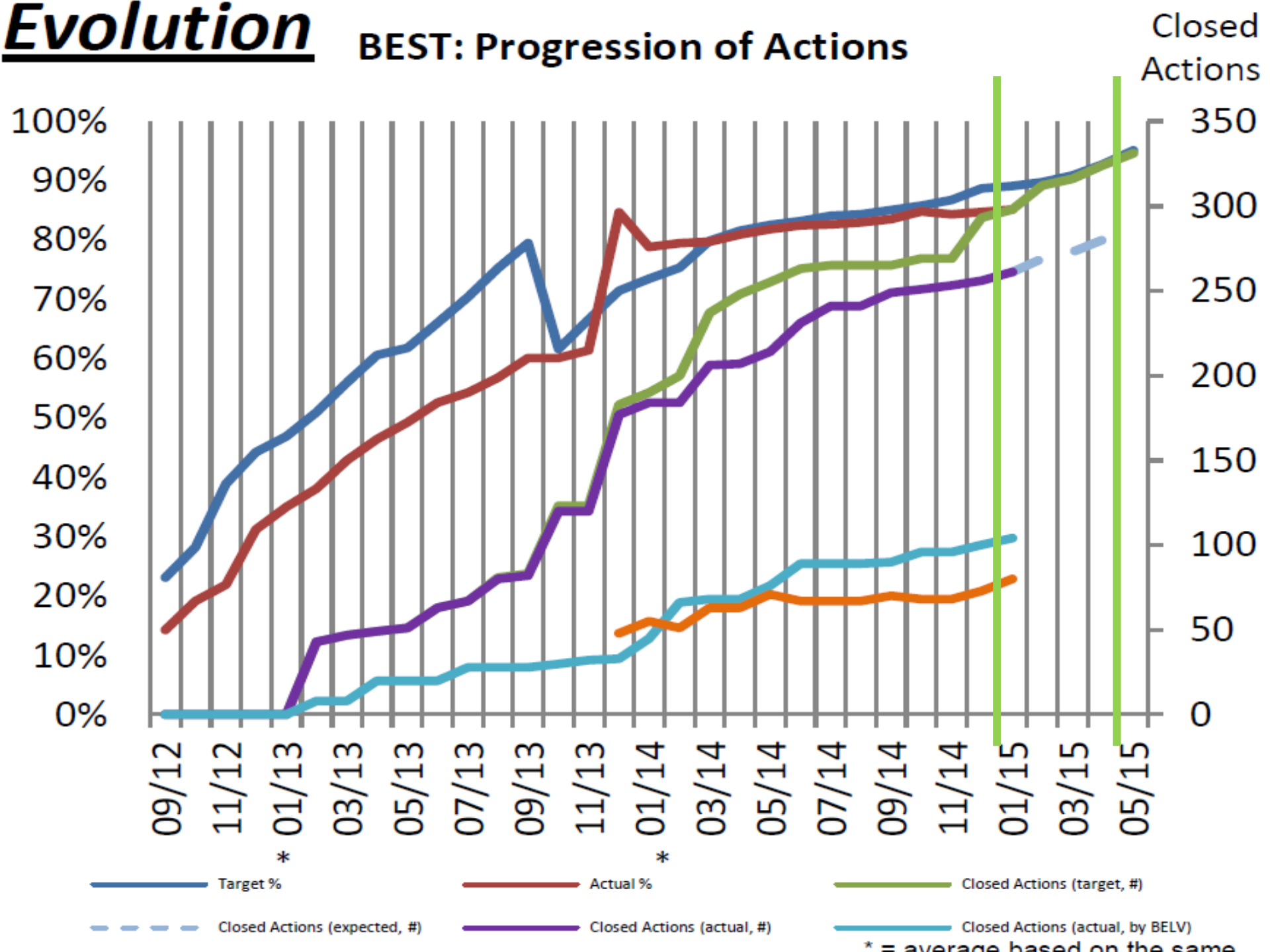
- « Living » NAcP - Regular update by Licensee (every 3 months)
  - Progress (delay for some actions)
  - New or changed actions (resulting of **safety evaluations**)
- NAcP follow-up by the Safety Authorities: FANC + Bel V (TSO)
  - Periodic technical meetings (Licensee – Bel V) depending on progress
  - Periodic progress meetings (Licensee – Bel V - FANC): every 3 months
  - On-site inspections to check implementation
  - FANC inspections dedicated to NAcP Follow-up
  - Every action is analysed and reviewed by the Safety Authorities (Q645, 646, 650, 651, 658)

2. Stress Tests National Action Plan – Belgium: Update

- « Living » NAcP – 350 Actions (revision 12/2014)



Evolution


BEST: Progression of Actions
Closed Actions
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
350
300
250
200
150
100
50
0
09/12
11/12
01/13
03/13
05/13
07/13
09/13
11/13
01/14
03/14
05/14
07/14
09/14
11/14
01/15
03/15
05/15
*
*
Target %
Actual %
Closed Actions (target, #)
Closed Actions (expected, #)
Closed Actions (actual, #)
Closed Actions (actual, by BELV)
* = average based on the same

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  - External hazards
  - Power and Water Supply
  - Severe Accident Management
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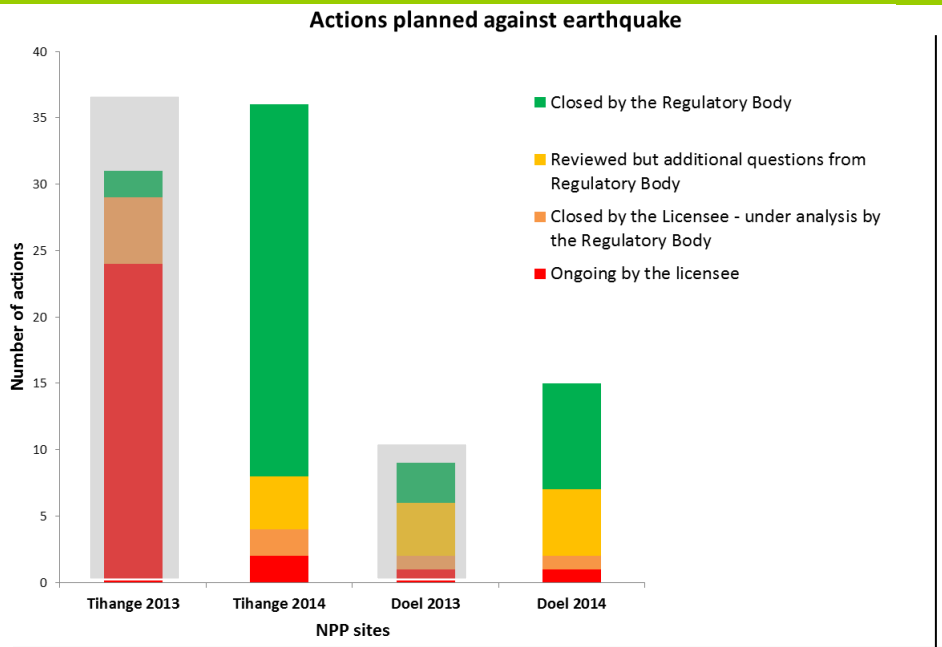
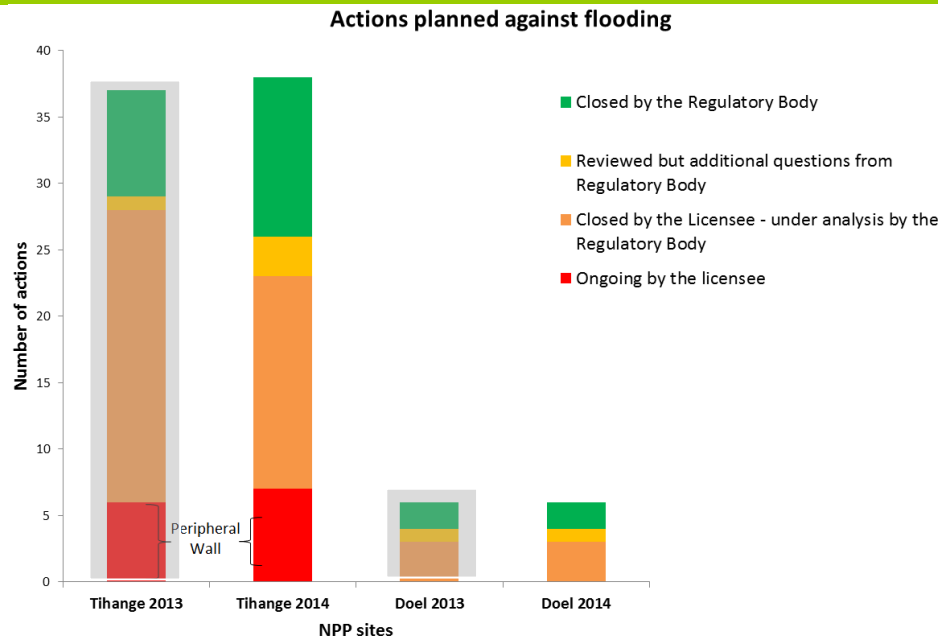
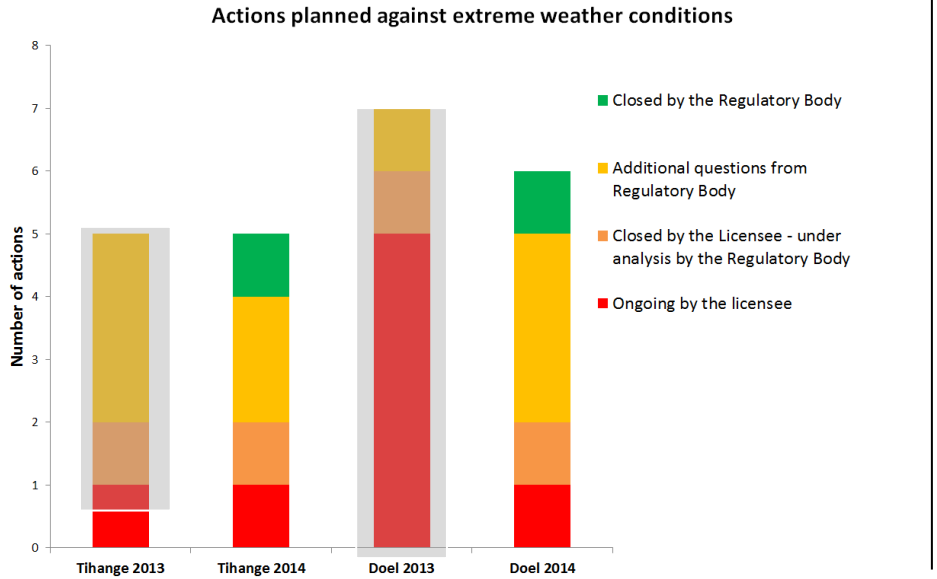
3. Stress Tests National Action Plan – Progress : External hazards

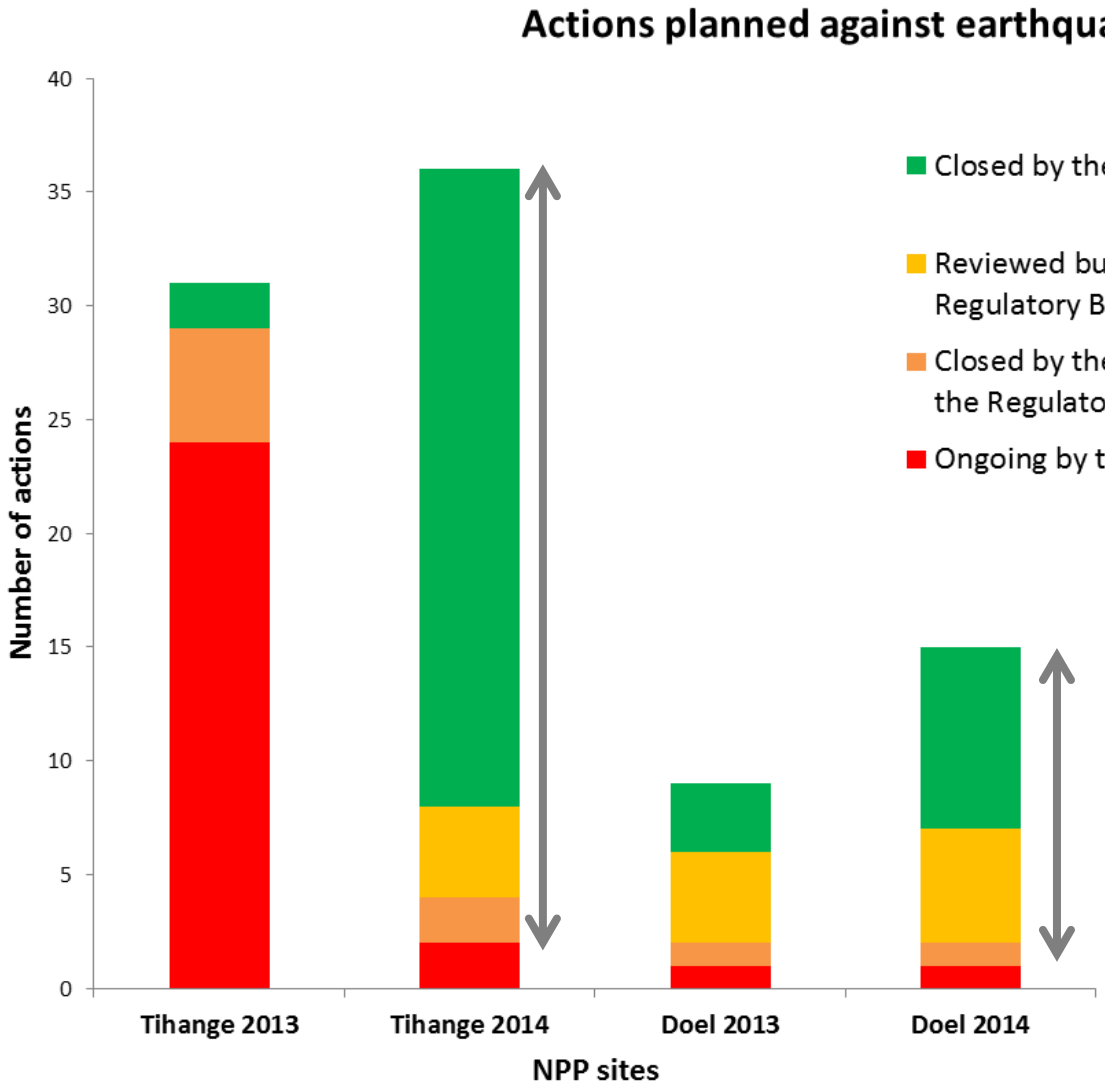






- Comparison December 2013-December 2014
- **Return period**: 10 000 years (Q648) (target for heavy rains)

3. Stress Tests National Action Plan – Progress : Earthquakes



Main actions ongoing

New assessment of the seismic hazard for Tihange and Doel NPPs -> May 2015

FANC federal agency for nuclear control

3. Stress Tests National Action Plan – Progress : Earthquake

In order to assess the **adequacy of the design basis earthquake** (DBE), the Royal Observatory of Belgium (ROB) performed a first seismic risk assessment in **2011**.

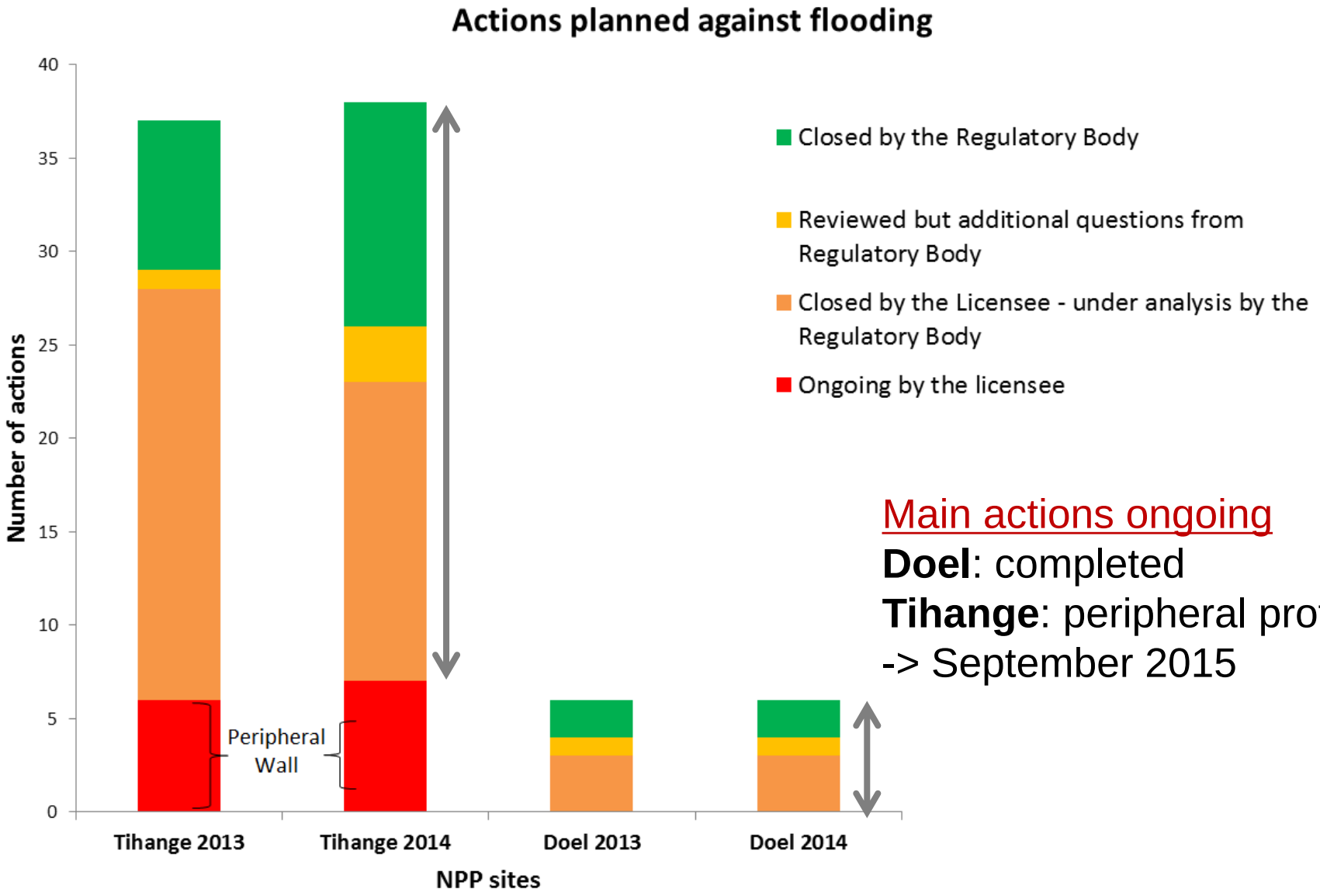
- **Doel** : conform
- **Tihange**: greater peak ground acceleration than presumed when facilities design. However safety margin assessment demonstrated that the equipment is more robust than required by the **design basis earthquake**.

A new assessment of the seismic hazard for Tihange and Doel NPPs' has been carried out by the Belgian Royal Observatory. The final report of this Probabilistic Seismic Hazard Analysis (PSHA) is currently in completion and will be presented to regulatory body in May 2015.

According to the licensee, it confirms for both sites the adequacy of the current DBE (not yet evaluated by the Belgian Safety Authorities)

(Answer to questions : 355, 356, 475, 86, 184, 476, 585, 635, 636, 637)

3. Stress Tests National Action Plan – Progress : Flooding



Main actions ongoing

Doel: completed

Tihange: peripheral protection -> September 2015

3. Stress Tests National Action Plan – Progress : Flooding

Doel: fully completed by the licensee, almost fully reviewed by the Safety Authorities

Tihange: Actions are ongoing – little delays : 2015

Initially – 3 levels of protection were planned at Tihange

1. Peripheral protection
2. Volumetric protection
3. Non-conventional means

3. Stress Tests National Action Plan – Progress : Flooding

Local volumetric protections

Tihange

- Initial deadline: 2013
- Abandoned : 2012

Justification :

- Would not provide infallible protection
- But would decrease the reliability of the protection strategy against flooding due the increased complexity

Local volumetric protections

Doel

- Initial deadline: 2012 - 2013
- Completed : 2013 / Closed : 2014

Justification :

- Beyond-design flood → limited local water accumulations (a few 10 cm)
- Simplicity (removable barriers)

Q 592, 643) It has been decided in accordance between utility and regulatory body to realize a volumetric protection for the whole Tihange site rather than for individual buildings. An efficient volumetric protection of existing buildings surrounded with more than 2 meters of water is very complex to achieve. The probability of failure is high and the necessary arrangements have drawbacks is terms of availability of SSC's.

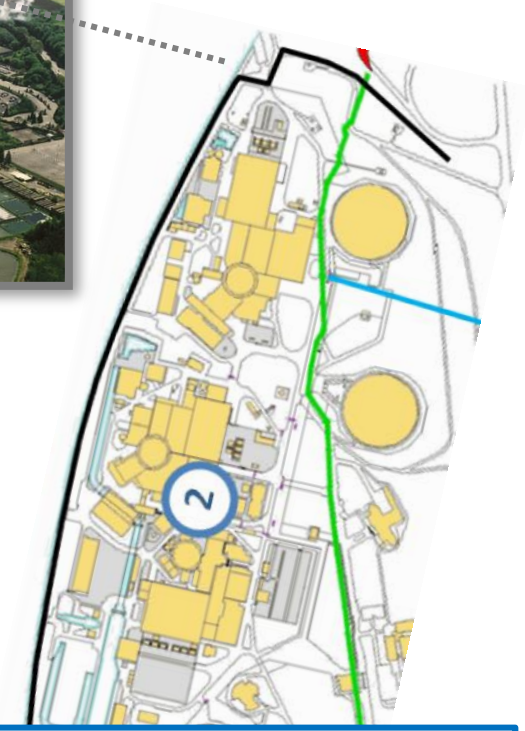
3. Stress Tests National Action Plan – Progress : Flooding

Tihange
Peripheral protection

- Initial deadline: 2014
- Current deadline: September 2015

Status:

- Wall : built
- Mechanical and electrical devices planned by June 2015



Q641, 642) The height of the protection wall is base on an extreme flooding occurring once in every 10,000 years.
A margin of 40 cm on the flooding level has been considered to take modelling uncertainties into account.
Ultimate safety systems have been added to fulfil safety functions in case of a more severe flooding. They are designed to remain operable with a river flow at 130% of the decamillenial flooding (i.e. 1 more meter in terms of water level).

Isolation chambers of the feed channel

3. Stress Tests National Action Plan – Progress : Flooding

Tihange

Non-conventional means

(Q270, 644)

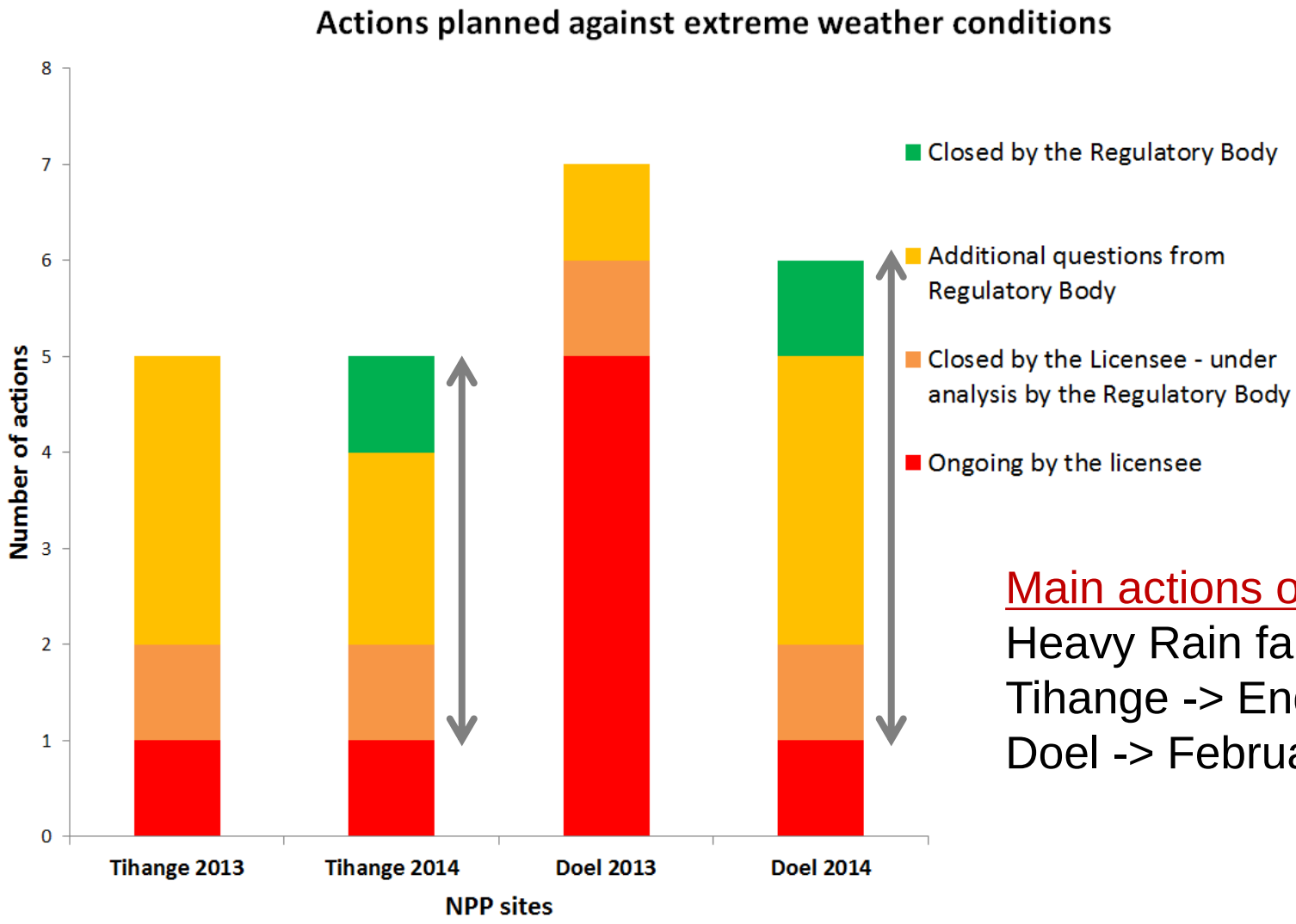
- Initial deadline: 2011-2012
- Completed : 2013 / Closed : 2014

A first level of protection against external flooding is constituted by wall, dike, isolation structures, pumping chambers...; it can cope against flooding event with an occurrence probability 10-4 years (with appropriate margin) and is considered as part of the new design basis condition for Tihange NPP.

Additional prevention means, like DG's in bunkered buildings, fixed pipes and pumps, are being considered for beyond design basis conditions: Non conventional means
There is no specific mitigation means for severe accident conditions in case of flooding. However, the filtered vent containment system will be located above the new flooding design basis level with a margin of 1 m.

- -> Fully operational

3. Stress Tests National Action Plan – Progress : Extreme weather conditions "snow, heavy rains, lightning…"



Main actions ongoing

Heavy Rain falls

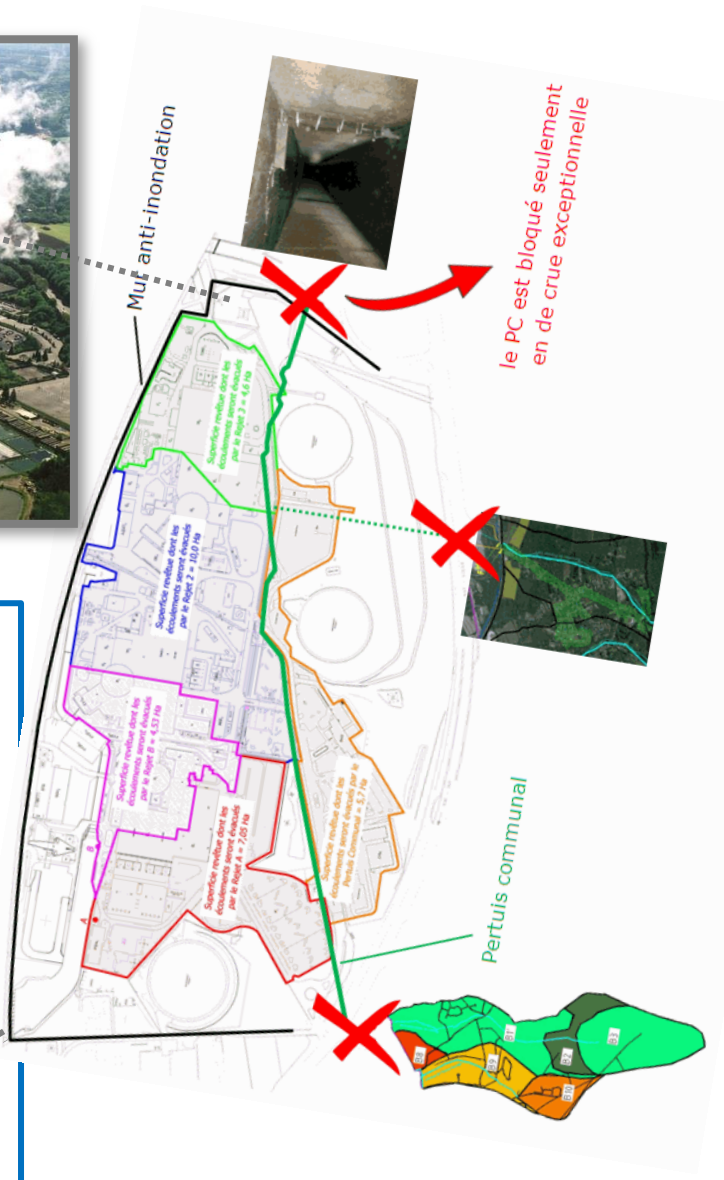
Tihange -> End 2015

Doel -> February 2015

3. Stress Tests National Action Plan – Progress : Rainfalls

Tihange
Heavy rainfalls
(Q649, 74)

- Initial deadline:
- Realization : 2015

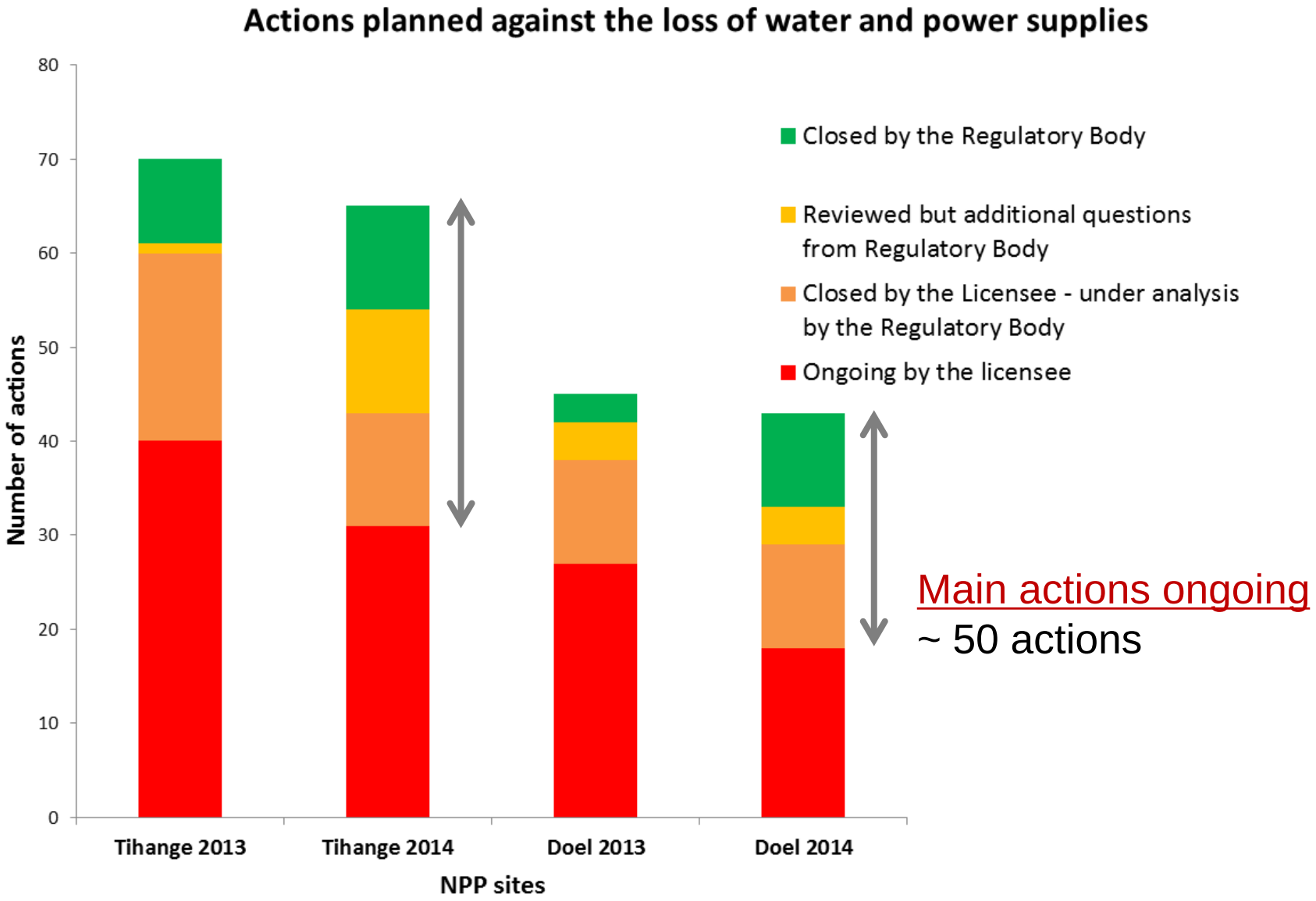


The revaluation of the impact of heavy rains for **Doel** shows that even though water can temporarily build up on the lowest parts of the site, safety systems remain dry and operable. The impact of heavy rains on Doel is limited by the fact that the Doel site is build above a large surrounding "polder" area.

The **Tihange** site is located in a river valley. Moreover, before the plant construction, the site was part of the Tihange village. The presence under the site of a sewage pipe collecting water from the upstream area (including 2 brooks) could bring large amounts of water in case of local heavy rains. To eliminate this risk, it has been decided to **divert the municipal sewage** towards the Meuse river upstream the NPP site.

3. Stress Tests National Action Plan – Progress : Rainfalls

3. Stress Tests National Action Plan
Progress : Loss of power and water supplies



3. Stress Tests National Action Plan – Progress : CSBO

- CSBO and UHS : delayed to 2016

Tihange

2012-2013 : - focus on the flooding project -> delay several CSBO actions.

- priority actions executed during plant outages

2014 : CSBO is a very complex issues. Focus on the site global strategy against CSBO.

2015 : design review of the CSBO and improvements

Doel, the CSBO strategy is already being implemented.

- Spent fuel pools: 2015-2016
  - Ongoing following the NAcP

3. Stress Tests National Action Plan – Progress : CSBO

- **17 Second level diesel groups at Tihange (Q191)** **(19 at Doel (Q88))**
  - **Unit 1**: 4 DGs (2 main EDGs, 1 "second level" DG, 1 DG associated to a fire pump)
  - **Unit 2**: 7 DGs (3 main EDG's, 3 second level EDG's, 1 EDG used as back-up during maintenance of main EDG's. This supplementary EDG can be connected to any unit).
  - **Unit 3**: 6 DGs (3 main EDG's and 3 second level EDG's).
- **(Q188) Which are the alternative Ultimate Heat Sinks for Doel and Tihange when all the units at the site are affected by the loss of primary UHS?**
  - **By design, a Second Level of protection was foreseen in Belgian NPPs.**
  - **Following Stress Tests, some mobile means were made available:**
    - In Doel, DG operated mobile pumps can be used to restore heat sink by using raw water ponds available on the site.
    - In Tihange, groundwater is used when available. If not, mobile pumps are connected with hoses to the river water intake.

3. Stress Tests National Action Plan – Progress : Severe Accident Management

- Tihange - New building: Site Operation Center (COS) : 2017
  - Initially not conveniently located to resist to a beyond-design flood and not ideally protected against earthquakes.
  - COS will be moved in term to a new building to be constructed and put into service in 2017.
  - several actions undertaken in the actual COS and other emergency rooms to improve their capacities (additional communication means, additional radioprotection equipment, an additional power generator - available in 2014, etc.).

- Doel

  construction of the new storage building for non-conventional means has been completed in 2014

3. Stress Tests National Action Plan – Progress : Severe Accident Management

- Severe accident management : Filtered Containment Vent : 2017
  - Basic design completed – realization phase begins
  - Filters and containment isolation valves - ordered
  - AREVA qualification file - ongoing
  - Realization and commissioning (7 NPPs) -> 2017

- Hydrogen management : Still under discussion (see later)
  - PARs and H2 management

- Emergency management organization
  - 2013: implementation of the new organization of the emergency plan to include "multi-unit" events at Doel and Tihange

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4. Response/clarifications to 2014 comments on Belgium NAcP

- 87 questions asked to Belgium
  - Impossible to fully answer to every question during this presentation –> selection of subjects
- **Generic Comments:**
  - WENRA new safety reference levels
    - Under transposition in the Belgian Law : Royal Decree
  - ENSREG recommendations
    - Fully transposed in the Belgium NAcP
  - Datasheets
    - The NAcP is a living document of hundreds of page partially written in three different languages

4. Response/clarifications to 2014 comments on Belgium NAcP

Emergency deep water intakes (Q657, 358)

NAcP

In the framework of the UHS scenario, the regulatory body has requested for Tihange 2 and 3 to carry out alignment and operating tests of the emergency deep water intakes from the Meuse river and to justify the availability of the emergency intakes in accordance with the requirements of US NRC RG 1.27. The related actions have been finalized in 2013 by the licensee and analysed by the regulatory body in 2014. The licensee conclusions and the consequent proposed actions are still not fully satisfying for the regulatory body and were being discussed at the end of 2014

Questions

Can you please explain why the proposed conclusion/action was not satisfactory and what happened after that? Will this lead to further delays and how much

Why is FANC not fully satisfied with the proposed actions? What is the current status of this project?

Answers

Improvements regarding deep river water intakes have been performed regarding availability, accessibility, procedures and operator training.

Questions remain open about on-site verification of some design specifications like line-up times.

4. Response/clarifications to 2014 comments on Belgium NAcP

External power supply (Q357, 89, 90, 656, 358)

NAcP

"To strengthen the power grid of Tihange, the licensee had to study the feasibility of a better geographical separation of the high-voltage lines (150 kV and 380 kV) to further improve the reliability of the external power supply to the NPPs, in collaboration with ELIA (the Belgian high-voltage network manager). In this framework, a request was sent to ELIA in 2013 to add new high-voltage lines from the other side of the Meuse, passing over the river. This solution was not judged realistic by ELIA.
In addition, the licensee had to make sure, in agreement with ELIA, that in case of a loss of off-site power (black-out), the NPPs of Doel and Tihange have the highest priority for reconstruction of the external power supply to the NPPs. This agreement was finalized in 2013 by the licensee and ELIA. "

Questions

It is stated in the report that the construction of a new high voltage lines across the Meuse river was judged as unrealistic by ELIA. Is there any alternative plan with respect to this issue?

Is it ensured that ELIA keeps enough resources to realise necessary reconstruction work for NPPs power supply?

It is unclear to us what the proposal was, what happened after that, and what the role of FANC was. Can you expand on that?

Answers

Even though Electrabel improvement request was rejected by ELIA, the absence of further separation of existing 150 kV and 380 kV HV lines can be coped in case of loss of external power by the numerous safety-graded diesel generators on site.

4. Response/clarifications to 2014 comments on Belgium NAcP

Siphon breakers (Q659)

NAcP

The regulatory body has requested the evaluation of… the configuration with the loss of water inventory in the spent fuel pools.

Question

Reference:
Item. 3.2.2. Loss of primary and alternate ultimate heat sink (UHS).
„Moreover, the regulatory body has requested the evaluation of two configurations for the spent fuel pools: the configuration with a fuel assembly handled in the reactor pool during a CSBO and the configuration with the loss of water inventory in the spent fuel pools. The first evaluation will be finalized in 2015 while the second one has been finalized in early 2014."
Questions:
1) What are the outcomes from the evaluation of the configuration with the loss of water inventory in the pools?
2) Are there any corrective actions resulting from the performed evaluation?

The evaluation of the configuration with loss of water inventory in the spent fuel pools shows that the genuine siphon breaker holes ought to be enlarged so as to reduce the water inventory depletion after a beyond design PL piping break.
PL siphon breakers will be modified in accordance with this conclusion.

4. Response/clarifications to 2014 comments on Belgium NAcP

Hydrogen risk **(Q661)**

NAcP

The assessment of the residual risk of hydrogen production and accumulation in the spent fuel pool buildings has been carried out in 2013. At the end of 2014, the study that shows that there s no explosion risk due to the accumulation of hydrogen in the spent fuel pool buildings of the NPP's, is still under assessment by the regulatory body.

The report states: "In addition, …, the study [that] shows that there is no explosion risk due to the accumulation of hydrogen in the Spent Fuel Pool buildings of the NPP`s, is still under assessment by the regulatory body." However, the previous Action plan from 2012 states under the Additional Topics section on page 2 of 9 topic no.9 "Recommendations, Requirements from other national reviews ": "Regardless of the outcome of the assessment of the residual risk of hydrogen generation and accumulation in the spent fuel pool buildings, the installation of PARs should be considered."

Could you please comment on the question, if it is still planned to install PARs in the vicinity of the SFP?

The position of the Belgian regulatory body is that PARs should be installed in the vicinity of SFPs, despite the conclusions of a study by the utility of hydrogen explosion risk in SFP buildings.

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5. Challenges and good practices identified during implementation - Belgium

- **Challenges**
  - Future of Doel 1 and Doel 2
  - Future of Doel 3 and Tihange 2

    → Implementation of costly modifications on units of unknown future.

  - Initial design ⟷ Strategy to implement (i.e. CSBO Tihange)

- **Good practices**
  - "Quick Wins" – Implementation of quick measures pending action realization or qualified equipment delivery
  - i.e. hiring of non-qualified mobile means

Questions

- FANC (Federal Agency for Nuclear Control)
- Bel V (TSO)
- Electrabel (Licensee)

2. Stress Tests National Action Plan – Belgium

- Multiple steps analysis