



European ASAMPSA_E project

Advanced Safety Assessment : Extended PSA

Objectives and progress of the ASAMPSA_E project

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PART 1 – ASAMPSA_E OBJECTIVES

7th FP - Ec call - November 2012

- The nuclear accident in Japan resulted from the combination of two correlated extreme external events (earthquake and tsunami). The consequences (flooding in particular) went beyond what was considered in the initial NPP design.
- Such situations can be identified using PSA methodology that complements the deterministic approach for **beyond design accidents**. If the performance of a Level 1-Level 2 PSA concludes that such a low probability event can lead to **extreme consequences**, the industry (system suppliers and utilities) or the Safety Authorities may take appropriate decisions to reinforce the **defence in depth** of the plant.
- The present topic aims at providing best practice guidelines for the **identification** of such situations with the help of Level 1-Level 2 PSA and for the definition of appropriate criteria for **decision making** in the European context.
- Involvement of regulatory authorities in the foreseen action is strongly encouraged. Cooperation with Japan is welcome.

Project concept

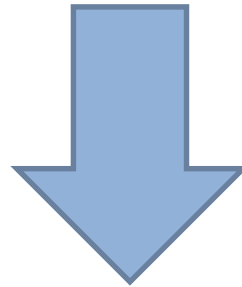
- Main objective is to promote/identify appropriate methods/guidance applicable to verify, with PSAs, that NPPs (in their environment) are "safe enough" after the reinforcements defined after the Fukushima accident.
- The scope of the project is extremely large and covers internal and external hazards. Its framework leads specialists on hazards assessment (earthquake, flooding, ...) and PSA working together ...

What is a guidance for ASAMPSA_E ?

- It is a set of **SHORT** documents where different experiences, methodologies are explained and compared. From this comparison some good practices, difficulties or limits are identified.
- The partners are invited to develop contributions to ASAMPSA_E future reports based on what they have done (success or difficulties)

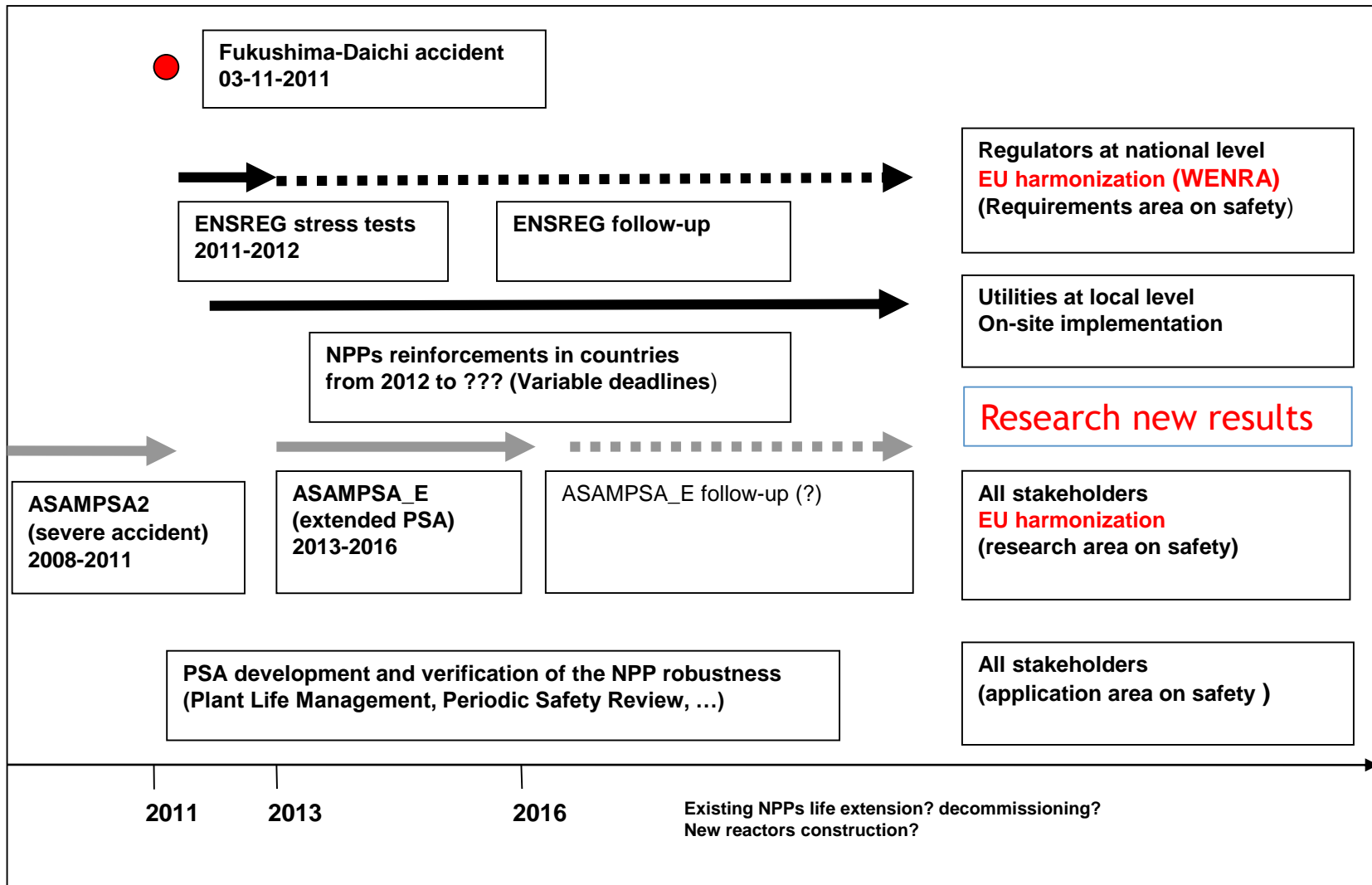
“Extended PSA” definition

An **extended PSA** (probabilistic safety assessment) applies to a site of one or several Nuclear Power Plant(s) (NPP(s)) and its environment. It intends to calculate the risk induced by **the main sources** of radioactivity (reactor core and spent fuel storages, other sources) on the site, taking into account all operating states for each main source and **all possible relevant accident initiating events (both internal and external)** affecting one NPP or the whole site.



The ASAMPSA_E project aims at helping European stakeholders to develop efficiently such **extended PSA** and verify that all **dominant risks** are identified and managed.

Context of ASAMPSA_E



Context outside ASAMPSA_E

- The ASAMPSA_E project is developed in parallel with many others activities associated to accident management
- **The ASAMPSA_E partners must take into account all context evolution (research progress, safety rules)**
- Examples from the updated WENRA safety reference levels (RLs) after the Fukushima Daiichi accident in the 2 following slides.

From WENRA updated RLs

F1.1 As part of defence in depth, analysis of **Design Extension Conditions (DEC)** shall be undertaken with the purpose of further improving the safety of the nuclear power plant by:

- enhancing the plant's capability to withstand **more challenging events** or conditions than those considered in the design basis,
- **minimising radioactive releases** harmful to the public and the environment as far as reasonably practicable, in such events or conditions.

From WENRA updated RLs

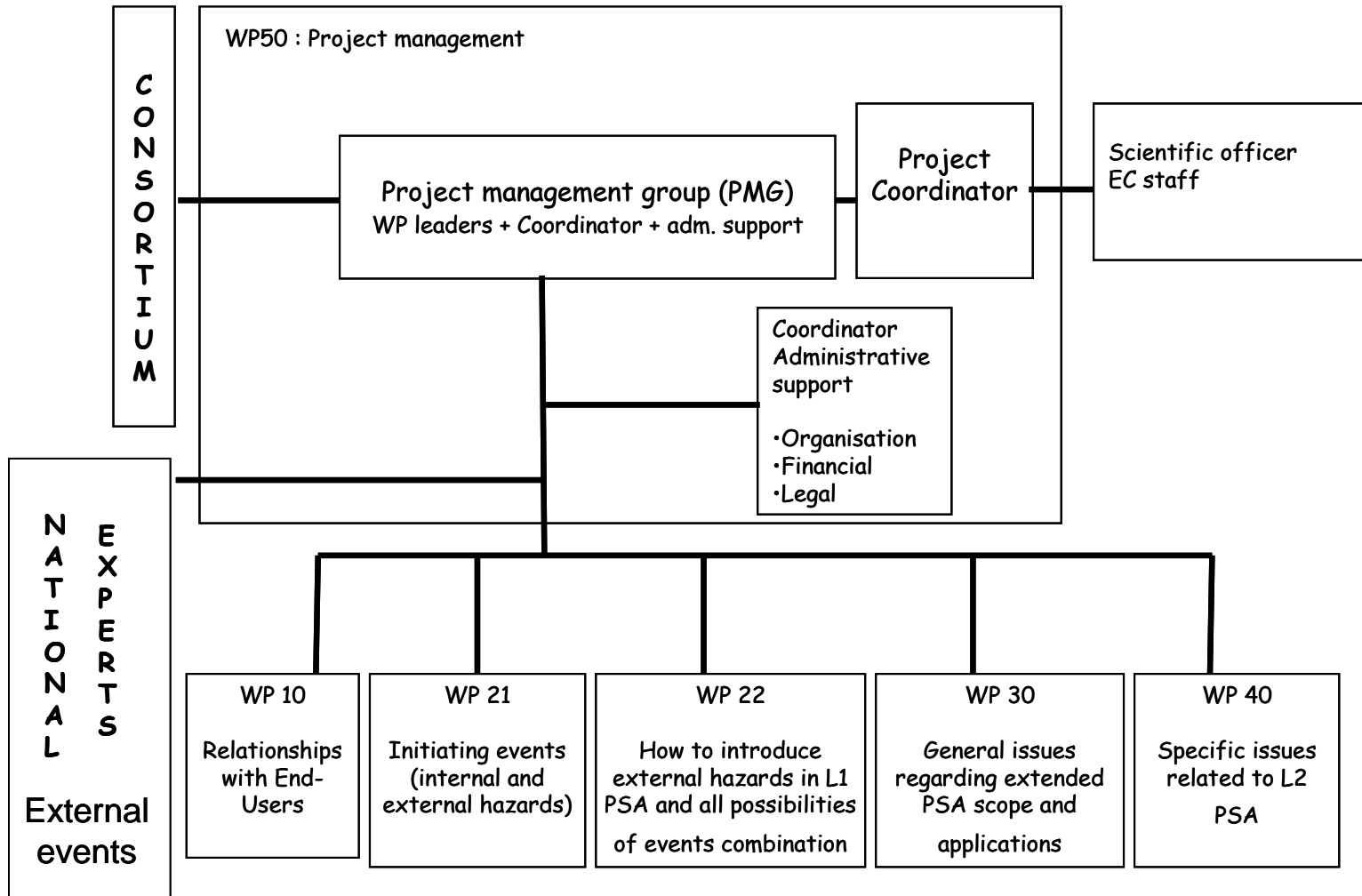
F1.2 There are two categories of DEC:

- **DEC A** for which **prevention** of severe fuel damage in the core or in the spent fuel storage can be achieved;
- **DEC B** with **postulated** severe fuel damage.

The analysis shall identify reasonably practicable provisions that can be implemented for the prevention of severe accidents. Additional efforts to this end shall be implemented for spent fuel storage with the goal that a severe accident in such storage becomes extremely unlikely to occur with a high degree of confidence.

In addition to these provisions, severe accidents shall be postulated for fuel in the core and, if not extremely unlikely to occur with a high degree of confidence, for spent fuel in storage, and the analysis shall identify **reasonably practicable provisions to mitigate their consequences.**

Organization of ASAMPSA_E



Project management group (PMG)

WP leaders + Project coordinator

Yves Guigueno (IRSN, WP10), Kurt Decker (Vienna University, WP21), Joakim Klug / Manorma Kumar (LRC, WP22), Andreas Wielenberg (GRS, WP30), Horst Löffler (GRS, WP40), Emmanuel Raimond (IRSN, coordinator)

Periodic PMG phone meetings every 2 or 3 months with the following objectives :

- To examine the progress in the development of deliverables in each WP,
- To share information between WPs,
- To identify difficulties if any and solve them with partners,
- To update a table of progress and actions,
- To check that all needed information is available on the project FTP site.

Interaction by e-mail with partners

Partners

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country
1(coordinator)	Institute for Radiological Protection and Nuclear Safety	IRSN	France
2	Gesellschaft für Anlagen- und Reaktorsicherheit mbH	GRS	Germany
3	AMEC NNC Limited	AMEC NNC	United-Kingdom
4	Ricerca sul Sistema Energetico	RSE S.p.A.	Italy
5	Scandpower	SCANDPOWER	Sweden
6	Nuclear Research Institute Rez pl	UJV	Czech
7	Universität Wien	UNIVIE	Austria
8	Cazzoli Consulting	CCA	Switzerland
9	Italian National Agency for New Technologies, Energy and the Sustainable Economic Development	ENEA	Italy
10	Nuclear Research and consultancy Group	NRG	Nederland
11	IBERDROLA Ingeniería y Construcción S.A.U	IEC	Spain
12	Electricité de France	EDF	France
13	Lietuvos energetikos institutas (Lithuanian Energy Institute)	LEI	Lithuania
14	NUBIKI	NUBIKI	Hungary
15	Forsmark kraftgrupp AB	FKA	Sweden
16	AREVA NP SAS France	AREVA NP SAS	France
17	NCBJ Institute	NCBJ	Poland
18	State Scientific and Technical Center for Nuclear and Radiation Safety”	SSTC	Ukraine
19	VUJE	VUJE	Slovakia
20	NIER Ingegneria	NIER	Italy
21	VGB PowerTech e. V	VGB	Germany
22	TRACTEBEL ENGINEERING S.A.	TRACTEBEL	Belgium
23	BeL V	BeL V	Belgium
24	Institut Jozef Stefan	JSI	Slovenia
25	Institute of nuclear research and nuclear energy – Bulgarian Academia of science	INRNE	Bulgaria
26	Regia Autonoma Pentru Activitati Nucleare Droberta Tr. Severin RA Suc	INR	Roumania
27	Technical University of Sofia – Research and Development Sector	TUS	Bulgaria
28	AREXIS S.A.R.L.	AREXIS	France

External Expert Advisory Board (EEAB)

1	US-NRC	US
2	JANSI	Japan
3	TEPCO	Japan

Other organizations may still be introduced in EEAB if volunteers (and accepted by the partners)

PART 2 - overview of the ASAMPSA_E deliverables as planned by the project partners

WP10 - Relationship with “End-Users” (needs, objectives, scope of extended PSAs)

<u>Del</u>	Deliverable name	WP	Dow del. Date	Comment	Planned delivery date
D 10.1	Initial survey – Questionnaire to be sent to the End-Users	WP10	30/09/2013	Done	25/11/2013.
MS1	Initial open workshop	WP10	01/03/2014		26-28/05/2014 in Uppsala, Sweden
D 10.2	Synthesis report on the End-Users responses to the questionnaire and the End-Users needs (final version after the End-Users workshop)	WP10	31/03/2014	Draft version sent 23/05/2014	Nov 2014
D 10.3	Final report on external events with high amplitude that have concerned NPP in operation (in Europe or other countries)	WP10	30/12/2014	On-going Available information is limited and should be completed if possible.	30/12/2014
MS2	Second open workshop	WP10	31/03/2016	To discuss guidance established by the project	31/03/2016 Date to be confirmed

WP10 - Relationship with “End-Users” (needs, objectives, scope of extended PSAs) - **Comments on the progress**

- A large international survey (questionnaire + answers + analysis) has been performed
- An international workshop in May 2014 : a set of 64 recommendations, meaningful presentations (survey results, examples of case studies for external hazards) ...
- The results are used to define the ASAMPSA_E strategy to develop a useful set of guidance documents

WP21-Initiating events (internal and external hazards) modeling

<u>Del</u>	Deliverable name	WP	Dow del. Date	Comment	Planned delivery date
D 21.1	Summary report of already published guidance for risk assessment related to each type of external event (WP21: hazard characterization)	WP21	31/05/2014	Report consists of > 140 reference list. A database in format End Note X4. Procedure to update this document	Delivery date : Nov. 2014
D 21.2	Report proposing an exhaustive list of hazards, and their correlations to be considered in an extended PSA. Sub list of issues to be examined in detail by WP21 and WP22 and strategic reasoning.	WP21	30/06/2014	A comprehensive list of natural and external man-made hazards is available. A table for correlation of hazards has been developed and is being reviewed.	Delivery date : Nov. 2014
D 21.3	External hazards characterization – ASAMPSA_E guidance – WP21 - Technical report to be sent for external review	WP21	31/12/2015	Content and methodology to build this deliverable have been defined during Sept 2014 ASAMPSA_E technical meeting	31/12/2015 (date to be confirmed)

WP21- Initiating events (internal and external hazards) modeling - **Comments on the progress**

- Based on End-Users recommendations, WP21 activities will be focused (with subgroups) on the following external hazards :
 - Earthquake,
 - External Flooding,
 - Extreme weather,
 - Biological hazards,
 - Lightning,
 - External explosion, external fire, aircraft crash

and on the coupling between these hazards.

- Contacts are being taken with the European Geosciences Union (session proposed to EGU 2015)

WP22 - How to introduce hazards in L1 PSA and all possibilities of events combination?

<u>Del</u>	Deliverable name	WP	Dow del. Date	Comment	Planned delivery date
D 22.1	Summary report of already published guidance for risk assessment related to each type of external event (WP22: integration in L1 PSA)	WP22	31/05/2014	A draft report has circulated among WP22 partners. It has been reviewed by WP21 and remarks sent to writing partners.	November 2014.
D 22.2	Implementation of external events modeling in extended L1 PSA - ASAMPSA_E guidance – WP22 – Technical report to be sent for external review	WP22	31/12/2015	Content and methodology to build this deliverable have been defined during Sept 2014 ASAMPSA_E technical meeting	31/12/2015 (to be confirmed)

WP22 - How to introduce hazards in L1 PSA and all possibilities of events combination? - **Comments on the progress**

Based on End-Users recommendations, work will focus (with subgroups) on the introduction of the following external hazards in L1 PSA :

- Earthquake,
- External Flooding
- Extreme weather
- Biological hazards
- Lightening
- External explosion, external fire, air craft crash

and, within L1 PSA, **on the coupling** between these hazards and L1 PSA internal initiating events and internal hazards.

WP30 - General issues regarding extended PSA scope and applications

D 30.1	Defence-in-depth concept – bibliography – technical report	WP30	31/03/2014	A draft document exists Discussed during sept. 2014 meeting. Partners have to complete the references.	Delivery date : Dec. 2014
D 30.2	Lessons of the Fukushima accident for PSA . Final technical report.	WP30	31/05/2014	A draft document exists but need to be reduced in size and completed by some partners.	Delivery date : March 2015
D 30.3	Criteria to select initiating events to be considered in an extended PSA - final report	WP30	30/09/2014	First draft discussed during sept. 2014 meeting. No clear convergence obtained yet on the project approach. First views on screening criteria for external are needed as soon as possible.	Delivery date : End 2015 (??)
D 30.4	Link between extended PSA and defence-in-depth concept – final report	WP30	31/12/2014	Discussed during sept. 2014 meeting. No clear convergence obtained yet on the project approach.	Delivery date : End 2015 (??)
D 30.5	Risk metric for extended PSA – final report	WP30	30/04/2015	ASAMPSA_E has an opportunity to propose original findings in this area. First discussion in Sept. 2014 meeting	Delivery date : End 2015 (??)
D 30.6	Guidance for decision making based on extended PSA	WP30	31/12/2015	Need to progress on D30.3, D30.4 and D30.5 before addressing this document.	Delivery date : End 2015 (??)

WP30 - General issues regarding extended PSA scope and applications

- It appears during Sept. 2014 technical meetings that before obtaining convergence between the ASAMPSA_E partners, some additional work is needed on principles associated to:
 - Risk metrics
 - Screening process (especially if coupling between hazards and IE is considered)
 - Role of PSA in Defence in Depth concept

- WP30 will also examine application of the generic concept of screening to the hazards examined in WP21, WP22.

WP40 - Specific issues related to L2 PSA

Del	Deliverable name	WP	Dow del. Date	Comment
D 40.1	Summary report on the impact and experience feedback of previous ASAMPSA2 project. Lessons for ASAMPSA_E	WP40	31/10/2013	Done.
D 40.2	Summary report of already published guidance on L2 PSA for external hazards, shutdown states, spent fuel pool	WP40	31/05/2014	Delivery date : Dec. 2014
D 40.3	Report proposing the content of future L2 PSA guidance to be established within ASAMPSA_E	WP40	30/06/2014	Delivery date : Dec. 2014
D 40.4	Implementation of external events modeling in extended L2 PSA - ASAMPSA_E guidance – WP40 - Technical report to be sent for external review	WP40	31/12/2015	A draft document has been initiated. It includes many open questions that have been discussed in Uppsala WP40 technical meeting.
D 40.5	Validation of SAMG strategy by L2 PSA - ASAMPSA_E guidance – WP40 - Technical report to be sent for external review	WP40	31/12/2015	“Optimization” is preferred than “validation” Discussed in Uppsala WP40 meeting. Important issue which is not only associated to hazards. Activities will start in Jan 2015
D 40.6	Complement of existing ASAMPSA2 guidance for shutdown states of reactors, SFP and recent R&D results - ASAMPSA_E guidance – WP40 - Technical report to be sent for external review	WP40	31/12/2015	Activities will start in Jan 2015
D 40.7	Final WP40 guidance document (external hazards implementation in extended L2 PSA, validation of SAMG strategy, complement of L2PSA guidance) with modifications suggested after the End-Users external review and the open workshop conclusions	WP40	31/07/2016	

WP40 - Specific issues related to L2 PSA

- Most technical activities will be performed during the 2015 year
- The scope is very large : internal initial events + hazards, reactor + spent fuel pool, SAMG optimization.
- WP40 will complete WP21 and WP22 guidance on
 - Earthquake,
 - External Flooding
 - Extreme weather
 - Biological hazards
 - Lightening
 - External explosion, external fire, aircraft crash

CONCLUSION

- **At the end of 2014, the ASAMPSA_E partners will achieve the first strategic phase of the project. It is 6 months later than in the initial planning but this phase is crucial due to the broad scope of the project and the highly technical content.**
- **Technical activities are now better defined.**
- **The project was initially planned to be concluded mid-2016. This deadline will be confirmed later.**