Consideration of the minimum initial burst pressure for the hydrogen storage containers

Prepared by Technical Secretary
GTR No.13 Phase2 IWG
17-19 October 2017 @ Brussels

Reminder of GTR13 Phase1 (original documents)

(i) Rationale for paragraph 5.1.1.1. baseline initial burst pressure *(Page 16)*

52. ..... Paragraph 5.1.1.1. verifies that BP_O is greater than or equal to 225 per cent NWP or 350 per cent NWP (for glass fibre composites), values tentatively selected without data-driven derivation but instead based on historical usage and applied here as placeholders with the expectation that data or analysis will be available for reconsideration of the topic in Phase 2 of the development of this gtr. For example, a 200 per cent minimum initial burst pressure requirement can be supported by the data-driven performance-linked justification that a greater-than 180 per cent NWP end-of-service burst requirement .....

I. Topics for the next phase in developing the gtr for hydrogen-fuelled vehicles

(Page 47-48)

158. Since hydrogen fuelled vehicles and fuel cell technologies are in early stages of development of commercial deployment, it is expected that revisions to these requirements may be suggested by an extended time of on-road experience and technical evaluations. It is further expected that with additional experience or additional time for fuller technical consideration, the requirements presented as optional requirements in this document (LHSS Section G of the preamble) s could be adopted as requirements with appropriate modifications.

Focus topics for Phase 2 are expected to include:

(a) Potential scope revision to address additional vehicle classes;
(b) Potential harmonization of crash test specifications;
(c) Requirements for material compatibility and hydrogen embrittlement;
(d) Requirements for the fuelling receptacle;
(e) Evaluation of performance-based test for long-term stress rupture proposed in Phase 1;
(f) Consideration of research results reported after completion of Phase 1 – specifically research related to electrical safety, hydrogen storage systems, and post-crash safety;
(g) Consideration of 200 per cent NWP or lower as the minimum burst requirement;
(h) Consider Safety guard system for the case of isolation resistance breakdown

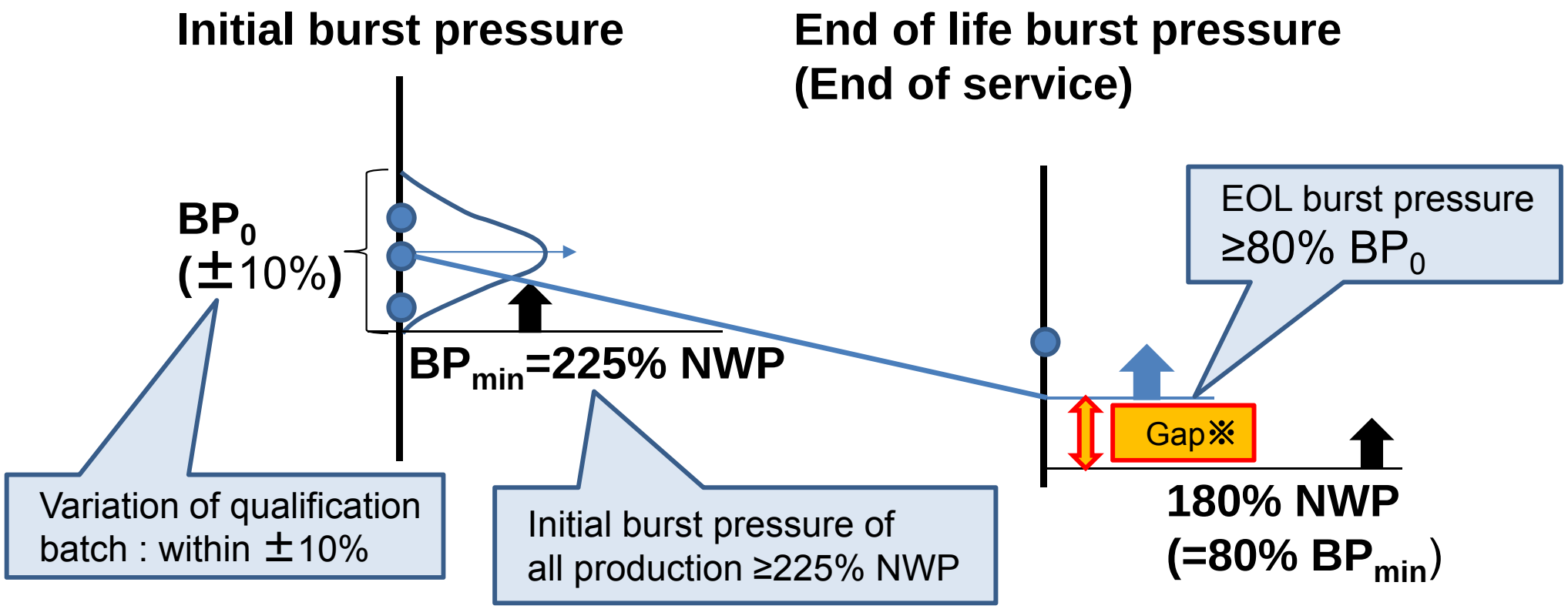
Reminder of GTR13 Phase1 (JASIC comments)

Technical Comments to Draft November 8, 2010-TF-Berlin

Requestor	Ref. Clause No./ Annex	Text	Proposed change by the Requestor	Comment (justification for change)
JASIC	B.5.1.1.1	**B.5.1.1.1 Baseline Initial Burst Pressure**. All containers tested must have a burst pressure within ±10% of BP_O and greater than or equal to **180%** NWP. The midpoint BP_O must be greater than 200% NWP to accommodate ± 10% manufacturing variability.	All containers tested must have a burst pressure within ±10% of BP_O and greater than or equal to **225%** NWP.	/ BP0 of 200% **± 10%** is not enough even for CFRP vessel. / The criterion should exceed 2.1NWP. / 2.25NWP, traditional value (NGV) is appropriate as BP0. / 225% NWP is same as Japanese regulation.

The appropriate minimum initial burst pressure for the containers should be determined based on the data of the verification test.

Concept of current burst pressure in GTR13

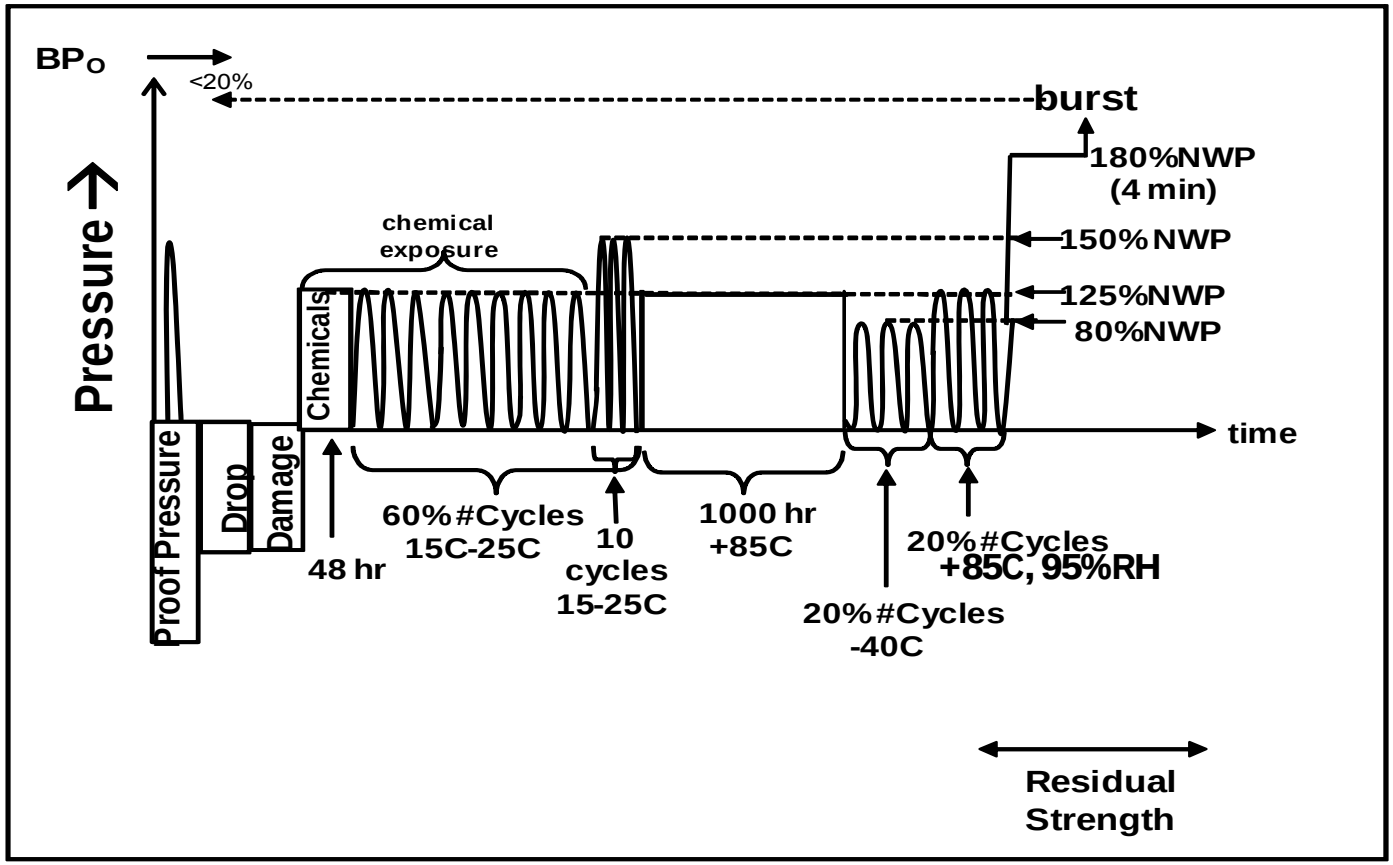


※ 225% NWP of initial burst pressure has been adopted as historical performance value.
However, this value does not correlate with EOL burst pressure.

Consideration of appropriate initial burst pressure

- Goal : Decision of the appropriate initial burst pressure which will correlate with 180% NWP of EOL burst pressure.
- Study : Determine the appropriate initial burst pressure from verification tests which be able to find out the factors of both variation and degradation using actual cylinders.

Target tests : Sequential hydraulic tests of GTR13



Verification test planed by JARI

※ JARI : Japan Automobile Research Institute

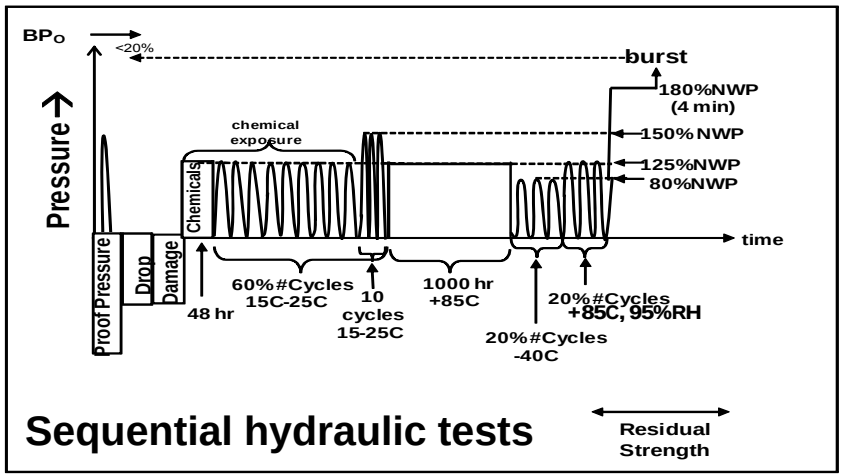
- Methods : Data acquisition for the variation of both initial burst pressure and EOL one and for degradation value.
- Sample cylinders
  - ✓ CFRP Type 4 cylinders for 70 MPa (from one production batch)
  - ✓ For initial BP : 10 cylinders each from 2 different suppliers
  - ✓ For EOL BP : 10 cylinders each from 2 different suppliers
- Additional study
  - ✓ Factor analysis by numerical simulation
  - ✓ Damage analysis by nondestructive inspection

Initial burst pressure

Evaluation for each production

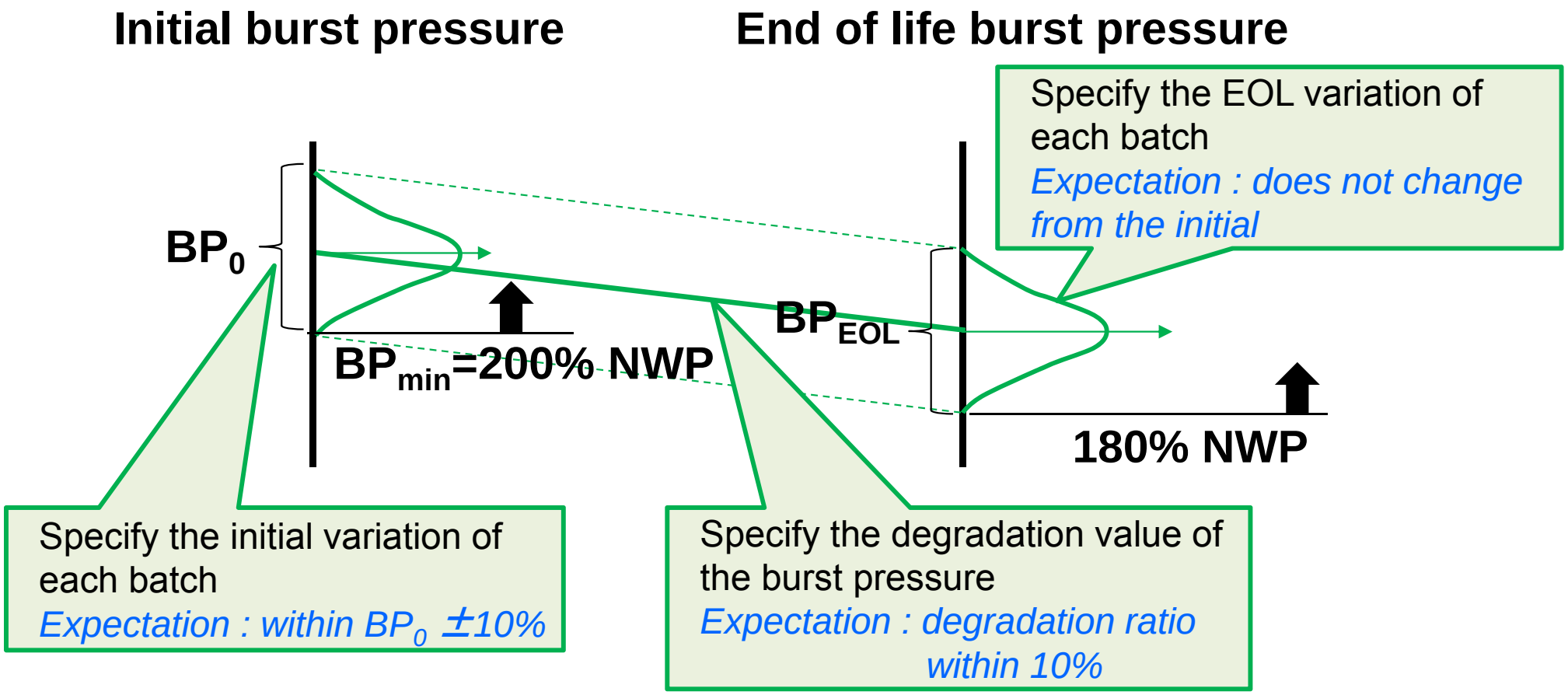
- ✓ **Variation comparison**
- ✓ **Degradation ratio calculation**

End of life burst pressure



Expectation from the verification test *(Estimation)*

- Decision of the appropriate initial burst pressure which will correlate with 180% NWP of EOL burst pressure.

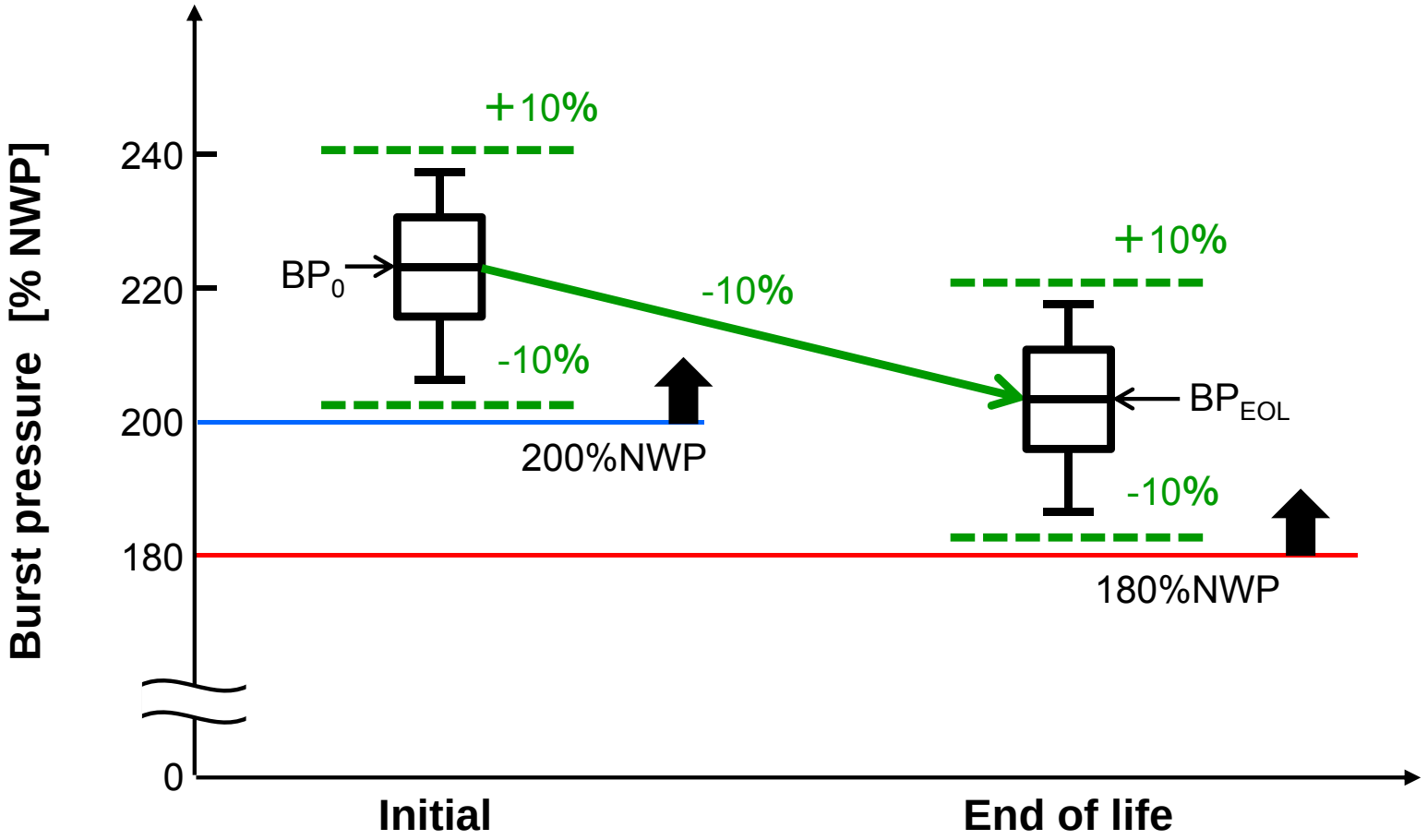


Find out the minimum initial burst pressure from the above specified values.

Expectation : BP_{min}=200% NWP (for CFRP cylinders)

Image of the results *(Estimation)*

- Decision of the appropriate initial burst pressure which will correlate with 180% NWP of EOL burst pressure.



Relationship between the initial BP an EOL BP *(Estimation)*

- The test data will be introduced in the next IWG. (February, 2018)

Thank you for your attention.