NEA 2017 Demand and Capacity Projection (2017 – 2022)

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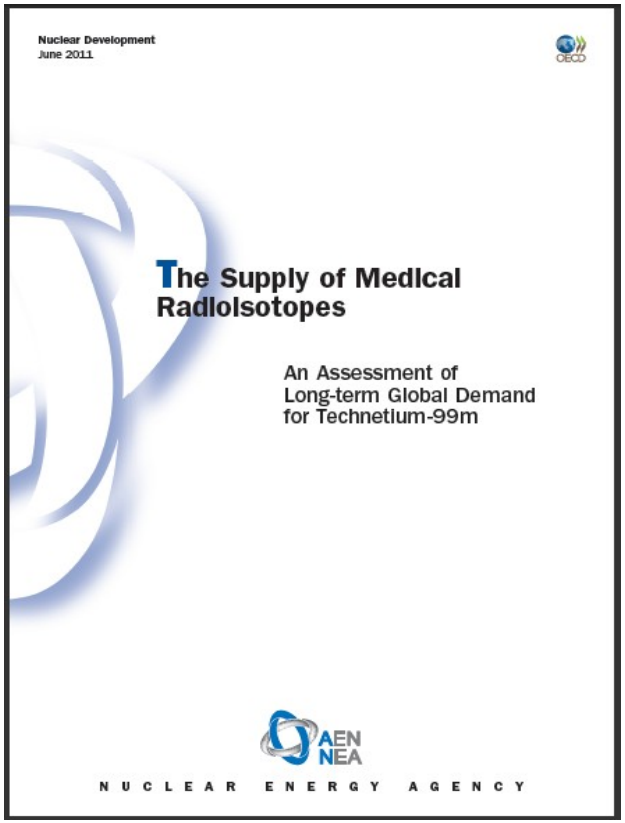
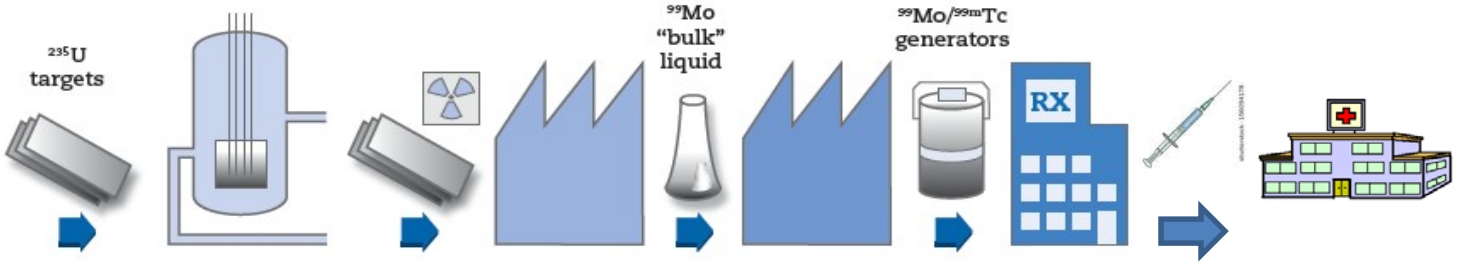
- The Nuclear Energy Agency (NEA) is a specialist agency of the Organisation for Economic Co-operation and Development (OECD), an intergovernmental organisation of 31 industrialised countries based in Paris.
- The NEA MISSION - To assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal basis required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purpose

+ Argentina and Romania in 2017

- 1st Mandate: June 2009-2011:
  - assessed the factors making the supply chain vulnerable
  - supply and demand data collected and analysed
- Some Key Findings
  - identified a classical “market failure”
  - economic structure unsustainable: does not support investment
  - potential shortages as current infrastructure reaches the end of life
- Output
  - developed 6 policy principles





The HLG-MR 6-Principle Policy Approach

- 6 policy principles agreed to by all major ^{99}Mo-producing countries:
  - all ^{99}Mo/^{99m}Tc supply chain participants should implement full-cost recovery (FCR)
  - reserve production capacity (Outage Reserve Capacity - ORC) should be sourced and paid for by the supply chain
  - governments should establish a proper environment for efficient and safe market operations, without intervening directly
  - governments should help facilitate the conversion to low-enriched uranium by reactors and processors
  - international collaboration should continue through a policy and information-sharing forum
  - periodically review the supply chain's progress towards economic sustainability and security of supply

Recent Supply Performance

- The existing supply chain participants have successfully met some difficult challenges in the last few years
  - despite some operational problems, supply has been maintained with only minor disruptions in some countries
  - Important changes to capacity
    - OSIRIS (France) end of operation December 2015
    - BR-2 (Belgium) 16-month major refurbishment, returned successfully to service in July 2016
    - NRU (Canada) end of routine ^{99}Mo production October 2016

Recent Supply Performance

- Successfully meeting demand has been achieved by
  - better co-ordination and planning (AIPES Security of Supply Workgroup)
  - supply chain diversification
  - active risk management activities by supply chain members
  - more paid ORC held in the supply chain
  - increased capacity in the remaining supply chain at both the irradiator and the processor level

2017 Demand and Capacity Projection (2017-2022)

- The NEA has published a new report on market demand and capacity projections
  - 2017 Medical Isotope Supply Review – ^{99}Mo/^{99m}Tc Market Demand and Production Capacity Projection (2017 – 2022). NEA reference: NEA/SEN/HLGMR(2017)2
    - report based on retrospective quarterly % capacity-usage data provided by most market participants from 2012 to 2016
    - updated project assessments from potential suppliers leading to 4 revised tables which are an appendix to the report

Demand 2017-2022

- The report reconfirms that the total market demand for the last 5 years was structurally lower than previously estimated
  - demand estimate has been held at 9,000 6-day Ci ^{99}Mo per week EOP
  - market growth rate has been left unchanged from previous reports
  - the Outage Reserve Capacity “target” line has been retained as “Demand + 35%ORC”

Capacity Projections 2017-2022

- Capacity projections for 2017-2022 were prepared for the same three scenarios for irradiation and processing capacity
  - Reference Scenario A:- existing supply chain only

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  - Technological Challenges Scenario B:- Reference Scenario A + qualified new projects and the assumption of some new technology challenges

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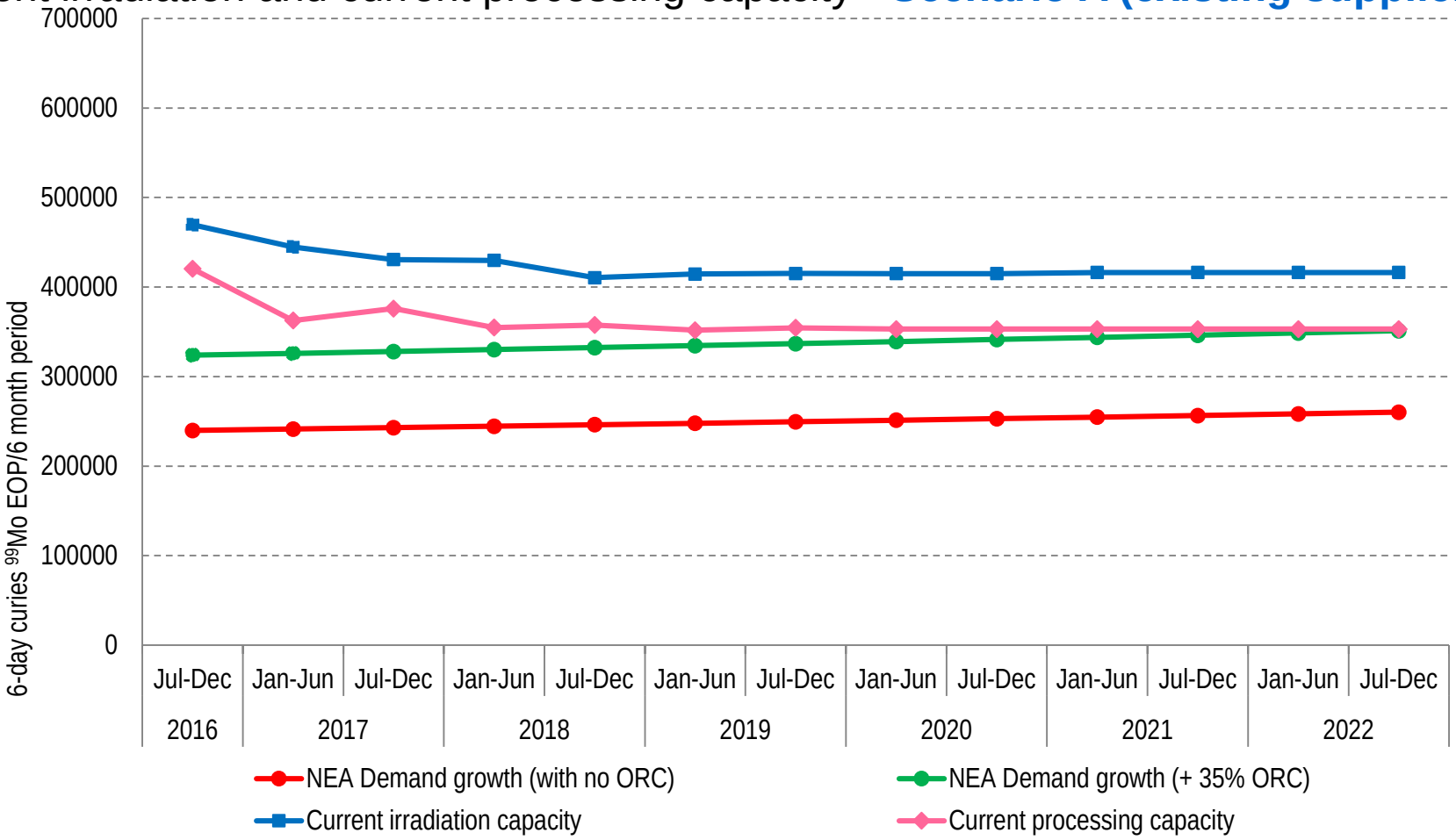
  - Reference Scenario A:- existing supply chain only
  - Technological Challenges Scenario B:- Reference Scenario A + qualified new projects and the assumption of some new technology challenges
  - Project Delays Scenario C:- Technological Challenges Scenario B + delays to new projects (+ 1 year delay)

Capacity 2017-2022 – Scenario A

Current demand (9 000 6-day Ci ^{99}Mo/week EOP) and demand +35% ORC vs. current irradiation and current processing capacity - **Scenario A (existing suppliers)**

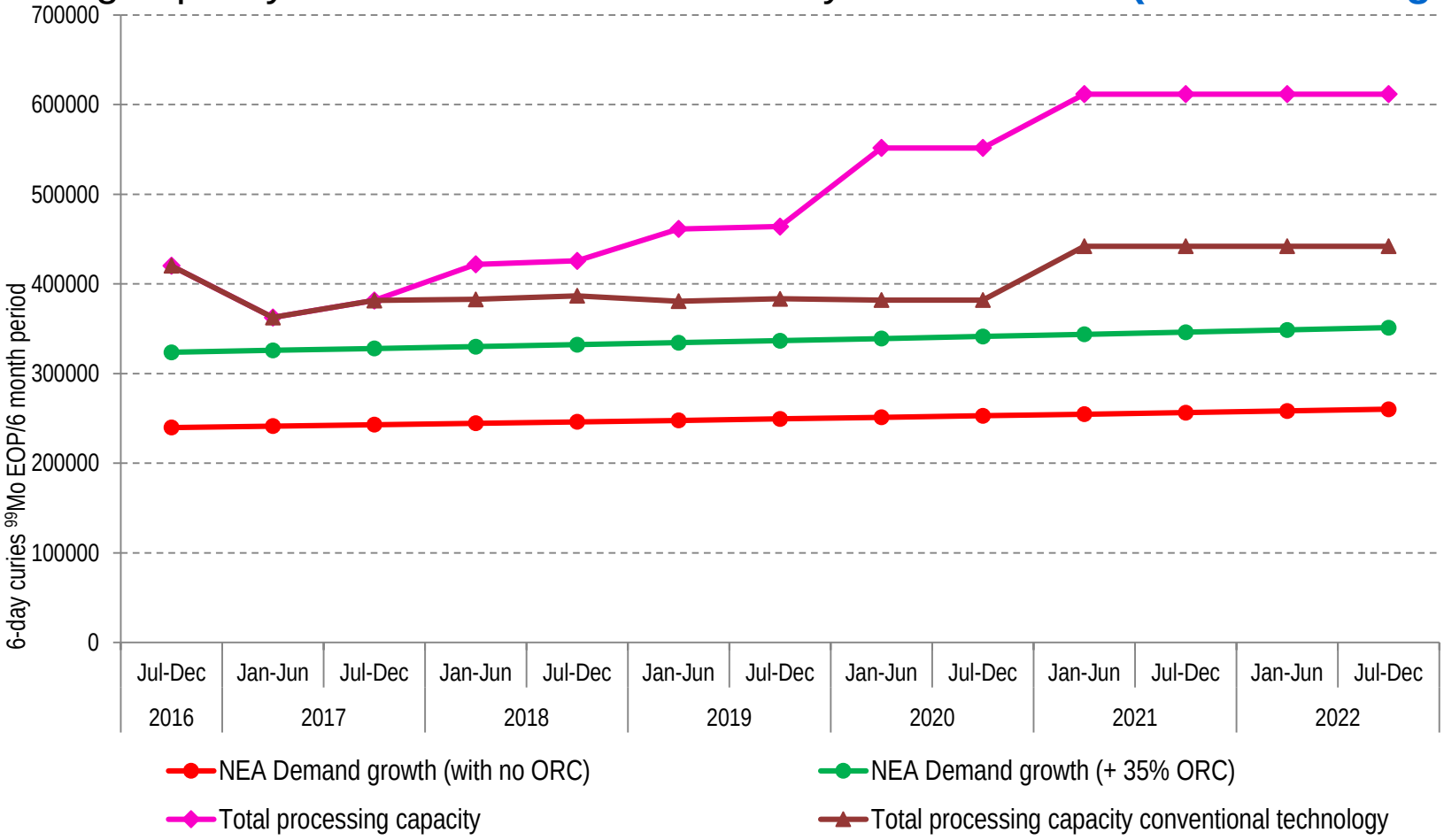


Status Review 2017-2022

- Scenario A Observations
  - baseline maximum irradiation capacity per week from existing supply chain has increased compared to 2016 report
    - but, baseline “Scenario A” total irradiation capacity in later years has decreased due to a reduction in anticipated number of BR-2 operating days (economic decision, not technical decision)
  - baseline maximum processor capacity from existing supply chain increased by a small margin compared to 2016 report
  - note; “Scenario A” processing capacity comes close to the ORC +35% line in 2022 if no other capacity added

Processing Capacity 2017-2022 – Scenario B

Current demand (9 000 6-day Ci ^{99}Mo/week EOP) and demand +35% ORC vs. processing capacity "total" and "conventional only" - **Scenario B (Tech Challenges)**

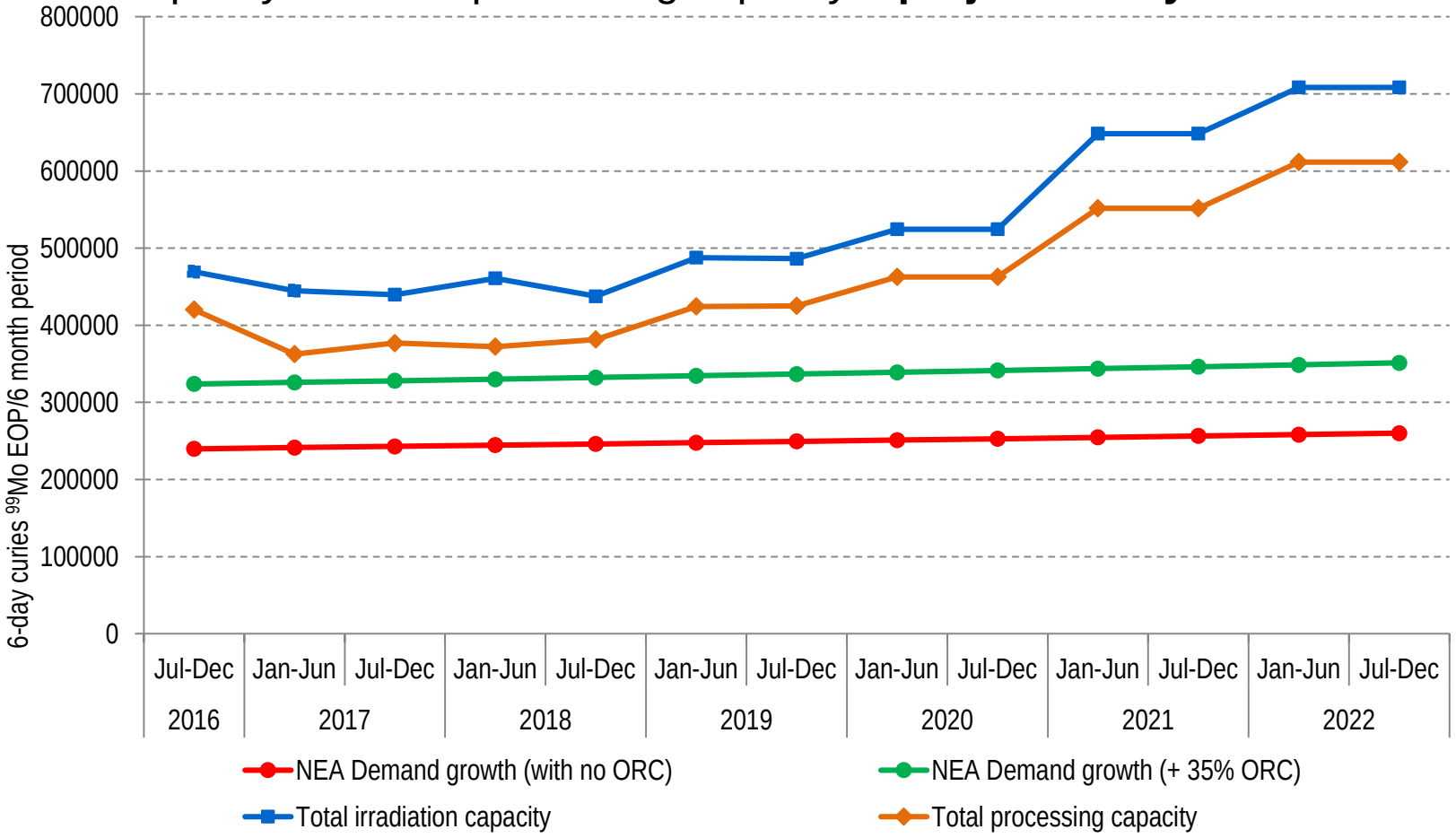


Status Review 2017-2022

- Scenario B Observations (Processing Capacity)
  - many prospective processing projects were delayed compared to the 2016 report,
    - first supply from alternative technologies delayed one year to 2018
    - also a reduction in projected capacity for some facilities
  - actual project delays have limited impact on projected 2017 and 2018 capacity
    - conventional technology capacity remains flat for most of the review period
  - substantial contribution from alternative technologies is still anticipated (the gap between the 2 lines)
  - note: the level of processing capacity projected to be available by 2022 is around 10% lower than anticipated in the 2016 report

Capacity 2017-2022 – Scenario C

Current demand (9 000 6-day Ci ^{99}Mo/week EOP) and demand +35% ORC v total irradiation capacity and total processing capacity – **projects delayed**: **Scenario C**



Status Review 2017-2022

- Scenario C Observations (probably the most likely projection)
  - modeling of further project delays has limited impact on the projected capacity in 2017 and 2018
    - note: the effect of project delays is now less critical than in the 2016 report, this is because an important conventional technology capacity increase (Australia) has already been achieved
  - with 1 year of further delays assumed, then first full year of supply from alternative technologies is delayed to 2019
    - as a result, the main contribution from alternative technologies is delayed until 2021
  - however, there is only limited impact from 1 year of further delays in 2021 and 2022, this is because the 2017 “Scenario B” projection is already relatively flat in that period

Key Points: 2017 Demand and Capacity Projection

- Good progress in increasing the existing capacity level
  - baseline Scenario A projection raised for 2nd year in a row
- On-time introduction of additional conventional processing capacity in Australia remains important (planned early 2018)
- Alternative irradiation and processing technologies and some conventional technology projects have been delayed
  - increasing multi-year delays are a general concern
  - introduction of some alternative technology in 2018 important
- Supply situation continues to require careful and well considered planning to minimise risks
- Regular monitoring and review needed, especially on the progress being made to bringing new technology to market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Thank you for your attention

Capacity Tables

- Tables 1&2: Current Irradiators and Processors
  - Positive aspects
    - increased capacity in place at the LVR-15 (Czech Republic) and the OPAL (Australia) reactors and at ANSTO (Australia) and Mallinckrodt/Curium (Netherlands) processing facilities
    - announcement of intent to convert to LEU by 2018 from RIAR and Karpov (Russia) facilities
  - Negative aspects
    - decrease in number of planned operating days at the BR-2 (Belgium) reactor from 2017 onwards
      - an economic, not a technical decision
    - delayed introduction of new irradiator capacity from FRMII (Germany)

Project Tables

- Tables 3&4: Prospective Irradiators and Processors
  - Positive aspects
    - some projects remain on schedule
  - Negative aspects
    - delays announced for a substantial number of irradiation and processing projects (NorthStar natural Mo (US), NorthStar Linac (US), RA-10 (Argentina), JHR (France), projects in Brazil and China)
    - uncertainty about project delay in Korea (earthquake/political)
    - reduction in projected capacity from MURR/GA/Nordion project (US/US/Canada) (already known in July 2016)
    - 4 projects delayed to beyond 2022