



# KYT2018 - Finnish Research Programme on Nuclear Waste Management

Brief presentation

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# KYT2018 starting points 1

- The research programme is based on the Nuclear Energy Act (990/1987)
  - *"research aimed at ensuring that the authorities have such sufficient and comprehensive nuclear engineering expertise and other readiness at their disposal that are needed for assessing of the various ways and methods of carrying out nuclear waste management"*
- International evaluation<sup>1</sup> in 2012 of KYT2014 research programme
  - Recommendations of the previous international evaluation (in 2007) have been taken into account
  - Research programme has reached its main goals
  - Recommendations were given, for instance concerning research topics, training, and collaboration with other research programmes

## **KYT2018 starting points 2: Summary of KYT2014 international review 2012**

- Programme has been continuously improved by following previous review observations
- Results obtained are in balance with funding, good applicability to practice, obvious training impact, young scientists involved, also basic research
- Focus on spent nuclear fuel management questions, LILW projects also included

## **KYT2018 starting points 3: Main recommendations of KYT2014 international review 2012**

1. Increase KYT visibility,
2. Further development of training,
3. Collaboration KYT-SAFIR,
4. Establish centre of excellence (Finland as pioneering NWM country),
5. Continuity of funding,
6. Follow up of results and feedback to projects,
7. Organisation of Support Groups (more support groups),
8. Organisation of Steering Group (active guiding expected, international experts, long-term research needs, identifying of missing competences)

## KYT2018 starting points 4

- Research period 2015-2018
- Annual budget
  - Around 2 M€ in 2015
  - Around 3 M€ in 2016-2018 (increase due to VTT Centre for Nuclear Safety)
- Funding from State Nuclear Waste Management Fund (VYR) into which nuclear waste producers pay annually 0,13 % of their assessed liability<sup>2</sup> respectively (0,08 % in 2015 and 0,13 % in 2016-2018)
  - Research organisations can also direct own funding in their projects

<sup>2</sup><http://www.finlex.fi/en/laki/kaannokset/1987/en19870990.pdf>

## **KYT2018 starting points 5: NWM environment when KYT2018 was prepared**

- Construction Licence application for Posiva's spent fuel disposal facility 28.12.2012
- Nuclear power decisions in Finland
  - OL3 Operating Licence application during next research period
  - OL4, FV1 Construction Licence application during research period?
  - FiR1 decommissioning being prepared, EIA started in 2013
- VTT Centre for Nuclear Safety
- Nuclear waste events abroad
  - Sweden: SKB's Construction Licence application 3/2011
  - USA: Blue Ribbon Commission final report 2012 on America's nuclear future <= Yucca Mountain was abandoned 2010
  - EU: IGD-TP (Implementing Geological Disposal - Technology Platform)

## Main steps to KYT2018 framework program

- Nuclear Energy Act
- KYT 2014 international evaluation 2012
- National strategy work for nuclear energy (YES) 2013-2014
  - Survey of the know-how of the nuclear safety division
- KYT 2018 and SAFIR 2018 boundary seminar of the planning groups 2014
- Experience from KYT 2014 program
- Framework program provides the overall guidelines as for the content of research in KYT2018
  - It is the general reference in the annual call of proposals, complemented by the topical guidance of the Steering Group

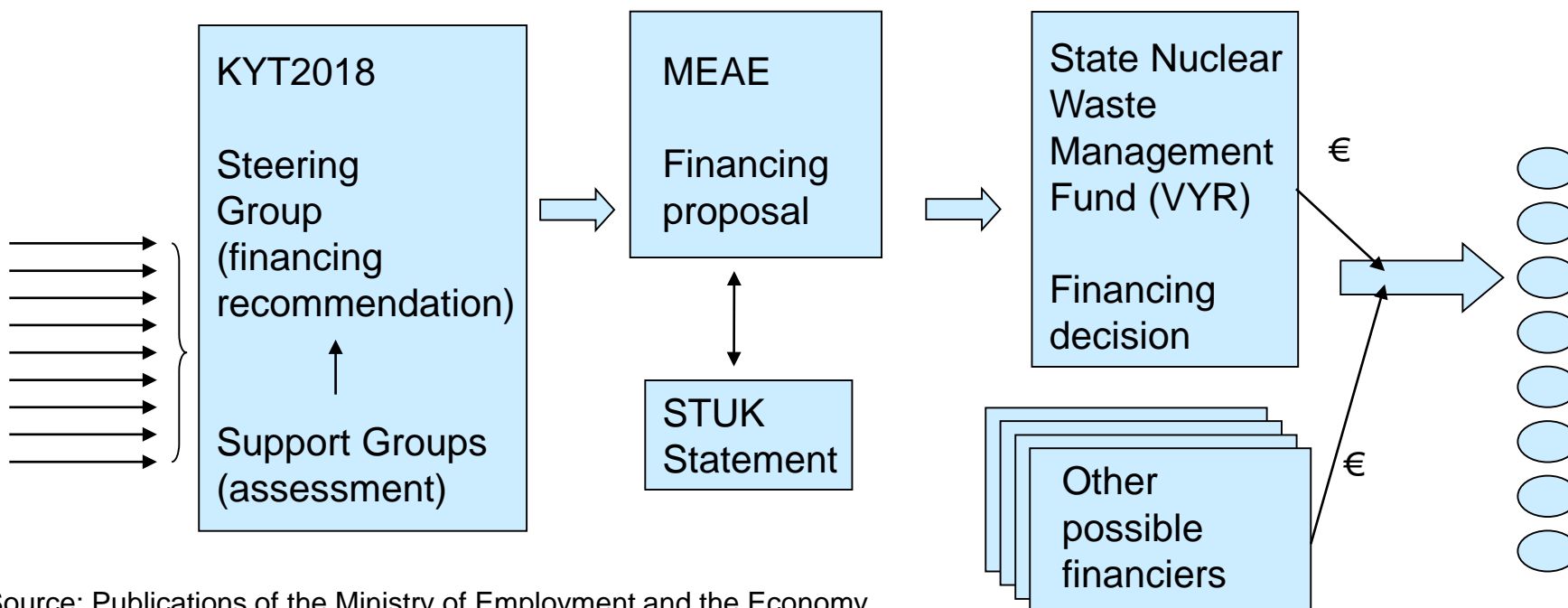
## KYT2018 aims

- Basic aim is to produce high quality research results to be used by Finnish nuclear authorities
  - STUK: Radiation and Nuclear Safety Authority, Finland
  - TEM: Ministry of Employment and the Economy, from 2017 Ministry of Economic Affairs and Employment (MEAE)
- Nationally central research topics
- Topics directly related to the respective nuclear waste management duties of waste producers or authorities do not belong to KYT2018
- The results of the research programme are public and thus available for all participants
- The long-term aim of KYT2018 is, for its part, to
  - Maintain national knowhow in nuclear waste management
  - Promote collaboration between authorities, nuclear industry and scientists



## Decision making in KYT2018 about project proposals

Project proposals	Assessment	Financing proposal	Financing decision	Projects to be financed
(October)	(Nov.- Dec.)	(January)	(March)	



Source: Publications of the Ministry of Employment and the Economy. Energy and the Climate 51/2014

# KYT2018 assessment criteria of project proposals

- Relevance and usability of results are assessed against research needs
- Networking with other actors in the field, KYT2018 seeks well-integrated joint projects
- Training and scientific merits
  - New experts
  - New expertise
- Efficiency shown in previous KYT or other projects
- Realism in cost and work amount estimates

## KYT2018 types of projects

- 1 year project
- Longer term project
- Coordinated project (established in KYT2014 due to recommendations in KYT2010 international review)
  - Actually a small research programme
  - Several organisations in the research consortium
  - Project has a named leader

# KYT2018 management

- Steering Group
  - MEAE (Ministry of Economic Affairs and Employment) appoints
  - Strategic lines of the research programme
    - Can propose topical focus areas for MEAE in the annual call for project proposals
    - Makes a recommendation for MEAE of projects to be funded
- Support Groups
  - Appointed by the Steering Group
  - Assess the contents of project proposals
  - Follow up and guidance of the projects receiving funding
- Coordinator
  - Management of the research programme
  - Competitive bidding
- Website
  - <http://kyt2018.vtt.fi/>

## KYT2018 Steering Group

Member (deputy)	Organisation	Duty
Jarkko Kyllönen (Kaisa Leena Hutri)	STUK	Chair
Mikko Paunio (Jari Keinänen)	STM	
Sami Rinne (Kati Vaajasaari)	YM	
Sami Hautakangas (Kristiina Söderholm)	Fortum	
Anne Kontula (Lasse Koskinen)	Posiva	
Nina Paaso (Arto Kotipelto)	TVO	
Linda Kumpula (Jorma Aurela)	MEAE	Vice Chair
Heikki Hinkkanen (Tuire Haavisto)	Fennovoima	Expert

## KYT2018 Support Group I: Buffer, backfill and canister

Member (deputy)	Organisation	Duty
Ville Koskinen	STUK	Chair
Jaakko Leino	STUK	
Ari Luukkonen	STUK	
Pasi Kelokaski	Fortum	
Seppo Kasa	Posiva	
Marja Vuorio	Posiva	
Kirsi Weckman (Maria Palomäki)	TVO	

## KYT2018 Support Group II: Safety assessment and innovations

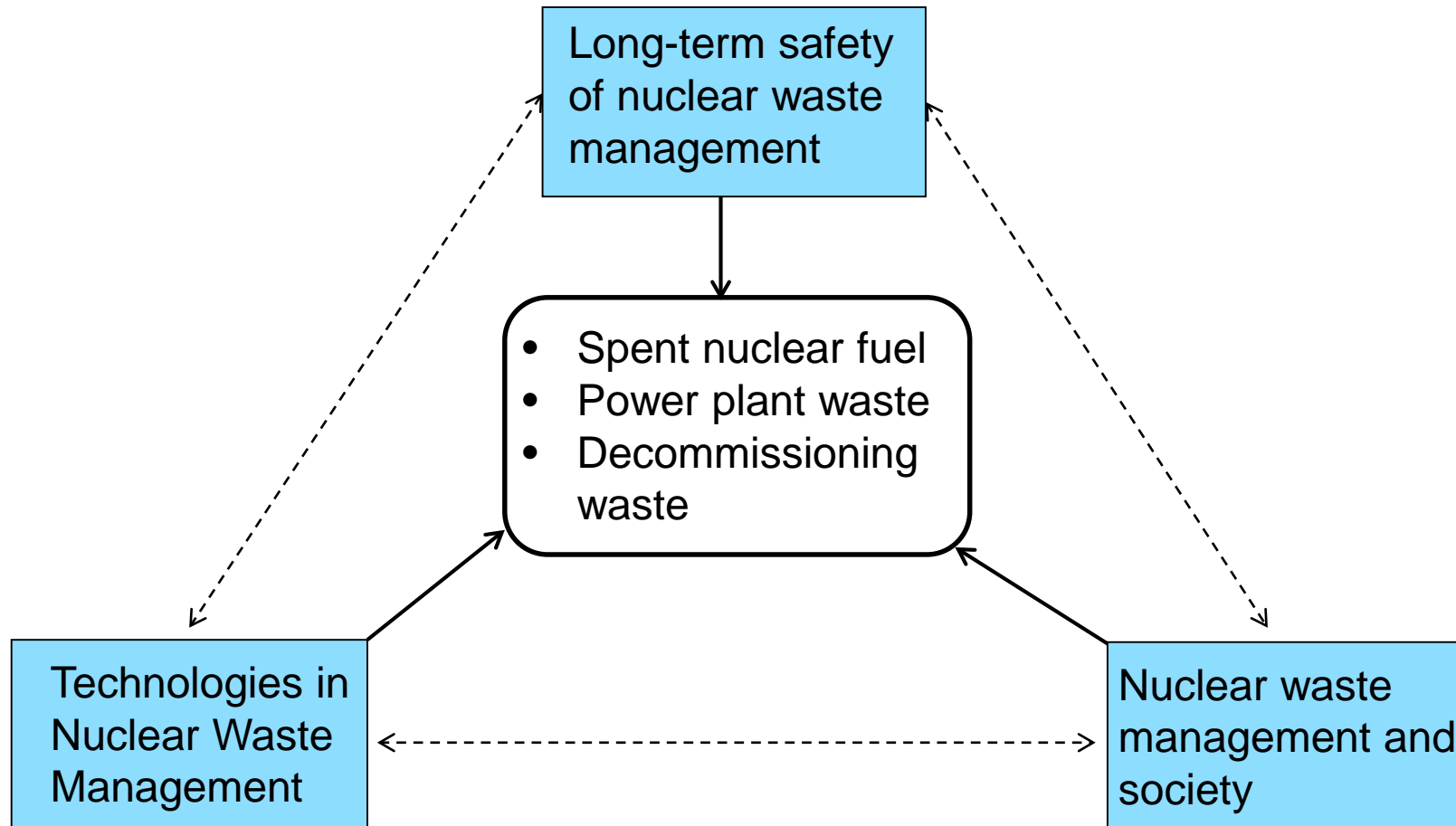
Member (deputy)	Organisation	Duty
Reda Guerfi	STUK	
Arto Isolankila	STUK	
Petri Jussila	STUK	Chair
Jarmo Lehikoinen	STUK	
Paula Ruotsalainen	STUK	
Tapani Eurajoki	Fortum	
Juho Kuusisto	Posiva	
Samu Myllymaa	TVO	

## KYT2018 Support Group III: Society and Man

Member (deputy)	Organisation	Duty
Linda Kumpula	MEAE	Chair
Juhani Tirkkonen	MEAE	
Jarmo Lehtinen	STUK	
Susan Pietilä	Posiva	
Maira Kettunen	Fennovoima	Expert
Juha Poikola	TVO	
Anna-Maria Länsimies	Fortum	
Sami Rinne	YM	
Kati Vaajasaari	YM	



# KYT2018 Research topics

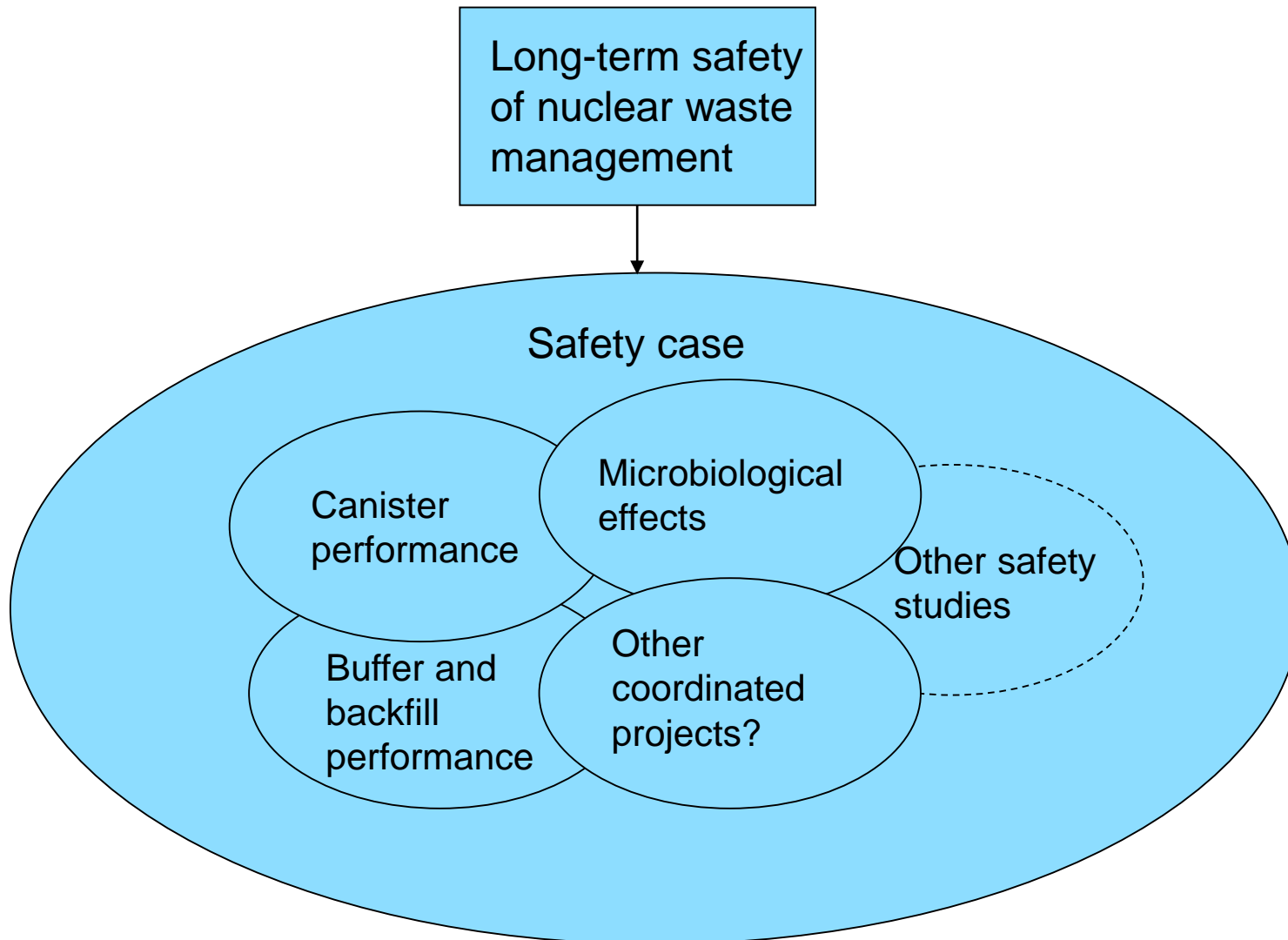


# Technologies in nuclear waste management

Possible research subjects are e.g.:

- Reprocessing, Nuclide partitioning and transmutation (P&T)
- Retrievability of the geological disposal and alternative implementation (e.g. deep bore holes)
- Storage alternatives, e.g. dry storage, other long-term storage
- Potential new solutions in low and medium level waste management, e.g. shallow land disposal of very low level waste, or disposal of new type waste, and reducing the amount of waste
- New solutions for implementing decommissioning, e.g. characterization and waste treatment methods of metal and concrete waste
- Development of alternative barrier material (e.g. canister material)
- Development of the evaluation methods of the costs in nuclear waste management

# KYT2018 Research topics 2



# **Safety research in nuclear waste management : Safety Case (coordinated)**

Gathers together all factors affecting the long term safety of nuclear waste disposal. Possible research topics are e.g.:

- The recognition of safety functions and the way in which scenarios are formed
- Alternative conceptual models and interpretations
- Development of methods for uncertainty analysis
- New sources of methodological information (safety assessment type of work outside nuclear waste research (e.g. Safety case work done in national nuclear safety program SAFIR 2018))
- Presentation of safety case for wider audiences (principles, methods, and limitations of Safety Case)
- The analysis of the evolution of the repository right after the disposal facility has been closed.

# **Safety research in nuclear waste management : Buffer and backfill performance (coordinated)**

Mass flows related to Safety Case context to and from canister through buffer, and buffer-canister-microbes coupling. Possible research topics are e.g.:

- Research concerning buffer and backfill performance
  - Modelling and experiments
- Development of THM and THC modelling lines and their integration
- Connection between material properties and performance
- Possible safety related detailed subjects

# **Safety research in nuclear waste management : Canister performance (coordinated)**

Canister lifetime related to Safety Case context, i.e. when does the release of nuclides start; how does undamaged canister limit the release of nuclides; and buffer-canister-microbes coupling. Possible research topics are e.g.:

- Long-term corrosion resistance of canister including microbial effects to corrosion
- Mechanical properties and their changes
  - Properties of the friction stir welded seam
  - Canister inner parts
- Effects of external loads on the canister (buffer swelling pressure, pressure changes due to glacial events)

# **Safety research in nuclear waste management : Microbiological effects (coordinated)**

Safety Case related context of microbial effects, i.e. buffer-canister-microbes coupling, the subsequent microbial effects on engineering barrier system materials, and on the transport of radionuclides. Possible research topics are e.g.:

- Sampling representativeness
- Estimating microbial activity in final disposal conditions
- How microbes affect on the performance of the release barriers
- Microbial activity in low and medium level waste disposal

# Safety research in nuclear waste management :

## Other safety related studies

Possible topics are e.g.:

- Long-term behaviour of concrete structures in final disposal conditions
- Studies related to the conclusion of tests simulating the final disposal conditions of operating waste
- The impact of spent fuel properties on the safety of final disposal, in particular the impacts of an increase in the burnup level and the final disposal of new fuel types
- The behaviour of C-14 in final disposal (spent fuel, operating waste, decommissioning waste)
- Bedrock research as regards the safety of final disposal, and the research to ensure the quality of the bedrock
- Biosphere research as regards the safety of final disposal
- The modelling of the closure of repository (e.g. tunnels) and the assessment of their performance.



# Social science studies related to nuclear waste management

Besides technical know-how nuclear waste management needs political and wider acceptance in society. Possible research topics are e.g.:

- Ethical and public debate
- Issues related to long time scales e.g. the closed repository and the long-term preservation of the knowledge
- Generation of nuclear energy.

## KYT2018 collaboration

- Thematic seminars
- Common seminars with SAFIR programme if needed
- Other research programmes
  - Scientific collaboration
- YTERA project of the Academy of Finland
  - Graduate School for nuclear technology and radiochemistry
- EU
- International expert organisations, e.g. OECD NEA

# KYT2018 summary

- Based on Nuclear Energy Act
- Research period 2015-2018
- Budget 2 M€/a (2015) -> 3 M€/a (2016-2018)
- Call of project proposals annually
- Different kind of project types
- KYT2018 International review in 2017<sup>3</sup>
- Framework programme (in English):  
[https://www.tem.fi/files/41406/TEMjul\\_51\\_2014\\_web\\_12112014.pdf](https://www.tem.fi/files/41406/TEMjul_51_2014_web_12112014.pdf)
- More information at website (<http://kyt2018.vtt.fi/>)

<sup>3</sup>KYT2018 Review Report, MEAE guidelines and other publications 9/2017,  
<http://kyt2018.vtt.fi/>



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