



Strål
säkerhets
myndigheten

Swedish Radiation Safety Authority

HOW TO SECURE COMPETENCE IN RADIATION SAFETY?

SSM:s view concerning Sweden



A national framework for knowledge management; the knowledge system

- Universities educate students and provide funding for researchers
- Dynamic research environments provide knowledge, and contribute to high quality education
- Students attracted to higher education and can expect being employed
- Employers recruit suitably educated people
 - Followed by internal training and deepened competence



A government assignment on long-term knowledge management

- Investigate the possibilities for maintaining national competence within the Authority's area of responsibility
- Identify the stakeholder's potential to recruit staff having sufficient qualifications
- Identify stakeholders that provide funding for research and education in relevant areas;
 - identify approaches to interaction on future areas on investment



Main background factors I

- International peer review (IRRS) showed that Sweden does not fully comply with IAEA standards for maintaining competence
 - No national strategy



Financiers

- The Nuclear Industry
- SSM, the Swedish Radiation Safety Authority
 - No TSO in Sweden, research budget instead
- Research funders:
 - The Swedish Research Council
 - The Swedish Energy Agency
 - The Swedish foundation for Strategic Research
 - VINNOVA - Sweden's Innovation Agency
 - FORMAS - a government research council for sustainable development



Financiers

- The Nuclear Industry
- SSM, the Swedish Radiation Safety Authority
 - No TSO in Sweden, research budget instead
- Research funders:
 - The Swedish Research Council
 - The Swedish Energy Agency
 - The Swedish foundation for Strategic Research
 - VINNOVA - Sweden's Innovation Agency
 - FORMAS - a government research council for sustainable development



Research and higher education

Chalmers Institute of Technology, Gothenburg
Nuclear engineering
Nuclear chemistry

Göteborgs University
Radiation biology
...

Lunds University
Radiation biology
Radioecology
...



LUNDS UNIVERSITET

CHALMERS



Uppsala University, Uppsala
Applied nuclear physics
Non-proliferation



Royal Institute of Technology, Stockholm
Nuclear safety
Rector technology
Nuclear physics
Nuclear chemistry



Stockholm University
Radiation biology
...



Complex matching

Areas of
occupation

Health care
Nuclear Industry
State authorities
Other nuclear
applications

Areas of
knowledge

Strålskydds-
principer

Strålningsfysik

Strålnings-
biologi

Strålskydds-
dosimetri

Radioekologi

Radiokemi

Operativt
strålskydd

Mätmetoder

Strålskydds-
beredskap

Icke-
joniserande
strålning

Kärndata

Reaktorfysik

Termo-
hydraulik

Svåra haverier

Kärnkemi

Utsläpps-
analyser

Bestrålnings-
effekter på
material

Kärnämnes-
kontroll

Militär
tillämpning



Main background factors II

- The decisions of the nuclear power industry to shut down four out of ten operating nuclear power reactors up to and including 2020
 - Though, result shows there will be reactors still in 2040, needing competence according to parliamentary energy commission reached a long-term agreement in 2016



Swedish nuclear power-plants



NPPs to be closed 2017-2020

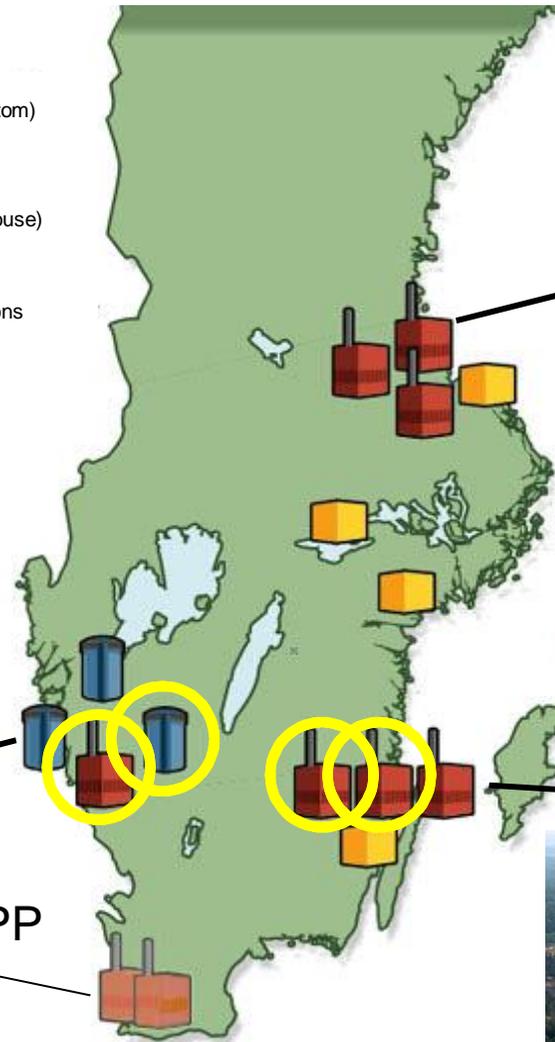
-  BWR (ASEA-Atom)
-  PWR (Westinghouse)
-  Other installations



Forsmark NPP



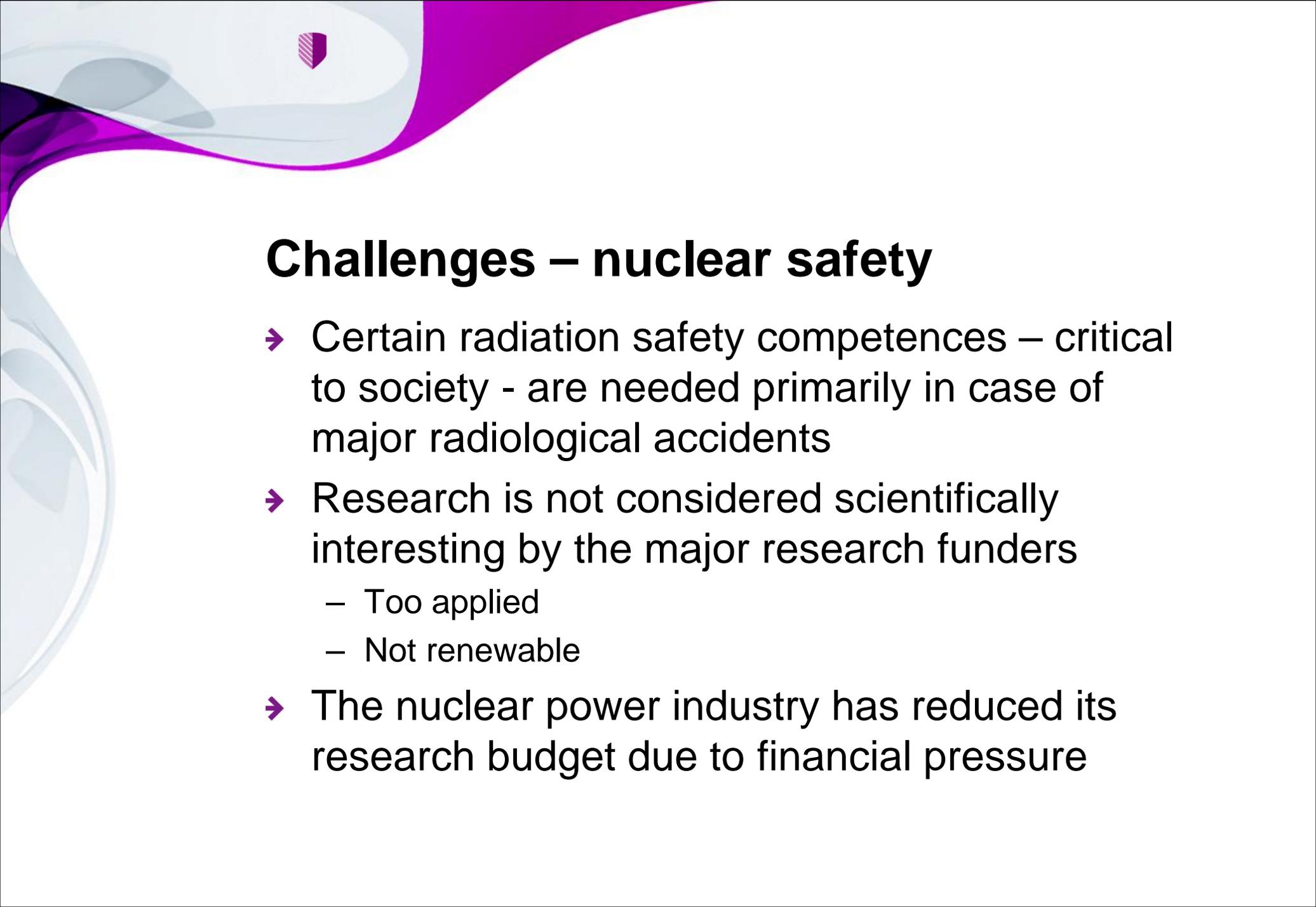
Ringhals NPP



Barsebäck NPP
Closed



Oskarshamn NPP



Challenges – nuclear safety

- Certain radiation safety competences – critical to society - are needed primarily in case of major radiological accidents
- Research is not considered scientifically interesting by the major research funders
 - Too applied
 - Not renewable
- The nuclear power industry has reduced its research budget due to financial pressure



The government assignment

Approach



Three perspectives investigated

- Employers' needs for competence
 - Shapes the needs of the national system for knowledge management
- Universities' programmes
- Society's need for scientific expertise



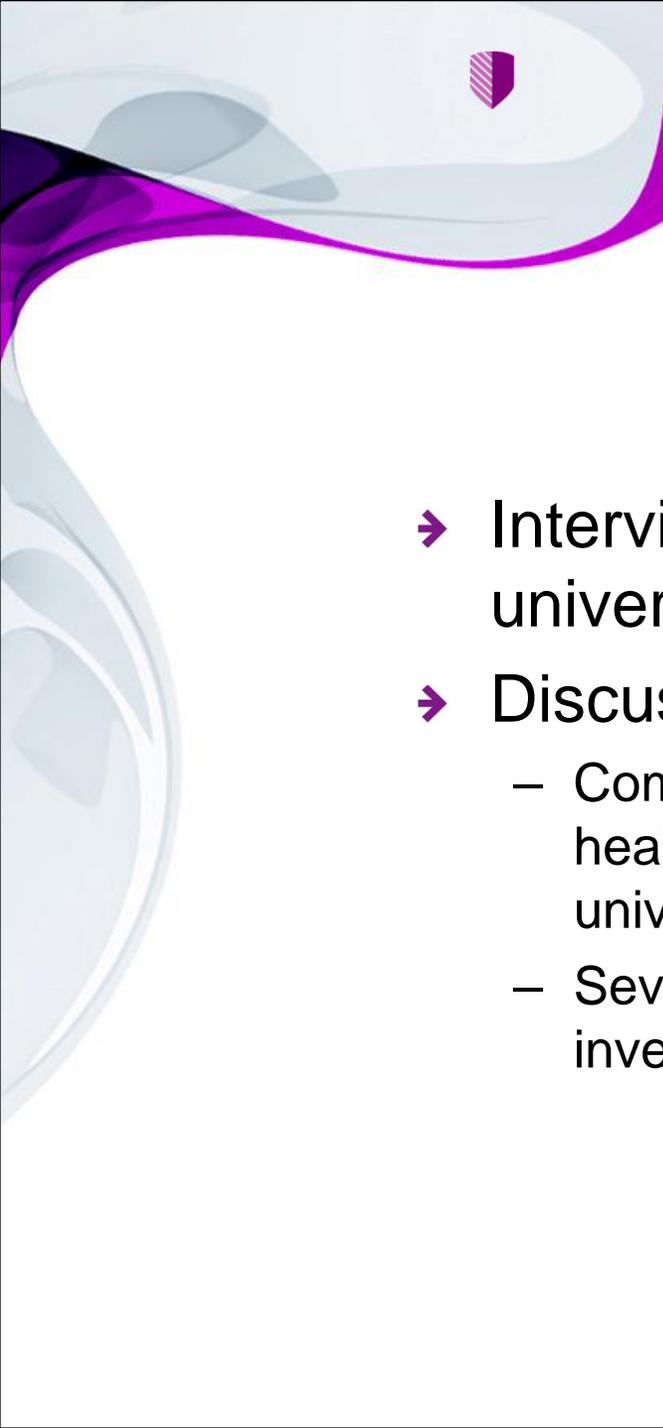
Four sectors

- Nuclear power sector
- Other industrial applications
- Healthcare sector
- Government authorities



The data compiled includes

- SSM:s former government assignments regarding knowledge management
- Professional skills assessments carried out by the major licensees of nuclear facilities
- Statistical data on employee competence
- Questionnaire responses from approximately 2,000 licensees

- 
- Interviews with 25 representatives of relevant universities
 - Discussions with the reference group
 - Comprising attendees from the nuclear power industry, health and medical services, competent authorities, and universities.
 - Several working meetings during the 18 months investigation time



A brief summary of the results



The nuclear power industry

- No decreasing recruitment needs within the industry
- Changing composition of skills:
 - Crews for the operation of nuclear power plants are decreasing
 - Increased need in nuclear waste, operational radiation protection and human factors (MTO)
- More difficult to recruit
- The majority of new employees receive sector-specific skills through internal training



Measures proposed

- 11 measures proposed to the Swedish Government
- 6 measures that SSM can carry out
- 2 recommendations to the licensees

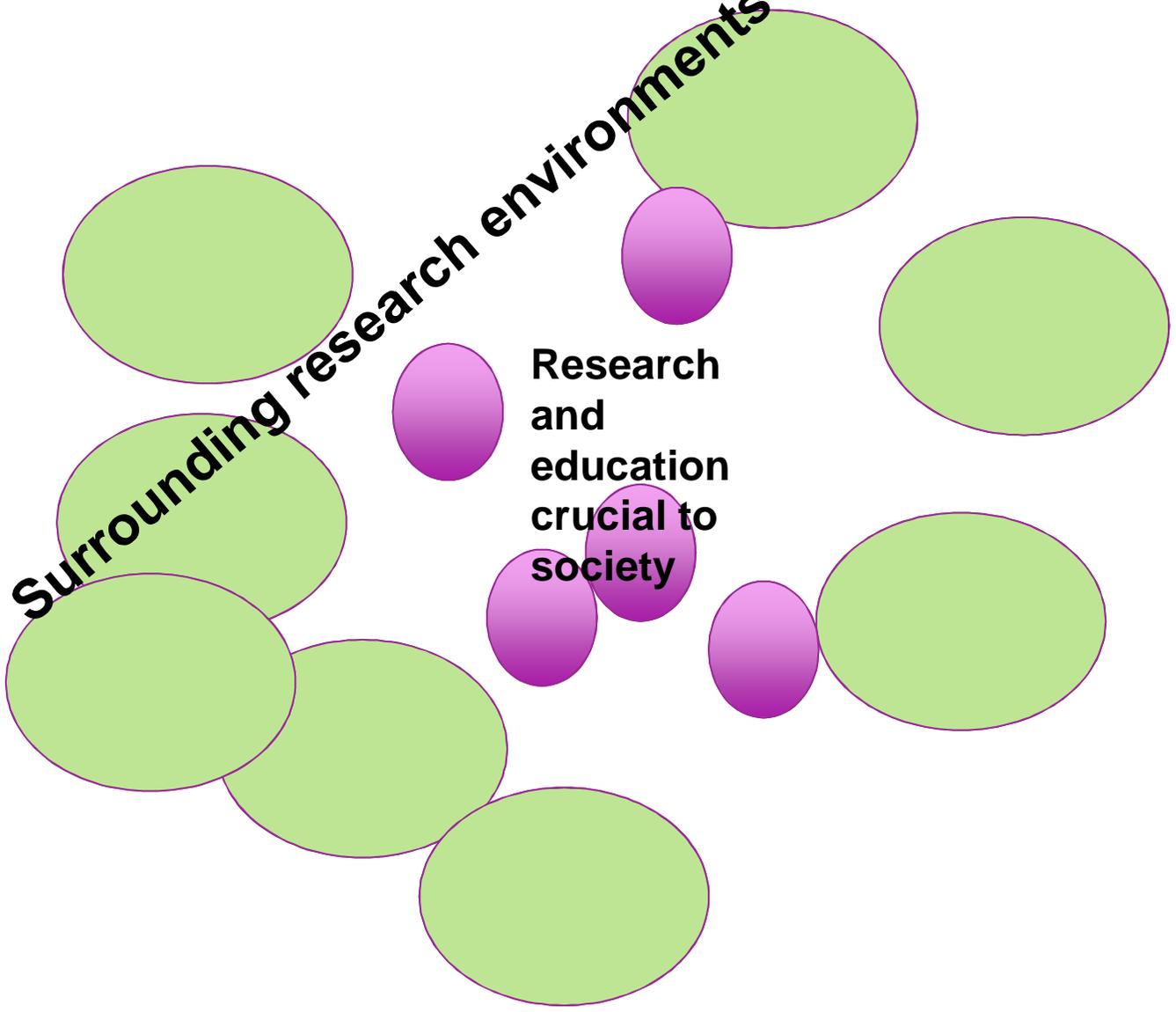
National Strategic Framework

Surrounding research environments

**Research
and
education
crucial to
society**

Surrounding research environments

Research and education crucial to society



National Strategic Framework

The diagram features a central purple circle containing the text 'Research and education crucial to society'. This is enclosed within a larger light green circle labeled 'Surrounding research environments'. The entire structure is framed by a purple arrow pointing to the right, with the text 'National Strategic Framework' written across its top.

Surrounding research environments

**Research
and
education
crucial to
society**



Research
and
education
crucial to
society

Critical subjects

- ➔ Reactor technology
 - Including reactor physics, thermal hydraulics
- ➔ Sever accidents and nuclear chemistry
- ➔ Nuclear non-proliferation
- ➔ Radiation biology
- ➔ Radio ecology
- ➔ Dosimetry



Research
and
education
crucial to
society

Measurements

- ➔ Increase SSM:s research budget by SEK 24 million
- ➔ Task SSM to investigate which education programmes need guaranteed availability, and which universities should offer them



Surrounding research environments

Measurement

- ➔ Task the national research financiers to cooperate on funding and shared strategies



Financiers

- ➔ The Nuclear Industry
- ➔ SSM, the Swedish Radiation Safety Authority
 - No TSO in Sweden, research budget instead
- ➔ Research funders:
 - The Swedish Research Council
 - The Swedish Energy Agency
 - The Swedish foundation for Strategic Research
 - VINNOVA - Sweden's Innovation Agency
 - FORMAS - a government research council for sustainable development

National Strategic Framework

Measures

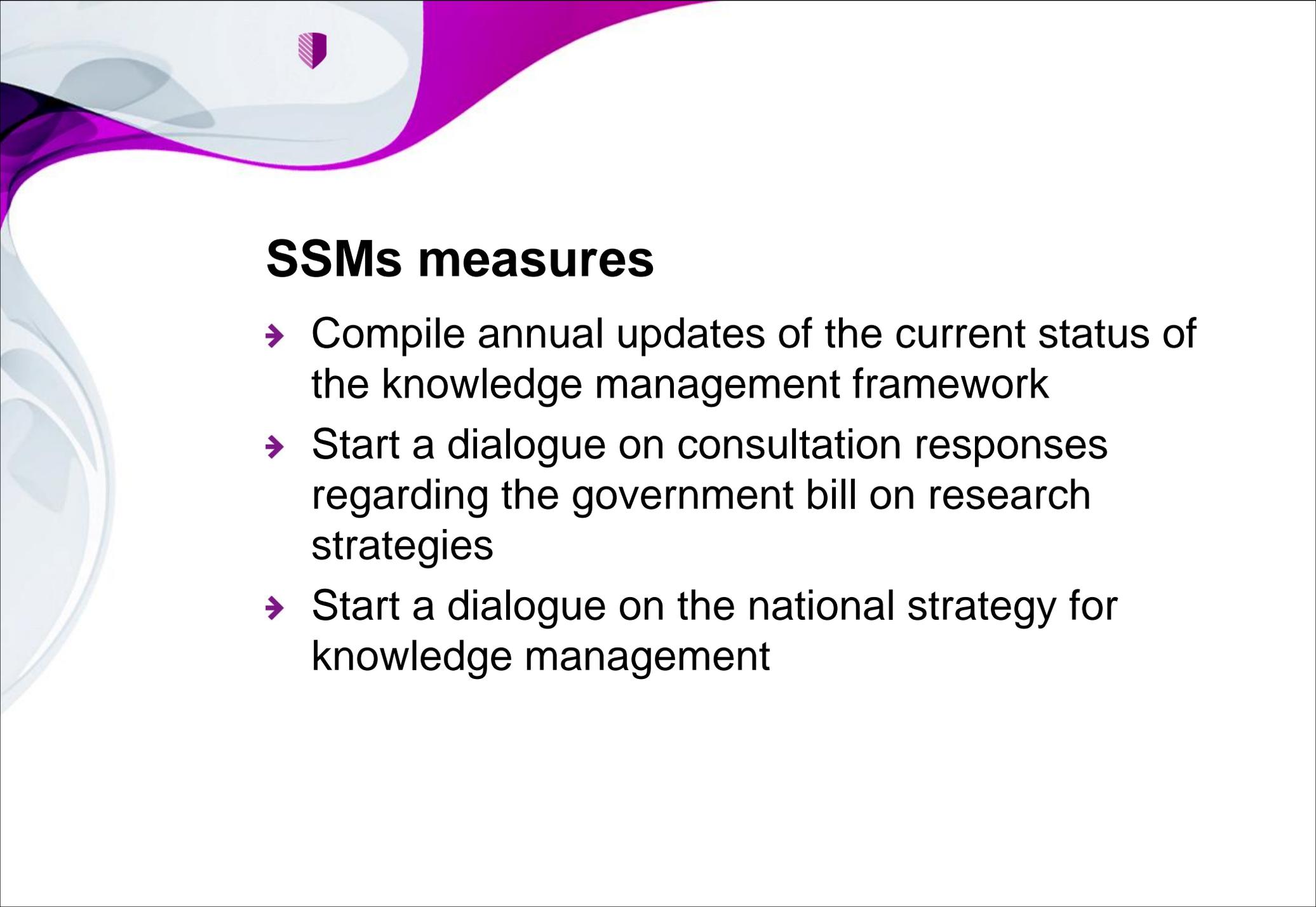
- ➔ Task SSM to produce and maintain a national strategy for knowledge management
- ➔ Establish a separate chapter covering the field of radiation safety in the government's research bill

National Strategic Framework

The diagram features a central purple circle containing the text 'Research and education crucial to society'. This is enclosed within a larger light green circle labeled 'Surrounding research environments'. The entire structure is framed by a purple arrow pointing to the right, with the text 'National Strategic Framework' written across its top.

Surrounding research environments

**Research
and
education
crucial to
society**



SSMs measures

- Compile annual updates of the current status of the knowledge management framework
- Start a dialogue on consultation responses regarding the government bill on research strategies
- Start a dialogue on the national strategy for knowledge management



Recommendations for licensees

- Licensees should run campaigns to increase the attractiveness of jobs in the sector
- Licensees should continue to develop opportunities for relevant employees to maintain and develop in-depth skills



Changes since September 2018

Industry

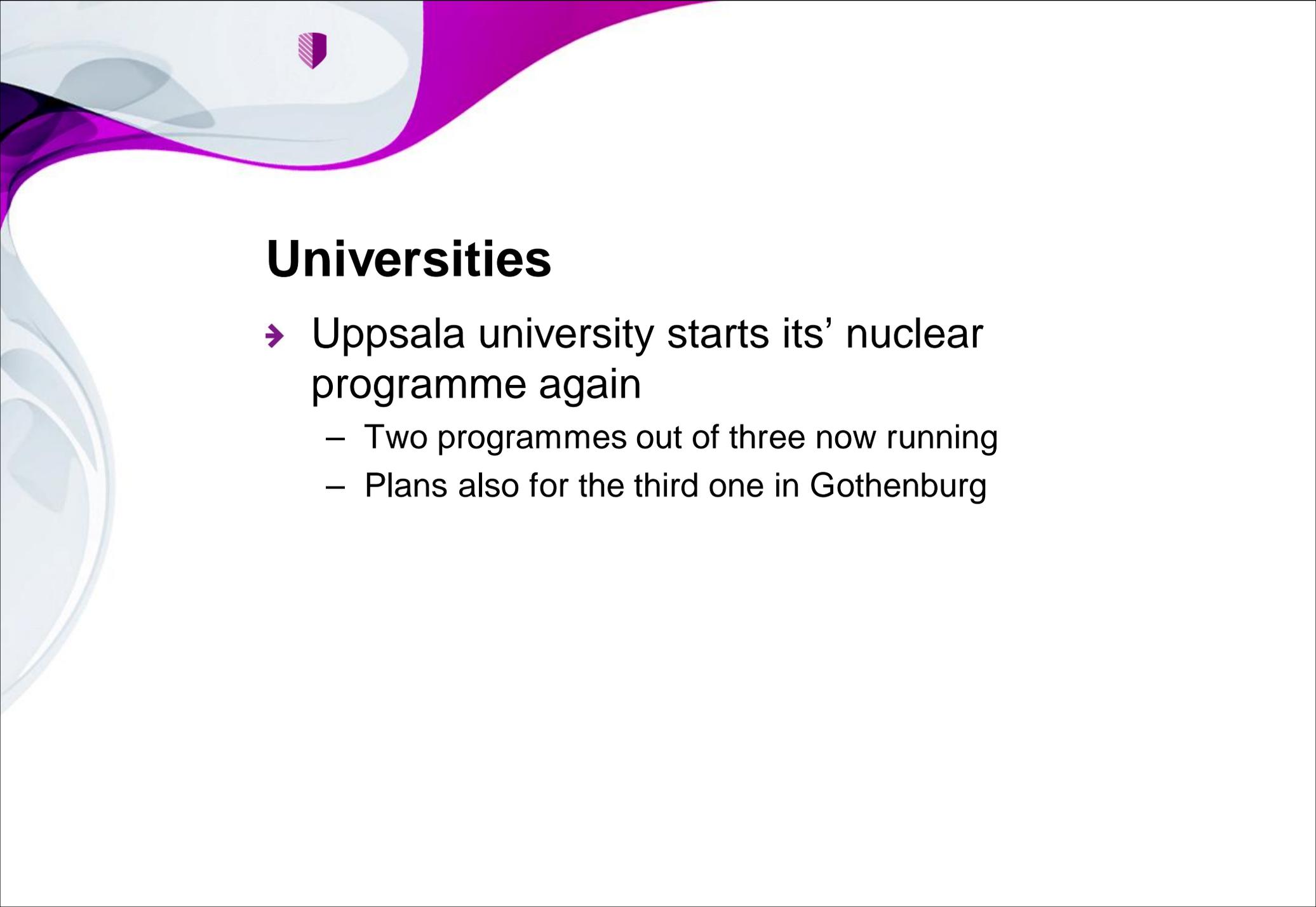
Universities

SSM



Nuclear power industry

- Recruitment campaigns
 - It is possible to recruit, but the cost is higher
- Vattenfall, Uniper in Sweden and TVO in Finland: establishing a network for future competence supply
 - New recruitment campaign on its way

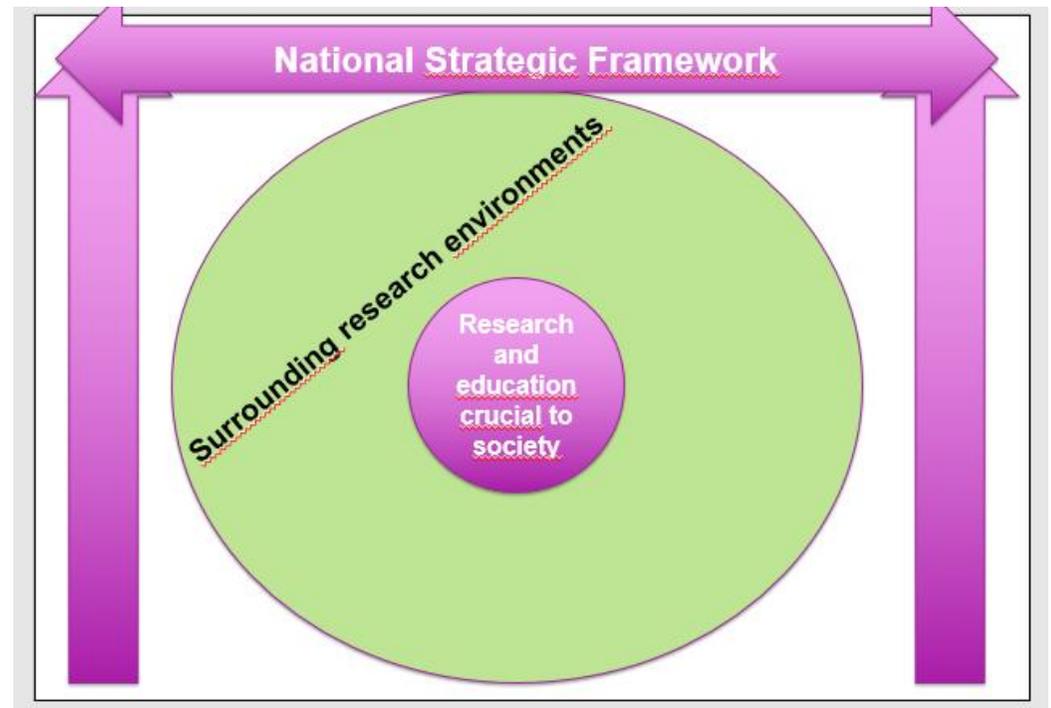


Universities

- Uppsala university starts its' nuclear programme again
 - Two programmes out of three now running
 - Plans also for the third one in Gothenburg

Government's measures

- ➔ A new government assessment might be on its way





Strålsäkerhetsmyndigheten

- Project started for compiling annual updates of the current status of the knowledge management framework
- The former reference group will be gathered annually
- Dialogue with the national research financiers to start
- Strategical choices to be made



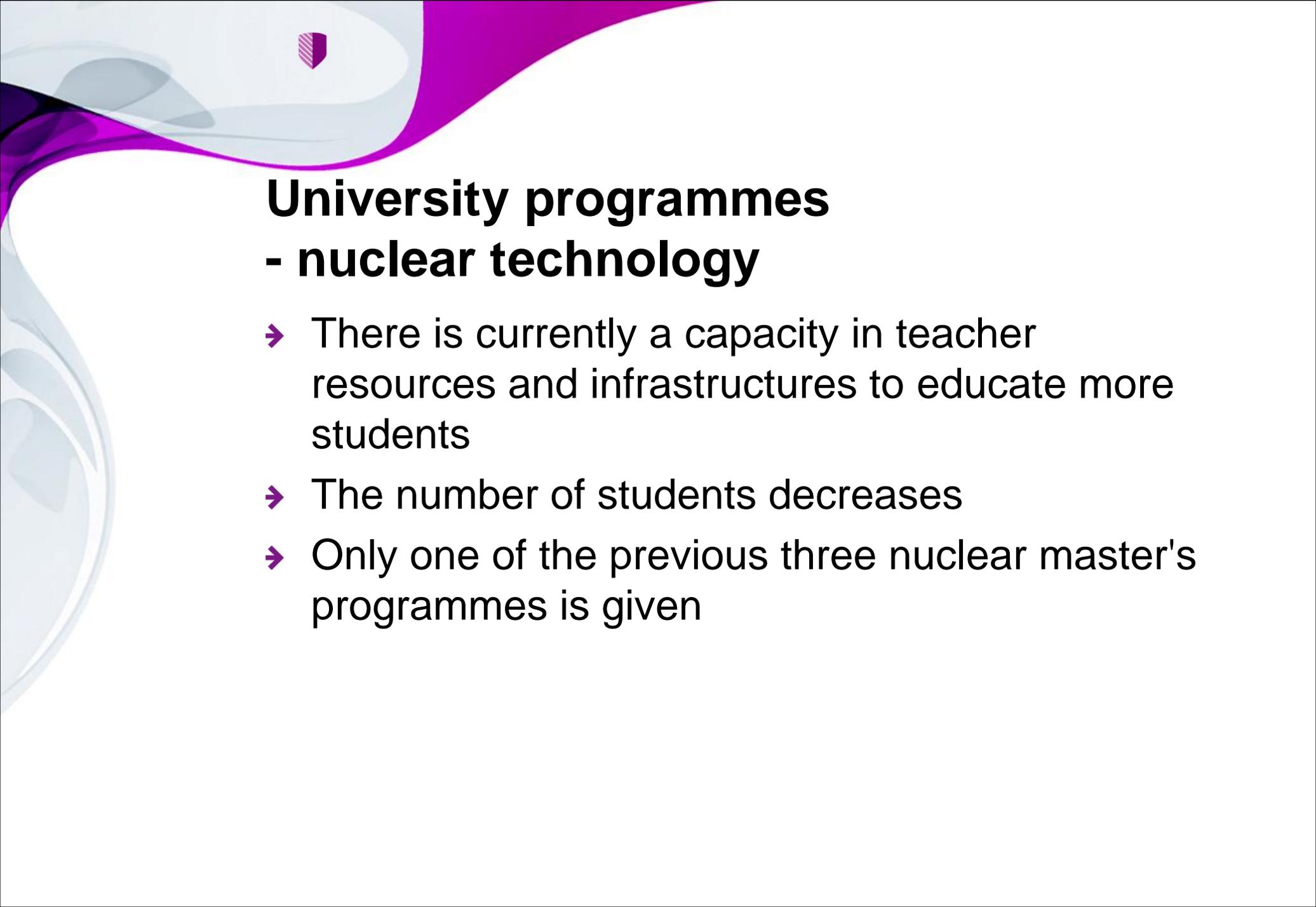
Thank you for listening!

Questions?



The nuclear power industry

- No decreasing recruitment needs
- ...on the other hand, changing composition of skills:
 - Crews for the operation of nuclear power plants are decreasing
 - Increased need in nuclear waste, operational radiation protection and human factors (MTO)
- More difficult to recruit
- The majority of new employees receive sector-specific skills through internal training



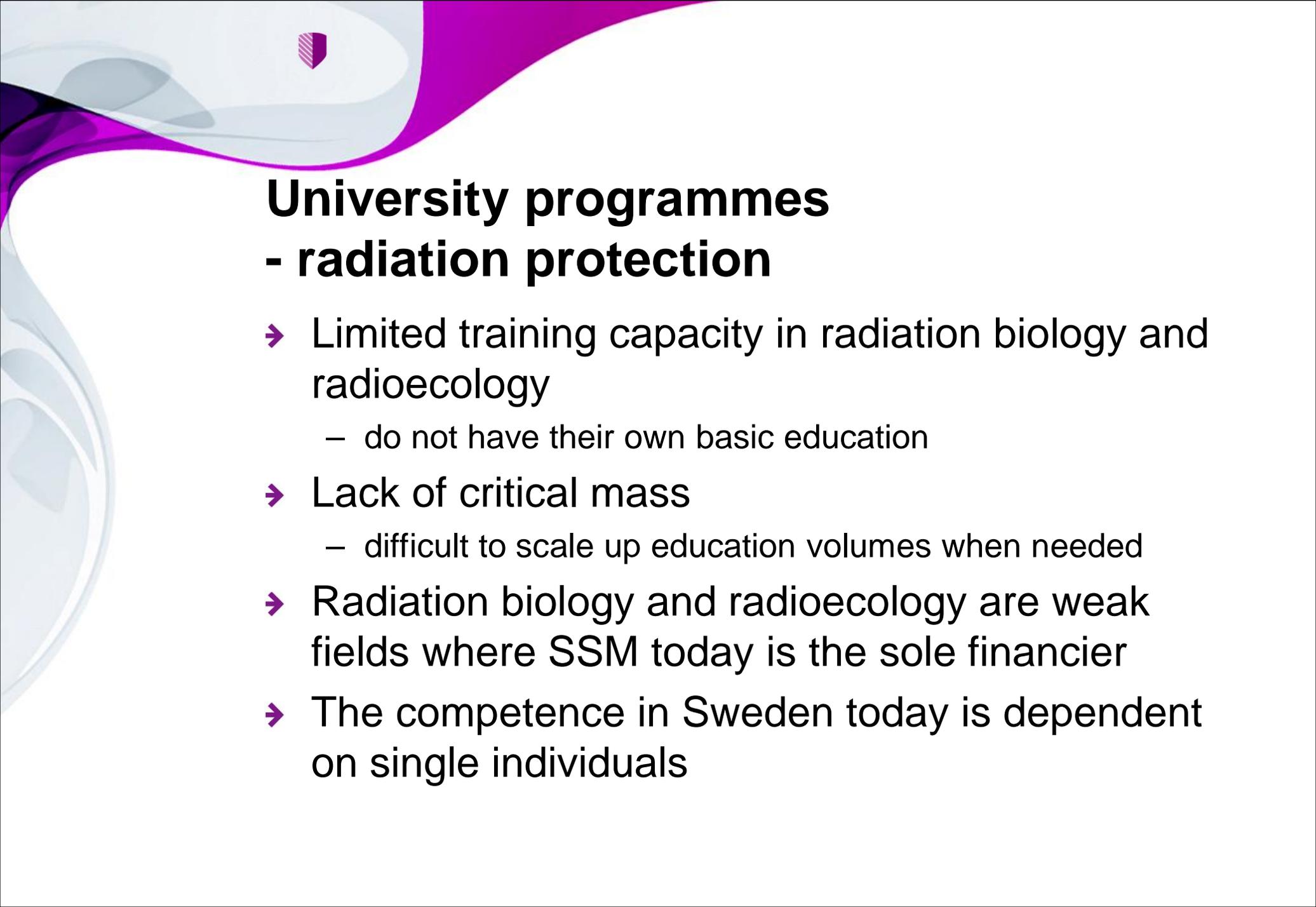
University programmes - nuclear technology

- There is currently a capacity in teacher resources and infrastructures to educate more students
- The number of students decreases
- Only one of the previous three nuclear master's programmes is given



Research environments - nuclear technology

- Universities' financial situation pressed:
 - Research funding is decreasing, among other things because of reduced support from industry
 - Decreasing number of students
- The link between education, research & employers is not straightforward
 - A large part of the education consists of in-house training and skills development at the employers



University programmes - radiation protection

- Limited training capacity in radiation biology and radioecology
 - do not have their own basic education
- Lack of critical mass
 - difficult to scale up education volumes when needed
- Radiation biology and radioecology are weak fields where SSM today is the sole financier
- The competence in Sweden today is dependent on single individuals