A national model for thyroid measurements in Sweden, following a nuclear power plant accident

NSFS Lillehammer 2025-08-28

VÄSTRA GÖTALANDSREGIONEN

Agenda

1. Background
2. Project structure
3. Findings
   - Target groups
   - Volumes
4. Work in progress
   - Measurement

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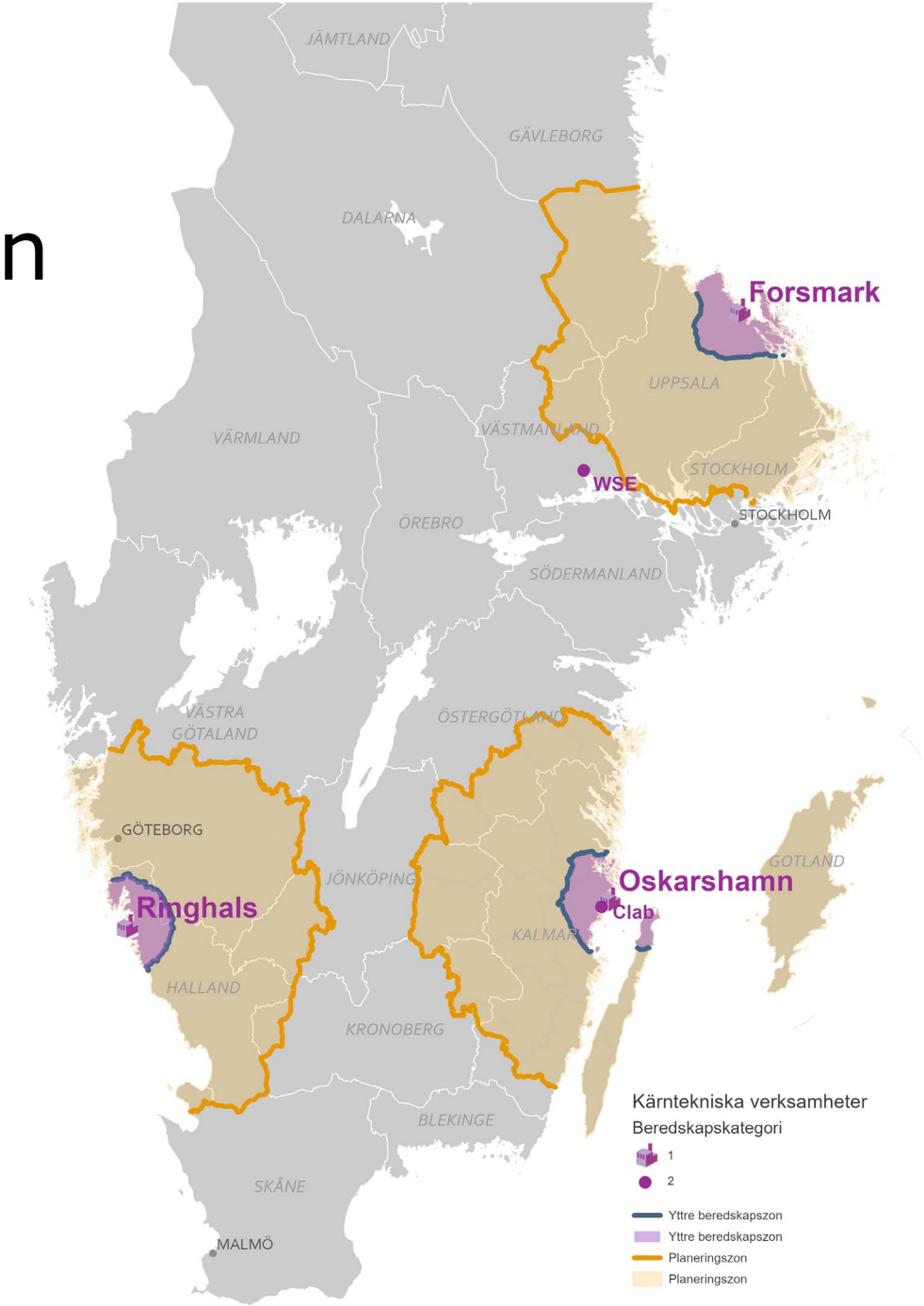
(stand-in for Mats Isaksson)

Background

Nuclear Power Plants in Sweden

Region	NPP
Västra Götalands Regionen Region Halland	Ringhals
Region Kalmar	Oskarshamn
Region Uppsala	Forsmark



Data: Länsstyrelserna, Lantmäteriet, Strålsäkerhetsmyndigheten (2025)

Emergency preparedness

- Extensive preparedness for accidents in NPP:s.
- Focus on external contamination
- Responsible authorities
  - **Swedish Radiation Safety Authority** (SSM): regulatory body (e.g. nuclear safety and radiation protection). Advisory role during an emergency.
  - **County Administrative Boards** (Länsstyrelse): state governance with responsibility for rescue services information and public protective actions.
  - Others….

Identified gap

- Lack of clear guidance regarding measurement and care of individuals exposed to radioactive iodine
- Focus on internal contamination
- Parties mainly concerned
  - **Health Care Regions** (21). Local government of the health care system. Regions are politically managed and relatively independent with large mandate within the healthcare system.
  - **The Swedish National Board of Health and Welfare** (Socialstyrelsen) is legally mandated by Swedish law to ensure readiness and resilience of the health and social care systems in times of crisis, heightened alert, or war.

Conclusion

The health care regions need to increase their readiness to handle a situation with radioactive iodine in thyroid in the general public after a nuclear accident in Sweden

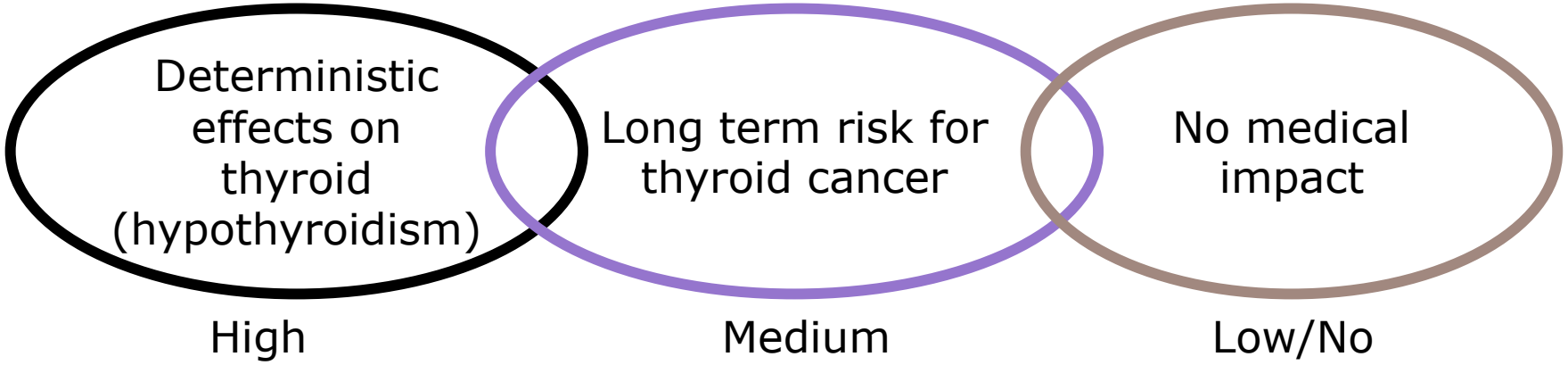
Project structure

The project aims to determine

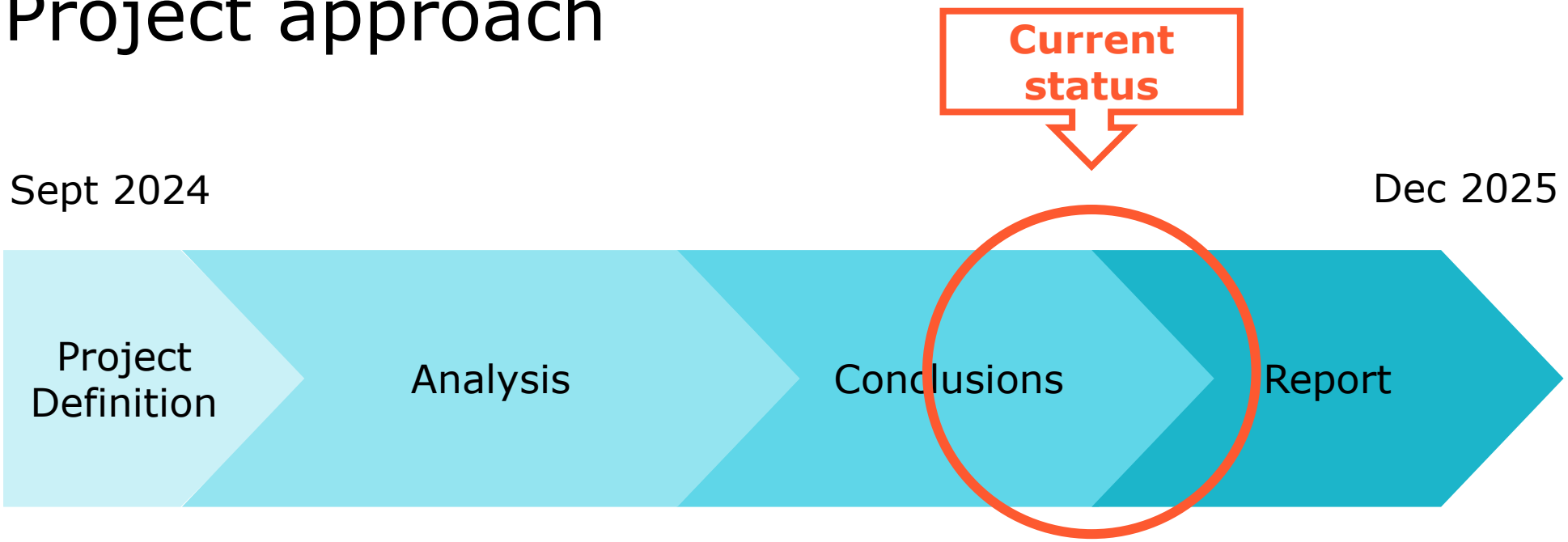
1. If the regions are responsible for making thyroid measurements
2. The estimated absorbed dose to the thyroid that can justify follow-up
3. The number of affected individuals that might need measurements
4. Method for measurements
5. Methods for follow-up of individuals
6. Communication materials needed to support execution
7. A strategy for long-term management of the method developed within the project

Scenarios for internal contamination

- The project scope definition is generated from three scenarios based on radiation dose interval.
- The scenarios high/medium/low (dose) have been elaborated further during project execution and is key for analysis and commuinication.



Project approach



- Conditions
- Project scope
- Time plan
- Deliverables
- Organization

- Knowledge sharing
- Data gathering
- Bi-lateral discussions

- Target groups
- Volumes
- Equipment
- Methods
- Organization
- Competences
- Follow up

- Suggested solution
- Recommendations for implementation

Project steering group

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Region Västra Götaland
Project Owner

Mats Isaksson
Center for Disaster Medicine and Medical radiation sciences at GU.

Stig Husin
Region Uppsala

Peder Kock
Swedish Radiation Safety Authority

Sara Brockstedt
Region Skåne

Niklas Haglund
Swedish National Board of Health and Welfare

Socialstyrelsen

Strål säkerhets myndigheten
Swedish Radiation Safety Authority

GÖTEBORGS UNIVERSITET

VÄSTRA GÖTALANDSREGIONEN

Region Halland

Region Kalmar län

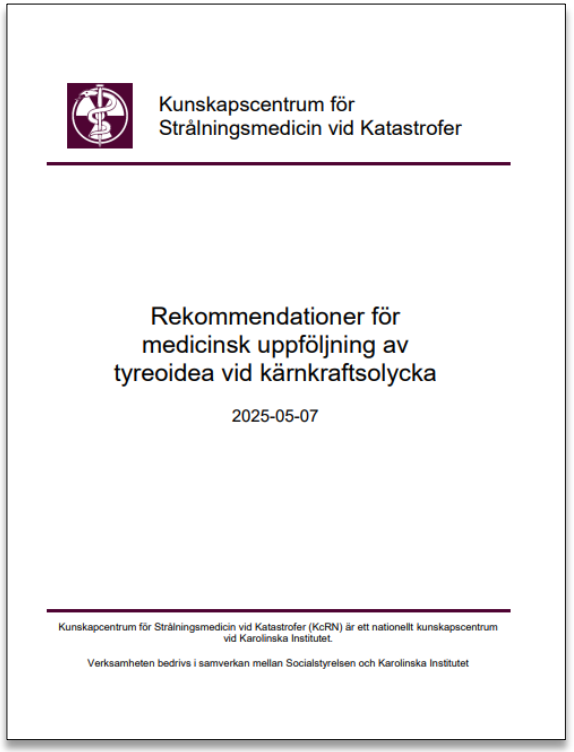
Region Uppsala

REGION SKÅNE

Findings
Target groups

Target groups for measuring and follow up

Project steering group has concluded to fully adopt the recommendations from KcRN (The Swedish National Board of Health and Welfare) regaring medical follow up on tyreoidea in case of an NPP accident.


Kunskapscentrum för
Strålningsmedicin vid Katastrofer

Rekommendationer för
medicinsk uppföljning av
tyreoidea vid kärnkraftsolycka

2025-05-07

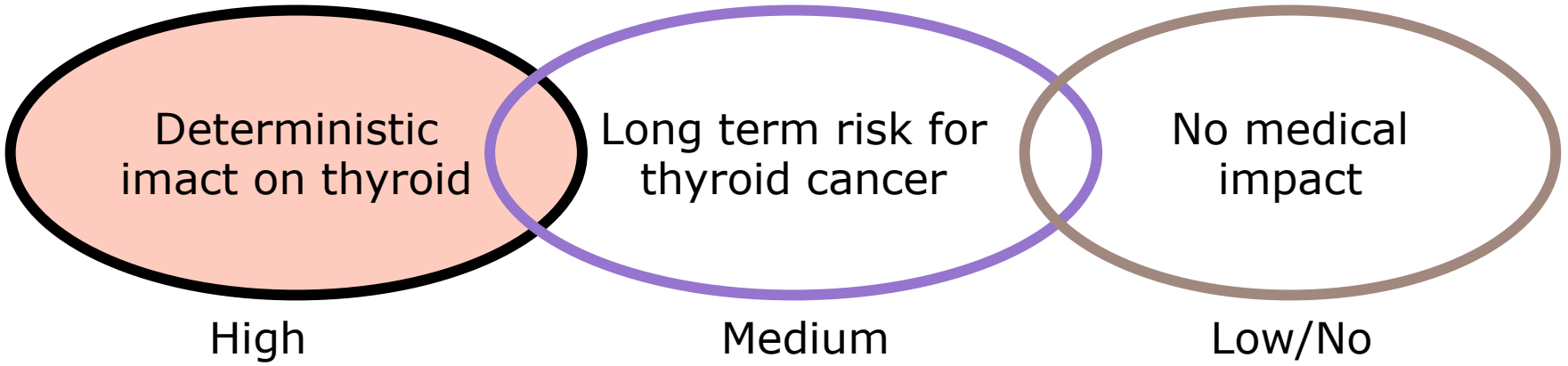
Kunskapcentrum för Strålningsmedicin vid Katastrofer (KcRN) är ett nationellt kunskapscentrum vid Karolinska Institutet.

Verksamheten bedrivs i samverkan mellan Socialstyrelsen och Karolinska Institutet

[Riktlinjer – Kunskapscentrum för Strålningsmedicin vid Katastrofer (KcRN)]

Conclusion 1

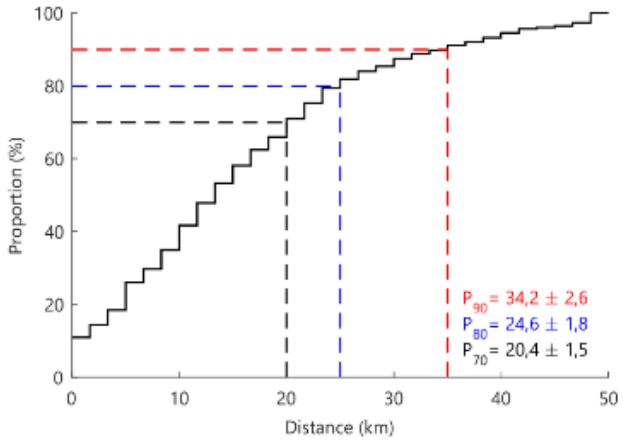
- Health Care Regions have a medical responsibility for measurement and care of individuals exposed for high radiation dose interval
- KcRN recommendation defines the high radiation dose interval



Findings Volumes

Hazard assessment

- Based on the same postulated event used to review EPZ[a] in Sweden
  - Approx. release: 100 PBq I-131 (10 PBq Cs-137; 5000 PBq Xe-133)
- 1 year of weather data (~700 runs)
- Evaluation of percentiles for maximum distances and areas for certain dose criteria[b] expressed in absorbed dose to the thyroid:



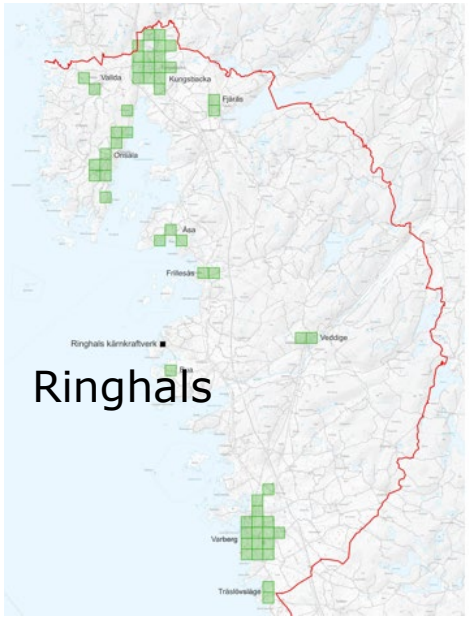
$D_{thyroid}$	P_{70} Distance (km)	P_{70} Area (km^2)	P_{90} Distance (km)	P_{90} Area (km^2)
Foetus, 4 Gy[c]	13	19	23	56
1 year old, 4 Gy	15	25	26	69
Adult, 10 Gy	-	-	-	-

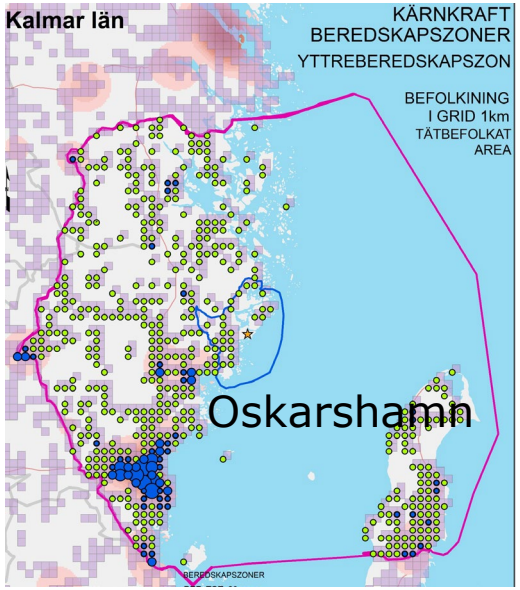
a) Review of Swedish emergency planning zones and distances, *SSM Report 2017:27e*
b) The results in the table are calculated assuming a protection factor of 0.5 from sheltering indoors
c) Assuming 2 Gy absorbed dose to thyroid of the mother

Assumptions for planning purpose and data collection

1. Potassium iodine intake: no
2. Stay: indoor
3. Range: urgent protective action planning zone – 25 km
4. Area: area from P90
5. Grid: 1 km x 1 km
6. Area distribution: considering local conditions (season, day, time of the day) to identify the most populated area within assumed range from NPP

Population data from Health Care Regions





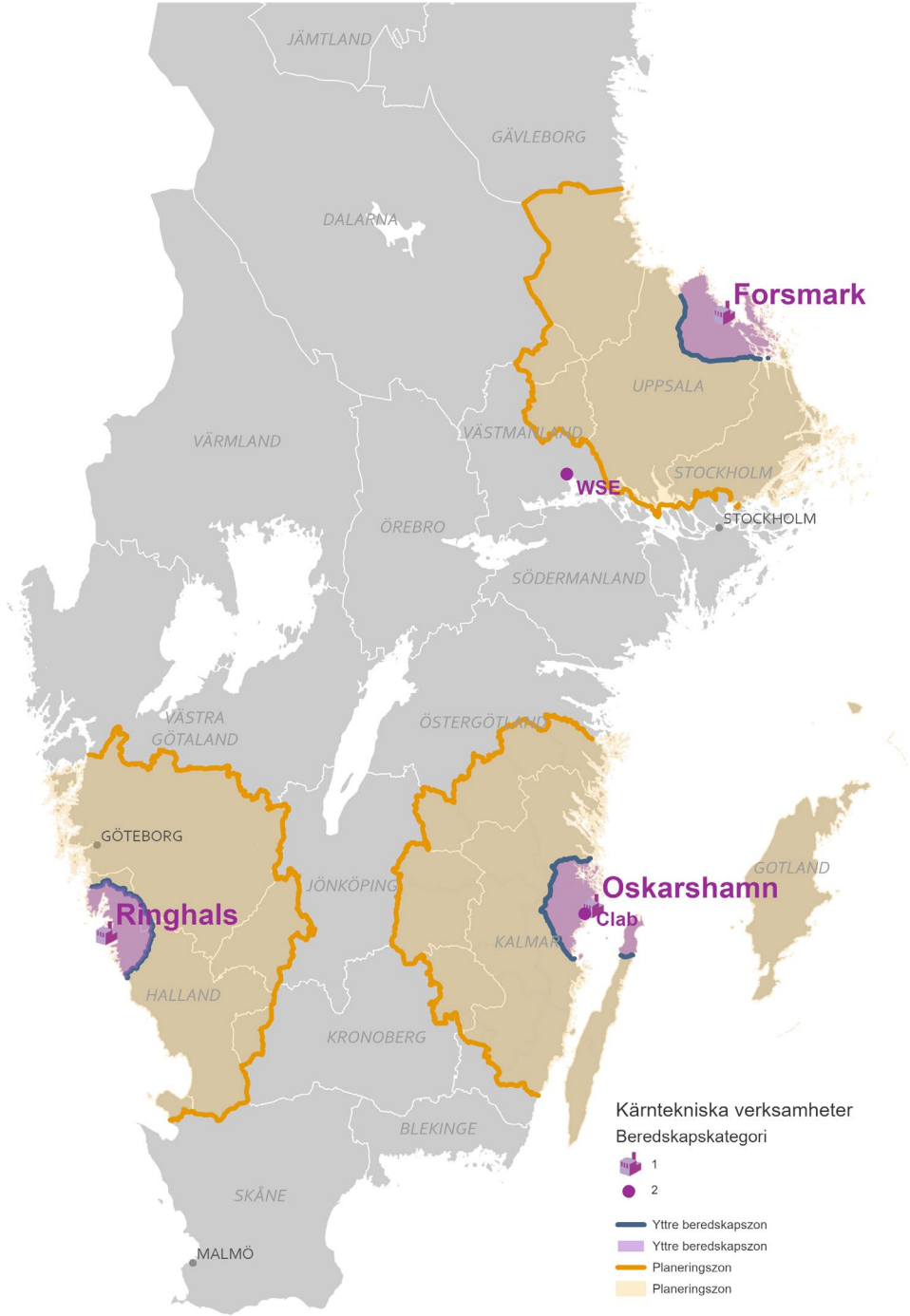
Forsmark

	Children (0-17)	Women (18-50)	Foetus*	Target volume
Ringhals	8492	7138	357	8849
Oskarshamn	4436	3970	199	4635
Forsmark				

* 5% of Women

Conclusion 2

- The estimated volume to measure will be aprox 25% of the population in the urgent protective action planning zone (UPZ) extending approximately 25 kilometres from PPT.

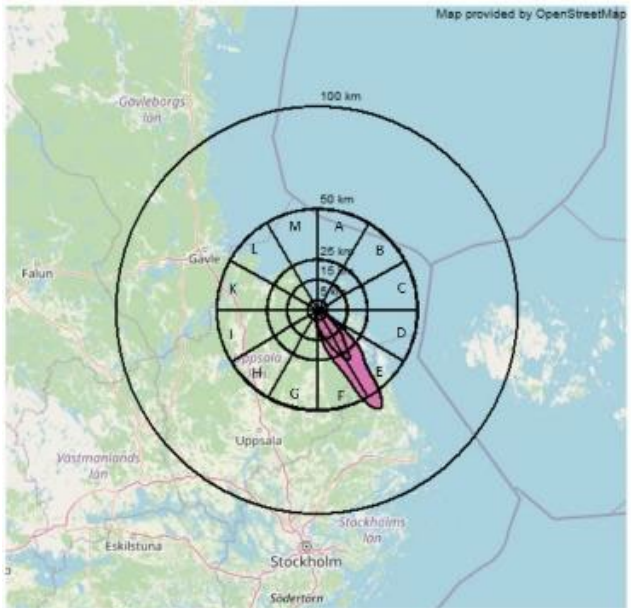


Data: Länsstyrelserna, Lantmäteriet, Strålsäkerhetsmyndigheten (2025)

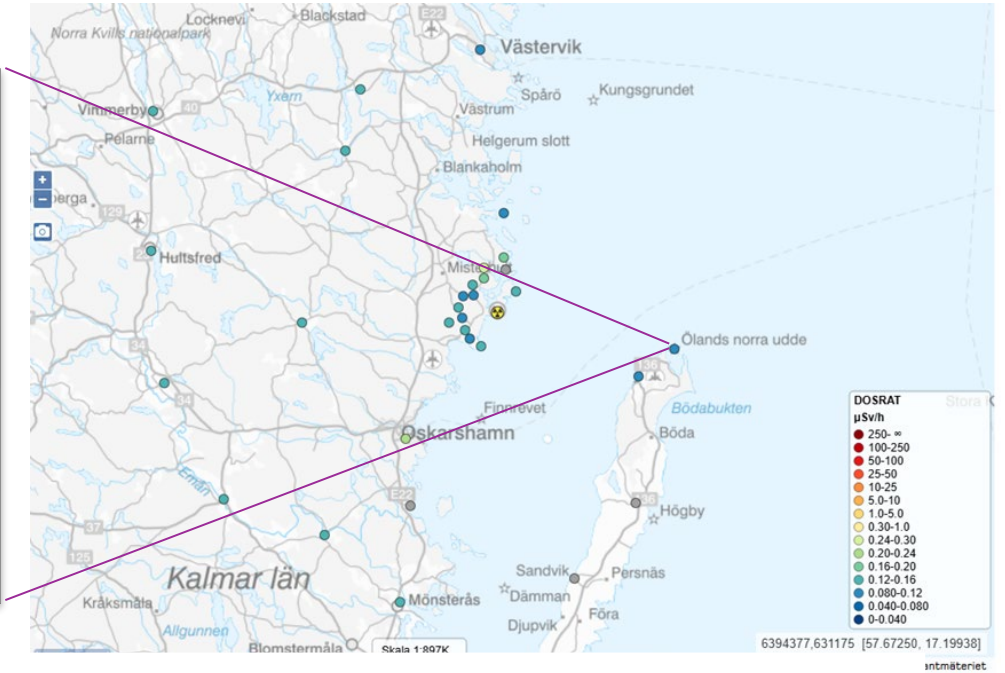
Work in progress
Measurement

Identification of exposed individuals

- Potentially exposed population is initially expected to be identified by:
  - Dispersion prognoses during response
  - Early monitoring from fixed monitoring stations, confirming plume passage



Example of dispersion prognosis



Example of fixed monitoring station (GM tube) and network around Oskarshamn NPP

Measurement model - approach

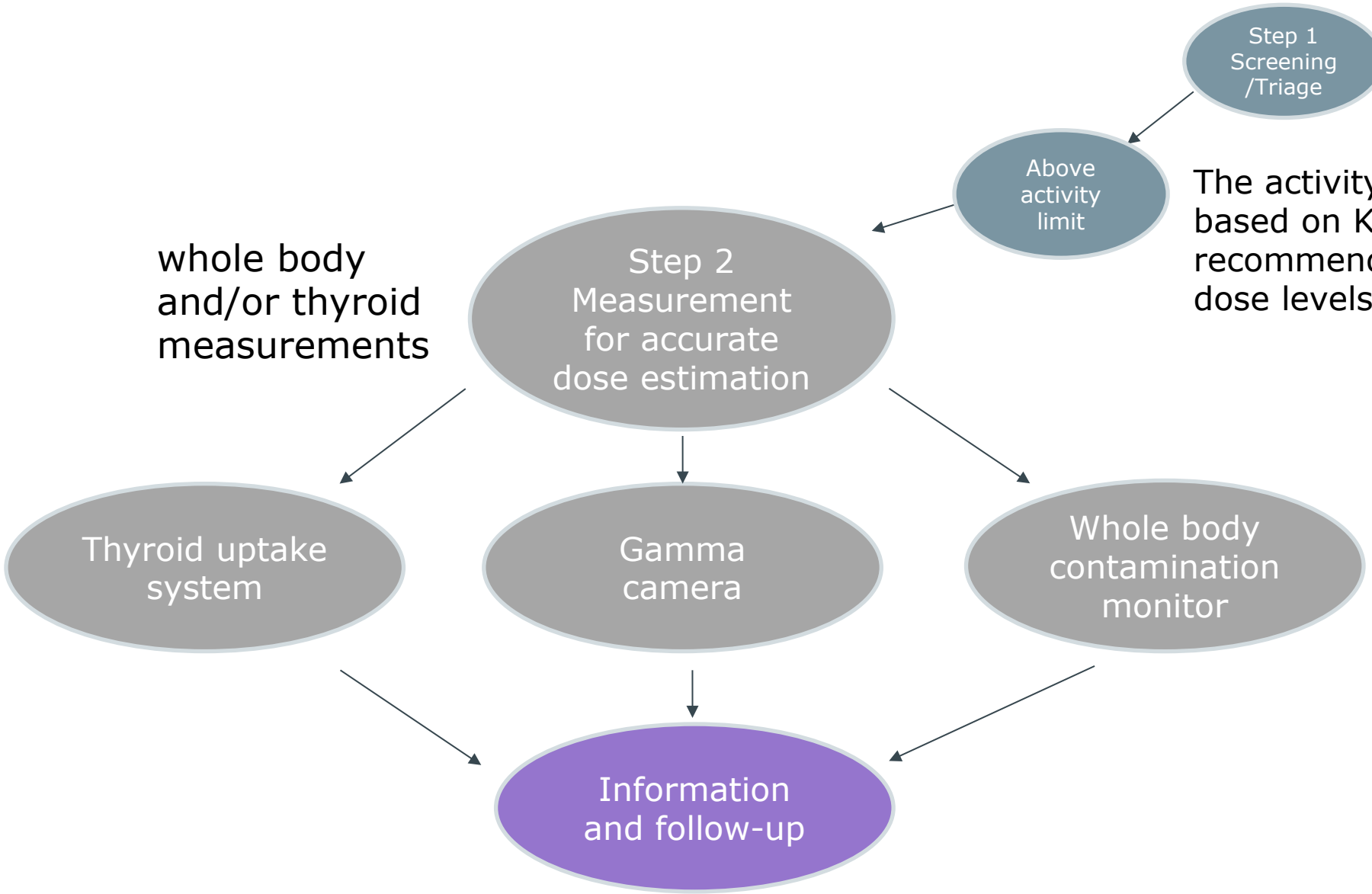
Two-step measurement

1. Screening/Triage
2. Accurate dose estimation measurement

Flow chart:

1. The public (including worried well?) – two-step measurement
2. Workers from NPP – directly to step 2

Step 2: Measurements for accurate dose estimation



whole body and/or thyroid measurements

The activity limits are based on KcRN's recommended radiation dose levels for follow-up

Practicalities – Step 1

1. Screening/triage
   - Suitable location?
     - On the hospital grounds
     - Mobile – open areas, suited for large numbers of people
   - Measurement equipment – hand-held
     - Contamination instruments
     - Radiation survey devices
   - Acitivity limits?
     - MBq, MBq/cm2, Sv, Sv/h, cps?

Practicalities – Step 2

2. Measurement for accurate dose estimation

- Measurements inside hospitals
- Use all the measuring equipment available – depending on the volumes
- Prioritization using screening - the flow into the hospital more manageable

Conclusion 3

Equipment

- Use of a dedicated set of handhold devises
- Adress needs specifications to national procurement
- Assume collaboration between Regions in case of emergency to assure equipment for local measurements

Thank you!

Mats Isaksson, Göteborgs Universitet
Martin Hjellström, Göteborgs Universitet
Eva Wallström, Västra Götalandsregionen
Ewa Glans, Västra Götalandsregionen
Stig Husin, Region Uppsala
Cornelia Held, Region Uppsala
Sara Brockstedt, Region Skåne
Anna Sörensson, Region Halland
Markos Koufakis, Region Kalmar

Niklas Haglund, Socialstyrelsen
Christel Hedman, Karolinska Institutet

Peder Kock, Strålsäkerhetsmyndigheten
Sofi Wickström, Strålsäkerhetsmyndigheten