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THYROIDSEM: Seminar: Assessment of accidental uptake of radioiodine in emergency situations

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Abstract

This document constitutes a follow-up report upon the one-day seminar held in Copenhagen at 29. September 2014 about population monitoring of I-131 uptake in the population during emergency situations in the Nordic countries (THYROID). Measurement techniques, dose assessment and preparedness were discussed. A questionnaire was used to collect feed-back from participants in order identify needs for future improvements. In conlusion, calibrations with actual I-131 should be considered, and a stan-dard template for reporting and calculations are requested.

Key words

Iodine, radioiodine, I-131, thyroid, calibration

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THYROIDSEM: Seminar: Assessment of accidental uptake of radioiodine in emergency situations

Final Report from the NKS-B THYROIDSEM activity (Contract: AFT/B(14)8)

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1. Introduction

This document constitutes a follow-up report upon the one-day seminar held in Copenhagen at 29. sept 2014 at Hilton Hotel. The title of the seminar was “Assessment of accidental uptake of radioiodine in emergency situations – Thyroid I-131 monitoring capacity in the Nordic countries”.
The seminar was funded by NKS-B (Nordic nuclear safety framework) in collaboration with Swedish, Danish, Norwegian and Icelandic governmental agencies for radiation protection and nuclear safety.

2. Organizing group

Lilian del Risco Norrlid. Strålsäkerhetsmyndigheten (SSM), Sweden.
Mats Isaksson. The Sahlgrenska Academy, University of Gothenburg, Sweden.
Bjorn Lind. Statens Strålevern (NRPA), Norway.
Óskar Halldórson Holm. Geislavarnir Rikisins (IRSA), Iceland.
Henrik Roed, Asser Nyander Poulsen. Statens Institut for Strålebeskyttelse (SIS), Denmark.

3. Motivation and aim

A calibration and proficiency testing project (THYROID, 2014) for emergency thyroid I-131 measurements, was performed during 2012-2013 in the Nordic countries (Finland, Norway, Sweden, Iceland, Denmark). Relevant laboratories and clinical departments that are expected to perform this kind of population monitoring during regional or national radiological or nuclear emergencies, were offered participation. Among participants, the instrument inventory was surveyed, and a set of calibration sources was circulated to allow recalibrations of current equipment. The calibrations were validated by comparison of reported measurements of an “unknown” source included in the calibration “package”. The local expertise in internal dosimetry for I-131 was probed by asking for an optional dose estimate.

There appeared to be little or no standardization or harmonization of the national equipment inventories. Also no standard protocol for thyroid measurements or dose estimation was identified. A great variety of instruments was identified ranging from handheld contamination or dose-rate monitors, technical spectrometry systems to clinical radio-imaging systems (gamma-cameras). Each type of equipment may offer advantages in terms of readiness, flexibility, simplicity, portability, resolution, precision and sensitivity. As another aspect, systems in everyday use may have a well-documented performance, but may need a reconfiguration as opposed to “dormant” dedicated equipment that may require a validation of performance and personal training before use.
Given the observed significant variation in dose-estimation competences and feedback collected during the project, a demand for a follow-up seminar was acknowledged.

The seminar aimed at:

- Bringing together participants from THYROID, to discuss practical and theoretical aspects of thyroid monitoring and dose assessment.
- To identify the role of thyroid monitoring competences in relation to national emergency preparedness.
- Making grounds, through participant feedback, for a set of recommendations for creation of a generic protocol that can be applied to various instruments, which fulfil requirements for e.g. documentation and quality assurance.
- Stimulate engagement in future calibration efforts.

4. Identified stakeholders and interests

The THYROID participant group consisted mostly of local technical experts (e.g. physicists) with interest in equipment, measurement facilities and quality assurance.
In addition to this group, representatives of emergency preparedness organizations were also invited.
The seminar was advertised on a webpage and participation was offered to the general public.

Topics discussed at the seminar included: Measurement methodology, dose-assessment tools, communication and ethics, data-storage and retrospective studies.

5. Participants

THYROIDSEM Participant list			10/1/2014 3:59	
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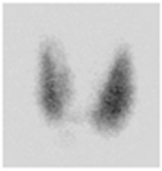
6. Seminar invitation

Seminar Invitation:

Assessment of accidental uptake of radioiodine in emergency situations

Thyroid ^{131}I monitoring capacity in the Nordic countries.



Dear stakeholder.

We are very pleased to be able to invite you to a one-day seminar as a follow-up activity to the THYROID calibration project. This will take place in Copenhagen Monday 29th September 2014 at the Hilton CPH Airport Hotel (in walking distance from the terminals and train station).

The now completed calibration program and proficiency test for thyroid monitoring instruments in the Nordic countries (NKS-B THYROID) explored the capacity for monitoring during emergency situations. We would like to present the results of the project and also offer training in dose-assessment. Also, this seminar is an opportunity to discuss aspects of thyroid monitoring in relation to emergency preparedness with international colleagues.

The seminar is aimed at stakeholders from laboratories, hospitals, emergency preparedness and governmental organization etc. We aim at getting representatives from all Nordic countries. Admittance is free of charge, though cost of transportation and eventual accommodation is not covered.

If you accept the invitation, we will kindly ask you to complete a questionnaire that will be used as important input to the discussions. This will be distributed before the seminar.

To register, please send an email to: Thyroidsem@sis.dk with your contact details, and await confirmation.

Program:

(Coffee and breakfast)

Morning Session (10:00-12:00):
- Welcome
- Introduction to THYROID
- Main conclusions from THYROID
- The "mock correction factor"
- Lecture on dose assessment by Dr. George Etherington (PHE, UK)

(Lunch buffet in restaurant Horizon)

Afternoon Session (13:00-17:00):
- Lecture on thyroid screening and emergency preparedness by Dr. Jan Johansson (SSM, Sweden)
- Preparedness organizations in the Nordic countries - differences and similarities.
- Individual/group work with questionnaire.

(Coffee and refreshments)
- Plenum discussion of questionnaire. Collection of comments for seminar report.
- Open discussion. Creation of expert network. Organization of future calibrations. Evaluation.

Organizing group: NIRP (SIS) (DK): Henrik Roed, Asser Nyander Poulsen. SSM (SE): Lilian del Risco Norrlid. NRPA (NO): Bjorn Lind. IRSA (IS): Óskar Halldórson. Göteborg Uni. (SE): Mats Isaksson. This seminar is supported by NKS-B as the THYROIDSEM activity.

7. Invited speakers
George Etherington from Public Health England, was invited to talk about dose assessment. Jan Johansson from Strålsäkerhetsmyndigheten Sweden, was invited to talk about thyroid monitoring during emergencies and the UNSCEAR report on the Fukushima accident.

8. Final programme
The results from the THYROID project were presented by the organizers. Talks were given by invited speakers.
Participants were split in groups that discussed a list of questions prepared by the organizers. After the group-work, comments on the questionnaire were collected during a plenum session. These comments were recorded and are presented below (Comments on Questionnaire).

Program

- 9:30 Coffee

- 10:00 Welcome
- 10:15 Introduction to THYROID
- 10:30 Main conclusions from THYROID
- 10:45 The mock-correction factor
- 11:00 Dose Assessment, George Etherington (PHE)

- 12:00 Lunch at "Horizon"

- 13:00 Emergency preparedness, Jan Johansson (SSM)
- 14:00 Overview of preparedness organizations in the Nordic countries
- 14:50 Introduction to group work.

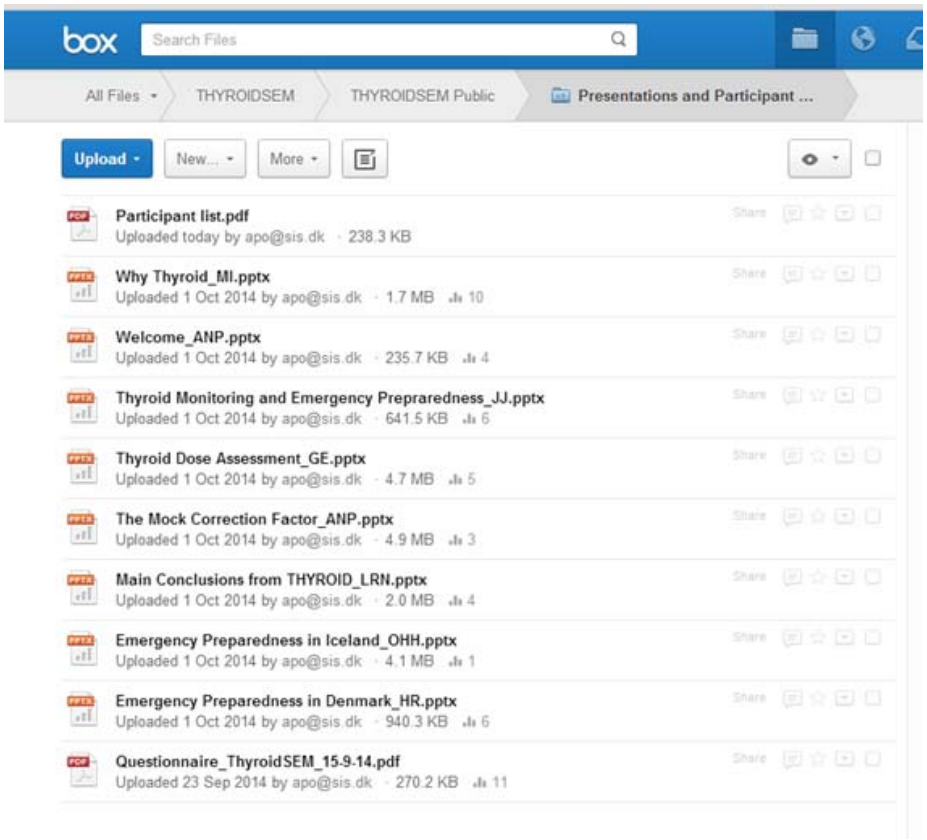
- 15:00 Group work & coffee (1 Thor, 2 Magni, 3 Vidar, 4 Freya, 5 Jord)

- 15:45 Structured discussion of group work
- 16:30-17:00 Open discussion. Plans for the future.

9. Presentations

A web-folder with public access has been created on www.box.com, where presentations are accessible. The link to the folder is also posted on the NKS webpage.

Link to public folder: https://app.box.com/s/rp39xqefryb6ixy0lzya



10. Comments on questionnaire
Questions discussed in groups are listed. Comments to questions given during plenum discussion are listed below.

Measurement techniques

M1. What level of standardization is required to assure the quality and reliability of thyroid measurements during emergencies?
- General protocol is needed.
- Some kind of (flexible) standard?
- Ideally everyone should use the same instruments to simplify calibration and procedures, but this is probably impractical.

M2. What information must be included in the measurement report?
- See example report form below.

M3. What are the performance criteria for equipment to be used for thyroid measurements?
- National requirement for calibration.
- Gamma camera should be checked regularly for the specific use.

M4. Is dedicated (standby) equipment preferable over (reconfigured) equipment taken out of everyday use?
- No, should be avoided. Equipment used for preparedness should be used regularly to maintain skills and assure it is actually working.
- Equipment taken out of everyday use would be better. As it is more likely to work properly and staff will be familiar with its operation.

M5. If a “mock correction factor” is to be employed for Ba-133/Cs-137 calibrations, how can it be validated?
- Real I-131 should be used for calibration.

M6. How can calibrations with I-131 be organized (source certification, logistics)?
- Secondary standard laboratory should issue certificate on the iodine (do we have such capacity in DK?).
- Each department can measure activity to 10 % precision.

M7. What is the appropriate time interval for calibrations and proficiency testing?
- 3-5 years is appropriate.

M8. How to deal with other interfering nuclides or external contamination?
- Use narrow energy windows (gamma cameras).
- Use reference persons (eg. the members of the measurements).
- Look at the spectrum.
- Write in the report if other nuclides are present.
- Use a “body background” taken over the thigh of the person. Significant external contamination should have been removed before thyroid measurement.

Dose estimation

D1. How can dose estimation be harmonized?
- Standardize measurement.
- Easy calculation, e.g. use templates.
- Standardized software?
- Use standard software.

D2. What intake regime can be assumed as default for dose estimation (ingestion/inhalation, exposure time, particle size...)?
- Used reference value (eg. Inhalation, 1 µm particle, acute intake).
- Flowcharts.
- For reactor incidents we have assumed 1 µm AMAD, inhalation only, acute and a default mix of I-131 and shorter-lived iodine radionuclides.

D3. Is looking up values in a table or graph (Bq, days since exposure, mSv) an acceptable way to do dose estimation?
- Good idea, for first approximation!
- Yes.

D4. Is it best to report equivalent thyroid dose or effective dose? How to avoid mixing of these numbers (if both are reported in mSv)?
- State it as an absorbed dose (mGy).
- In exercises we are generally asked for thyroid dose (because there is an ERL specified in these units?). Both are likely to be needed.

D5. Is it relevant to analyze urine for I-131 as complement to thyroid measurements?
- Relevant for quantify of the exposure situation (is the assumptions on intake regime valid?) – a few samples.
- Not routine measurements – depending on number of persons.

D6. Must dose uncertainty be calculated and reported?
- Think of digit to report.
- ISO-27048.

D7. What are the requirements for a dose-estimation software tool to be used during emergencies?
- Free, open access.
- Simplicity.

Communication, Facing individuals

C1. Is briefing of individuals prior to measurements necessary?
- Yes, but time consuming. Group briefing is suggested.
- Draft for leaflet in the TMT Handbook.
- Different measuring situations may needs different information.
- Yes, by a pre-prepared leaflet written without jargon.

C2. Can the level of comfort and general perception of the measurement procedure be affected by the appearance of the measurement facility (interior/ambience)?
- In a hospital this is probably already taken care of.
- The decontamination area is a very “rough” environment.

- Yes, but in an emergency it is unlikely that this can be achieved.

C3. What are challenges when technical specialist communicates with the general population?
- In a hospital this is probably already taken care of.

C4. Must operators be trained in communicating and interacting with individuals?
- In a hospital this is probably already taken care of.
- Ideally, yes.

C5. How can radiation, dose and risk be explained to e.g. small children?
- In a hospital this is probably already taken care of.

C6. How can a parametric measurement result (i Bq or mSv) be converted to a conclusive statement?
- 'Don't even bring it up'. Use 'green', 'yellow', and 'red cards'.
- High doses , 'red cards' needs follow up anyway – and put in the medical protocol/journal.
- See examples in TMT handbook.

Preparedness

P1. What is the realistic reaction time from notification to startup of measurements?
- A couple of hours.
- In the UK, we plan for some capabilities 6 hours after any decision that monitoring is required. 24 hours for full capacity.

P2. What is a realistic capacity in individuals per day of a single detector?
- What to do with planned examinations for the day?
- Should staff stay longer?
- 10-15 min per patients in gamma cameras.
- The rate controlling step is likely to be completion of forms and dose estimation, rather than the measurement itself. For a team of two people per detector, very approximately 25 individuals per hour.

P3. How fast can new personal be trained to perform thyroid measurements for dose estimation?
- Protocols are standardized for gamma cameras.
- ½ hour instruction is adequate.
- Assuming dose calculation is done using look-up tables, perhaps 30 minutes. Refresher training would be needed.

P4. What are the requirements for equipment to be used for rapid thyroid screening in emergency reception center with a large number of people (triage)?
- Run on battery, compact.
- Standardized equipment – a recommended equipment – should be stated as mandatory (by regulator) to use this.
- Transportable, robust, simple to operate and sufficient sensitivity.

P5. How fast can new personal be trained to perform thyroid measurements for rapid screening (triage)?
- Need for a standard protocol!

- In 30 minutes, providing written instructions are available and the personal are familiar with monitoring. Refresher training would be needed.

Other Remarks:

- Should we publish a proposal for a standard protocol?

11. Summary and Conclusions

- There is a great wish for establishing a standard procedure that includes procedures and templates for reporting§, data handling and dose calculation. The standards should be useful for any kind of instrument, as harmonization of the equipment inventory is unrealistic. Gamma cameras are likely to be used. Dose estimates may be obtained from lookup in tables (Equivalent dose per Bq, days after intake).
- Equipment taken out of everyday use is preferred over standby equipment to minimize local equipment inventory and to assure that operators are trained, and instruments are functional and calibrated.
- The hospital setting is ideal for performing thyroid measurements as systems for handling individuals and communication skills are readily available.
- Conveying a parametric measurement result to individuals (in Bq or mSv) is discouraged, especially for no-risk or acceptable-risk results where individuals will be dismissed from further medical consultations. Instead, a categorized statement must be given (e.g. “No immediate health effect expected – negligible risk of long term effect” or “No immediate health effect expected – little risk of long term effect”...). The statements must be standardized at least on a national level. Experts in communication should be involved in choosing the exact phrasing.
- It was stated that calibrations with I-131 should be possible on a regional level. The radionuclide is occasionally available at nuclear medicine departments as leftover. A sample could be prepared in a container useful for a neck phantom. The prepared source could be certified by a national secondary reference laboratory if present, or by gamma spectrometry using a mathematical detector calibration and estimation of uncertainty (e.g. Canberra LabSocs). Historically, this has reportedly been carried out by a representative of the authority who brought an I-131 source to the measurement sites.
- Measurement data, estimated doses and information relevant to retrospective studies of population exposures (e.g. UNSCEAR), must be stored in a way that permits later retrieval. The use of personal medical records was questioned. The data format in medical records may not be comprehensive enough to be used for population dose studies (lack of measurement details). Personal medical records cannot be accessed without consent (though some data may be considered neutral with respect to privacy). Also, time limits for storage of medical records were stated as an issue of concern. An anonymous–entry database may be established for the purpose (person identity replaced by arbitrarily assigned person-ID).
- Guidance for action levels, dose estimation, reporting and communicating can be found in a recent publication (TMT Handbook).

§ The measurement report shall include the following information:

Individual measurement:

- Anonymous and unique person ID Code (assigned during measurement).
- Name, birthdate and gender of individual.
- Contact information (e.g. phonenumber or address).
- Start time and end time for exposure (may refer to regional exposure regime).
- Stable iodine (prophylaxis) intake date and time (checkbox for Yes/No).
- Date and time of measurement.
- Measuring distance (cm) (choose from list).

- Gross count-time and -rate, room-background count-time and -rate, individual body background (thigh) count-time and rate.
- Net count-rate (cps).
- Calculated thyroid activity (Bq).
- Detection limit (MDA) (Bq).
- Field for remarks (e.g. on special measurement conditions or finding of other radionuclides).
- Reference to system information.
- Name of person responsible for issuing measurement report.

System information:

- Measurement site address.
- Name of person responsible for calibration.
- Instrument type and ID.
- ROI setup (in keV).
- Date of calibration, phantom information and source identification (traceable to certificate).
- I-131 specific calibration factor (Bq/cps or μSv/h/Bq) and uncertainty (k=1 %) for specified distances (e.g. 0 and 10 cm) and phantom size (age group).
- Information on use of mock-correction factor.
- Copy of calibration source certificate.

12. Identified future tasks

- A document template or data-tool (spreadsheet) for collecting, analysing and reporting individual results should be prepared. Former THYROID participants may be involved in designing such template.
- A communication strategy for dose-associated health risk should be established. E.g. estimated doses must be grouped into intervals for which a standardized health-risk statement should be communicated. Examples of reporting letters to individuals are given in the TMT Handbook (Annex 3) for dose levels of 1-20 mSv, less than 1 mSv and less than the method detection limit.
- The possibility for providing certified I-131 calibration sources should be investigated.
- Regional meetings of experts (e.g. medical physicists) may facilitate such work.

13. References

(THYROID, 2014) NKS-B report: "Assessment of accidental uptake of iodine-131 in emergency situations", NKS-298. Asser Nyander Poulsen, Bjorn Lind, Lilián del Risco Norrlid, Mats Isaksson, Óskar Halldórsson Holm, Jussi Huikari. 2014. www.nks.org.

(TMT Handbook) "Triage, Monitoring and Treatment of people exposed to ionising radiation following a malevolent act". Carlos Rojas-Palma, Astrid Liland, Ane Næss Jerstad, George Etherington, Maria del Rosario Perez, Tua Rahola, Karen Smith (Eds.). 2009. SCK-CEN, NRPA, HPA, STUK, WHO, Enviros, CLOR. www.tmthandbook.org.

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Key words	Iodine, radioiodine, I-131, thyroid, calibration

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