LESSONS LEARNED FROM CONVERTING A CS-137 BLOOD IRRADIATOR

ST. OLAVS HOSPITAL
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INTRODUCTION

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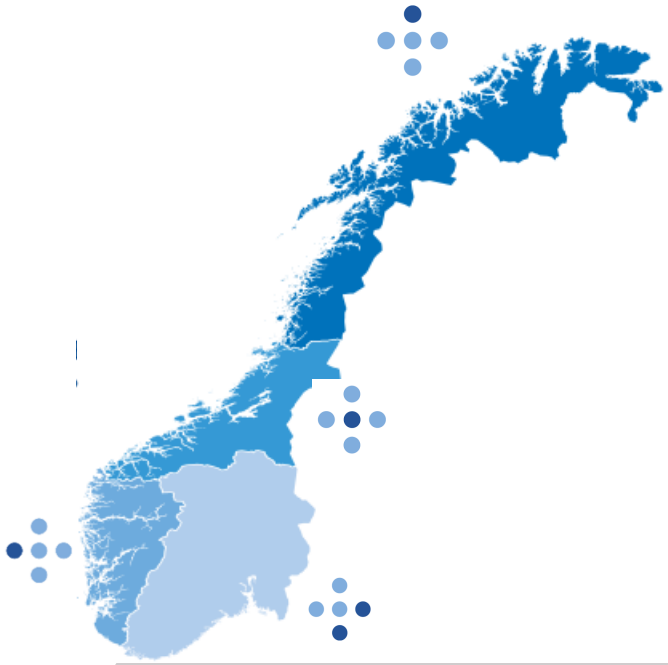
- Master in Biophysics and Medical Imaging/Engineering
- Worked as a Medical Physicist since 2005
  - Radiotherapy – University Hospital of Northern Norway (2005-2007)
  - Nuclear Medicine – St. Olav University Hospital (2008)
  - Head of Medical Physics Department – X-ray – St. Olav University Hospital (2009-2016)
  - Head Radiation Protection Officer (2005-2016)
- Current position: Project Manager at Sykehusbygg HF – Norwegian Hospital Construction Agency



HEALTH ORGANIZATION IN NORWAY

Ministry of Health and Care Services (MOH)

Regional

- Central Norway Regional Health Authority
- Northern Norway Regional Health Authority
- Western Norway Regional Health Authority
- South-Eastern Norway Regional Health Authority

Local hospitals

- St. Olav University Hospital
- St Olav University Hospital - Ålesund

BLOOD IRRADIATORS IN NORWAY

- There were a total of 13 Cs -137 sourced Gammacell irradiators in Norway in 2014
- During 2015 all the equipment was changed into X-ray technology
- The current model at St. Olav University Hospital is Raycell from Theratronix
- The implementation of change was not up to each hospital – it was implemented by the Norwegian Radiation Protection Authorities (NRPA) in collaboration with the MOH
- The reason of the replacement was due to national security

ORIGINAL TIME FRAME

2005 2009 2010 2017

- 2005: Gammacell Irradiator
- 2009: Risk analysis – regarding fire and security aspect
  - As a result, the Gammacell was moved within an access controlled area in 2010
    - Video surveillance was installed in addition to alarm connected to the security system at the hospital
    - The floor had to be reinforced due to the weight
    - Challenge due to a lot of equipment at the blood bank
- 2017: The expected lifetime of the Gammacell - planning of new X-ray system

Source: www.theratronics.ca

ACTUAL TIME FRAME

2013 2014 2015

- 2013: The regional health authorities required a security analysis of the Gammacell, which we delivered December 2013
- 2014:
  - January – Demands from the NRPA that measures should be taken according the Gammacell
  - February – Corresponding to the letter from the Hospital
  - April – Letter from NRPA that using the equipment was OK as long as we started the process of changing equipment during 2014
  - May – Info gotten from one supplier, specification received from Western Norway Regional Health Authority
  - June – Application for an exemption for the replacement of the irradiator until 31.12.2016 sent to the Ministry of Health (we needed that from 1st of January 2015) – Application dismissed and the change had to be done no later than 1st of July 2015
  - September - October – Working with the requirement specification for the new equipment, and sending it
- 2015:
  - 11th of June – The Gammacell was moved out of the Hospital
  - 13th of June – The new Raycell was ready to use

THE PROCUREMENT PROCESS

- The procurement process was led by the Central Norway Regional Health Authority
- They wanted to go through the process themselves, but the hospitals was not satisfied with this
- My hospital contributed with key personnel into the procurement group (The group: Bioengineers as well as a physician, a medical engineer and a medical physicist/radiation protection officer)
- We got requirement specifications from other health regions
- These did not entirely satisfy our demands, but it was very helpful and gave us a good starting point
- We added some key points which focused on
  - Radiation time – Uniformity - High reliability – Training
  - It saved us a lot of time

THE CHANGE

- 3 days
  - Removing the old equipment
  - Setting up the new one
  - Training the staff

- The staff is very pleased with their new equipment
- It was no need to employ additional staff
- Workflow is easier – they could remove access control

- A "super user" is now in charge of further training
  - The Hospital always demands proper training in the process of purchasing new equipment
- The Medthech engineers was also trained
  - Though not for annual service – we still need the firm's service engineer
  - The local supplier in Norway have two engineers which is trained for this equipment, so when the guarantee time has ended we can use them

ECONOMICS

- The equipment probably cost more in Norway than in other countries
- We were told that the total cost was ~ US $ 480.000, including the disposal
  - The contract shows US $ 541.000 for each equipment included 10 % discount due to quantity order
- At the time it was large fluctuations in the currency market (25 % more expensive with todays currency)
- Additional cost due to infrastructure ~ US $ (90.000 – 117.000)
- Our funding was difficult – we were told that it would be taken care of, but in the end our hospital had to pay for it our selves
  - Challenging for the hospitals and affect the planned investment for the next years
- Expenses for service agreement with the vendor (~35.000 US $)

UNFORESEEN EXPENSES DUE TO INFRASTRUCTURE

- Electrical requirements
  - We had to install a 400 V TN-S Supply of three-phase 25 A
- Water requirements
  - We had to install a water cooling system

Electricity Requirements

Single-phase 60 Hz, 60A typically at 240V
Three-phase 50 Hz, 25A typically at 400V

Photon Energy

160 KV (60-80 keV average)

Water Requirements

Flow Rate: ..... >10 L/min (2.6 US gal/min)
Potable Quality: ..... ≤ 7 grains/US gal hardness
Pressure: .....35-60 psi (241-414 kPa)
Temperature: ..... 10-25 ˚C (50-77 ˚F)

ADDITIONAL INFO – GOOD TO KNOW

- A big panel in the back and two side panels that will have to be opened during service
- You will need a big floor space
  - Width: (1450 + 2*800) mm = 3050 mm
  - Depth: : (800 + 1450/2)mm = 1525 mm
  - And the room for a service person…
- The equipment we have is mounted on wheels it is possible to move it
- The vendor recommend UPS

Source: www.theratronics.ca

AFTER 3 YEARS USE

- The users are happy with the change
- The hospital deliver irradiated blood to three other hospitals in the region
- The local MTA engineers are happy – they had som trouble with the old machine
- Only small problems have been registered in the engineers service system:
  - Hard to start after power stop
  - General cleaning (algaee) must be used more frequently than recommended
  - Refill with destilled water – not necessery with deionisied water (RO-water)
  - Empty the sieve regularly after cleansing for algaee

END OF LIFE MANAGEMENT

- Disposal of the source was a part of the demands in the purchasing process
- In Norway we are not allowed to buy sources from vendors that do not accept to take care of the disposal
- We had to pay the expense though and that was approximately 75.000 US $ – now the vendor says it will be approximately 175 000 US $
- Due to the good planning and especially good help from the vendor - this process went very well

SOME PICTURES

SOME PICTURES

SOME PICTURES

CONCLUSION

- Involve key personnel at the hospital
- Graded information? - Provide key personnel the necessary information
- Start funding process as early as possible and contact "local" suppliers for prices
- Clarify where the new equipment shall be placed and ensure that the electronics and cooling water supply meets the needs of the blood irradiator
- Everything is manageable if it is planned thoroughly