

# Presentation on the UK –Norway Initiative on Nuclear Warhead Dismantlement Verification

UK/NOR/VERTIC Report

PrepCom

May 2009

# Presentation Outline

- Overall Project Objectives (Ole Reistad)
- Managed Access Exercise
  - Development of the Exercise Strategy (Ole Reistad)
  - Exercise Play – December 2008 (Attila Burjan)
  - Observations and Analysis (Attila Burjan)
  - Lessons Learned and Conclusions (Attila Burjan)
- Information Barriers (Dave Chambers)
- Observations (Andreas Persbo)
- Next steps (Ole Reistad)

# Project Objectives

- Research project goals:
  - Develop new technologies, methods and procedures for the verification of future multilateral and bilateral disarmament treaties
  - Keep scientific and technical nature of the project
- Project Partners
  - UK: MoD, AWE plc
  - NOR: FFI, IFE, NRPA, NORSAR
  - NGO: VERTIC

# Project Elements

- Development of verification methodologies
  - Exercise inspections of a mock-up 'nuclear weapons complex' in the course of verified dismantlement of a mock-up nuclear weapon
- Development of IB system
  - Tool needed for successful implementation of a chain of custody without revealing weapons attributes and characteristics

# Managed Access Timeline

- Project planning activities (2007/8)
  - Development of technology, identifying facility infrastructure, inspection arrangements and concepts related to implementation at multi / bilateral level
- Dry Run (Nov 08)
- Familiarisation visit (Dec 08)
  - To familiarise the inspectors with the facilities
  - To negotiate the terms for the monitoring visit
- Monitoring visit (June 09)
  - Full scale exercise – verification of the dismantlement of a mock-up nuclear warhead using the IB systems.

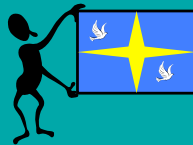
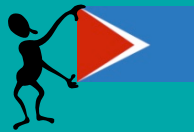
# Initial Challenges

- Managing proliferation concerns
- Managing expectations
- Difficulties managed through:
  - Trust and determination
  - Good relationship
  - Careful planning of a realistic scenario

# Setting the Scene

## Exercise Assumptions

- 'Agreed' bilateral Nuclear Weapon Protocol or Treaty between NWS & NNWS
- 'unclassified' access as an aim
- Mutual will to succeed in transparency & confidence building
- Opportunity to test effectiveness of technique in a verification context

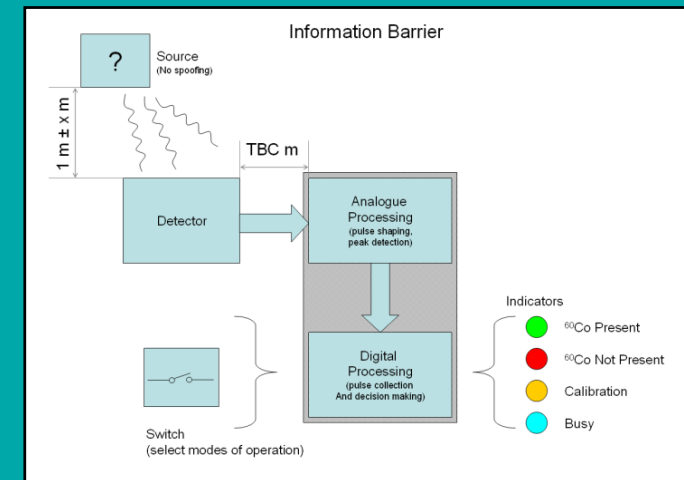
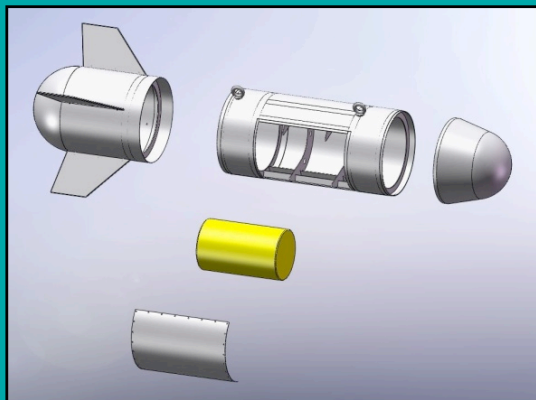
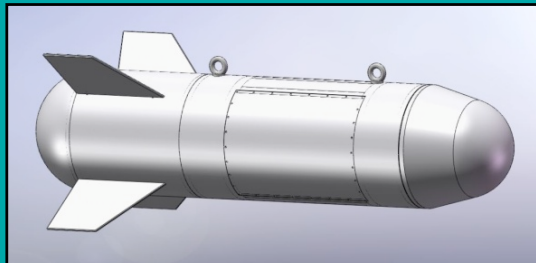


## Scenario

- Familiarisation visit by NNWS **Luvania** (UK) to agree inspection arrangements to monitor the disassembly of NWS **Torland's** (NOR) holdings of **Odin** under a Bilateral Protocol
- Bilateral Protocol 'drawn up' by planners
  - Initiated via exchange of letters
  - Details to be worked out by negotiation

# Project Equipment

- Mock-up weapon with a Co-60 source simulating fissile material
- Weapon transport containers
- Information barrier system

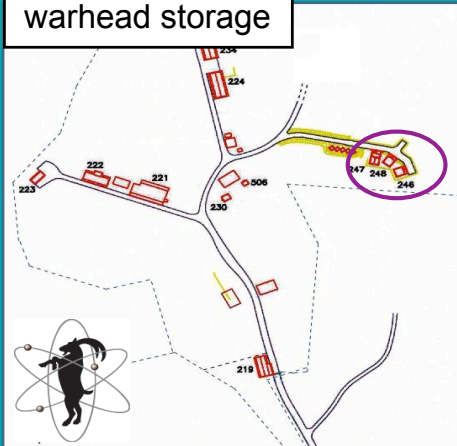




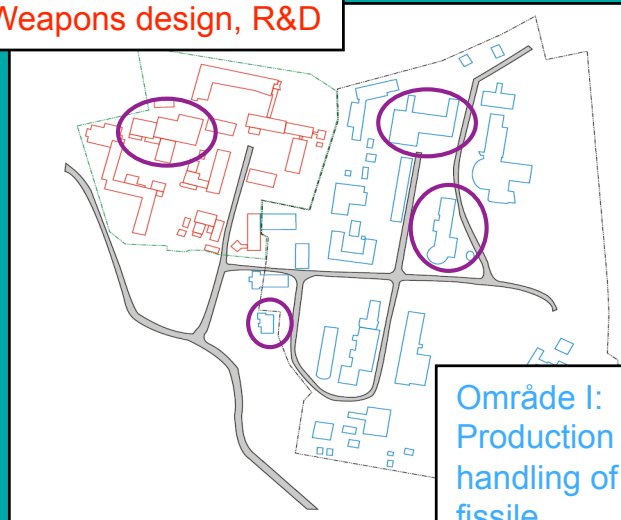
# Project Infrastructure

- Adequate facilities suitable for simulating nuclear weapon complex has been identified out of existing Norwegian facilities

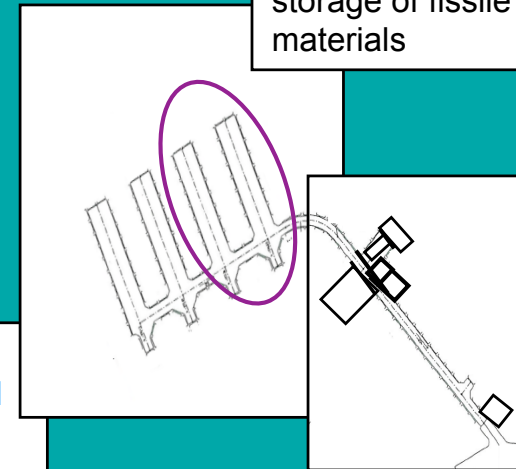
Område D:  
High Explosives  
and interim  
warhead storage



Område F:  
Weapons design, R&D



Område I:  
Production and  
handling of  
fissile  
materials



Område H:  
Long-term  
storage of fissile  
materials

# Exercise Documentation



EXERCISE EXERCISE EXERCISE

## Declaration by the Kingdom of Torland concerning the disarmament of nuclear weapons

1. The Kingdom of Torland has a strong interest of strengthening its security concerning its plan with r This declaration will remain

2. The "Odin" class nuclear Torland's nuclear deterrent bombs which are currently in the order of 30 kTons

3. The Kingdom of Torland is in accordance with the terms of inspectors from Luvania

4. The rights and privileges of the Verification Procedure of

5. The dismantling of the Establishment facility at ' (F&I) will be put in motion



STATENS ATOMVÅPEN DIREKTORAT

24 October 2008  
Var referanse: 2008/2008-1/SAD/917  
Oversettelse referanse:

Government of the Democratic People's Republic of Luvania  
c/o Nuclear Sciences Establishment  
Luvania  
Luvania

### Letter of Invitation

The Government of the Kingdom of Torland presents its compliments to the Government of the Democratic People's Republic of Luvania and has the honour to transmit declaration pertaining to its nuclear weapons program. As detailed in that arsenal of the Kingdom of Torland includes 10 plutonium based Odin class Towards fulfilment of its obligations in relation to the Portland Pact, the K Torland intends now to proceed with the dismantlement of this class of weapons. This dismantlement will be conducted in accordance with the provisions of the Procedure of the Portland Pact.

The Government of the Kingdom of Torland hereby invites the Government of the Democratic People's Republic of Luvania to monitor the dismantlement of weapons of the Odin class and to assess the Kingdom of Torland's compliance with the Portland Pact obligations in relation to this dismantlement process. In accordance with the provisions described in the Verification Procedure, the Government of Torland assumes that the inspection activities to be conducted by the Government of the Democratic People's Republic of Luvania will commence with a managed familiarization visit, to be followed by a managed access on-site monitoring

The Government of the Kingdom of Torland looks forward to the response of the Government of the Democratic People's Republic of Luvania to this invitation that the timelines and other terms of the inspections, to be conducted in line with the Verification Procedure, will be agreed in due course.

Vedlegg: 1

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Besøksadresse: Oms Næringspark, 1332 Oddeleik	Innveg: +47 67 18 25 30	WWW: www.torland.no
Selskapsnummer: Torpe Selva	Tel: +47 67 14 74 37	E-postadresse: info@torland.no

Exercise – Exercise – Exercise



## Exercise d DISTRIBUTION LIST

## Report of the Familiarisation Visit to the Torland Atomic Weapons Establishment 8<sup>th</sup> - 12<sup>th</sup> December 2008.

12 December 2008

To: The Luvanian Secretary of State for Defence.

### Executive Summary

An Inspection Team, headed by Mr G Butler (a senior officer from the Luvanian Nuclear Science Establishment), by agreement with the Torlandian Government, undertook a familiarisation visit to establish requirements for a Verification Procedure under the Portland Pact.

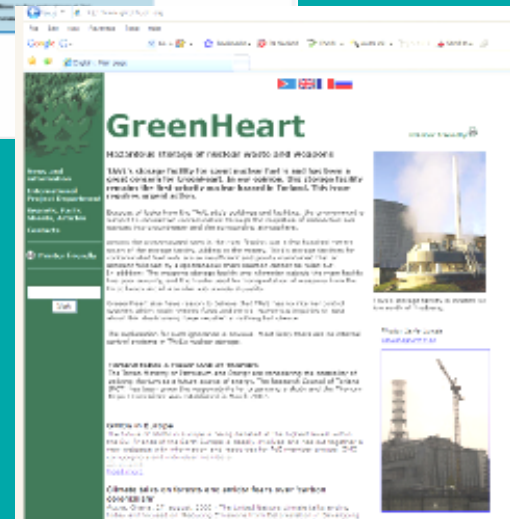
This was fully accomplished and is reflected in the accompanying agreement.

### A description of the activities conducted by the visitors and the host Party's reaction to these activities.

The Luvanian Inspection Team arrived in Torland on the 8<sup>th</sup> and commenced preliminary work with Torland's representatives headed by Svenne Horstved (Director General Atomicdirektoratet - SAD) and Einar Haugsted (Chief Negotiator and Director General Atomvåpenkontrollen - TAVL) on the 9<sup>th</sup> December.

These meetings established the timetable for the subsequent meetings and the fact inspected. Physical inspection of the facilities took place on Wednesday 10<sup>th</sup> and Thursday 11<sup>th</sup>. Subsequent negotiations took place on the afternoon of Thursday 11<sup>th</sup> and Friday 12<sup>th</sup>. The requirements and limitations required by both sides each party under the Portland Pact regarding a verifiable dismantling of the ODIN class weapons were established. Agreement was reached at around 9:30, Friday 12<sup>th</sup> December.

The factual findings of the Visitors relevant to the purpose of the visit and the reaction to these findings.



# Dry run (November 2008)

- Norway Team made up from various labs
  - Test protocol
- UK present to test scenario
- Useful tour
- Significant work left to do!



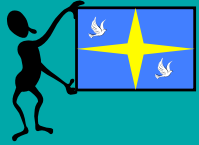
# Exercise Play (Dec 08)

- Play went 'Live' from hotel until return
- Transported by Torian transport
- Access training
- Host presentations
- Negotiation phase
- Site visit
- Further discussions



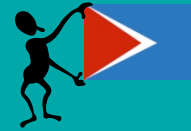


# Fielded Teams



Luvania

- Senior and Experienced personnel
- Team Leader with strong negotiation skills

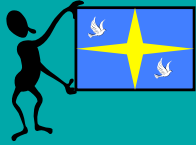


Torland

- Senior and Experienced personnel
- Team Leader with strong negotiation skills
- Core team from Production, facility management with call on all Depts.



# Negotiation Styles

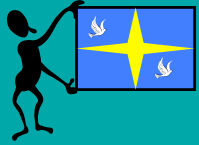


Luvania



Torland

- Clear plan
  - Put onus on Torland
  - Develop negotiation strategy
    - Break-out sessions
  - Lots of preparation
    - Several Luvianian sessions back home
- Natural Conservative negotiation style
  - Draw out Luvianian position
  - Used presentations to answer questions
  - Agreed to things ‘in principle’
  - Referred up to higher authority



# Luvianian Team Intent

- Team Leader Briefs - Objectives
  - Understand processes
  - Stitch together information
  - Confirm route of products
  - Find chain of custody 'weak points'
  - Propose fixes; seals, inspection and/or measurement - produce verification framework
  - Agree Diagnostic protocol
- Get an agreed position by end of visit



# Torian Team Intent



## Strategies:

- Close escorting
- Under control of facility
- Good shrouding
- Unscripted
- Information well protected – controlled opportunities to question facility staff
- Well Timed
- Well handled by hosts

## Visits:

- Explosives Stores
- Corridors
- Receipt & Dispatch Area
- Dismantlement Area
- Storage Area
- Repository







# Negotiation Strands

<b>Luvianian Request</b>	<b>Torian Agreement</b>	<b>Comments</b>
<b>Inspectors in Facility to monitor movements</b>	<b>Agreed in principle</b>	<b>Further negotiation required (how many, who &amp; where?)</b>
<b>Radiometric measurements</b>	<b>Only with Joint-designed Information Barrier</b>	<b>Further negotiation required</b>
<b>Access to records &amp; procedures</b>	<b>Read only access granted to selected documents</b>	<b>No information to be removed from facility</b>
<b>Use of Tamper Indicating Devices</b>	<b>Agreed in principle</b>	<b>No devices to be removed from facility</b>

# Key Lessons Learned

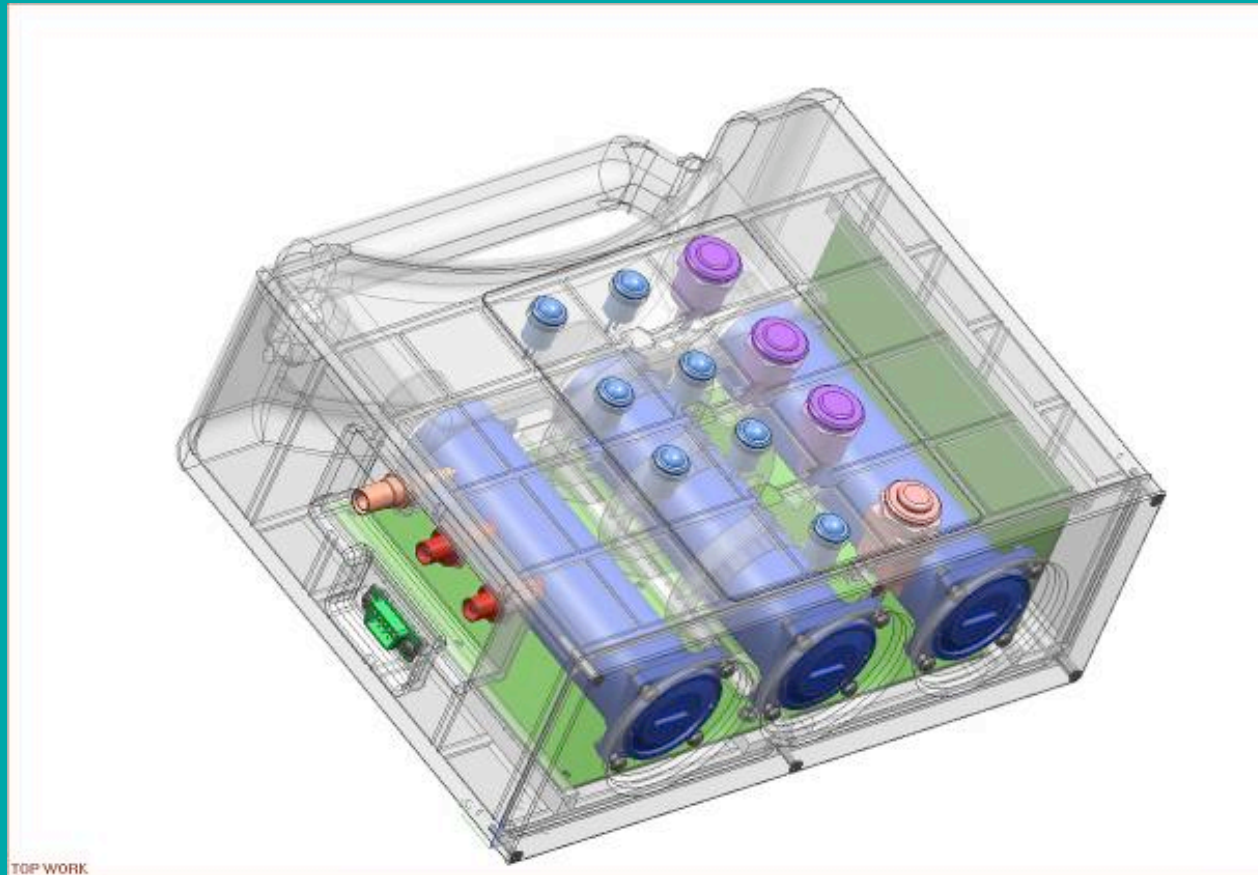
- Negotiated a controlled degree of access into sensitive facilities.
- Luvianian Aims met
  - Verification Protocol agreed 'in principle'
- Dry run found to be indispensable
- Extensive use of Break-out sessions crucial to assimilate information effectively
- Intrusive, resource intensive
- Challenging for Facility and security personnel
- Does not address 'initialisation'
- Devil is in the detail – even at this basic level
- Recognition that needs highly structured process
- C of C complements technology measurements

# Exercise Conclusions

- Exercise was deemed a success as all NOR/UK aims were achieved.
- Far exceeded planners' expectations
- Highlighted importance of Tags & Seals and Information Barriers
- Chain of Custody can't be maintained without the use of measurements and seals



# Information Barrier Development



# The Requirement

Our mission is to try to work out methodologies to verify the dismantlement of nuclear warheads without release of proliferate or sensitive information.

Verification Inspectors will be faced with items like these. Without looking inside the container, how do you know what's in it?



Non-Destructive assay technologies using the radioactive signatures in gamma ray and neutron emissions.



# The Task

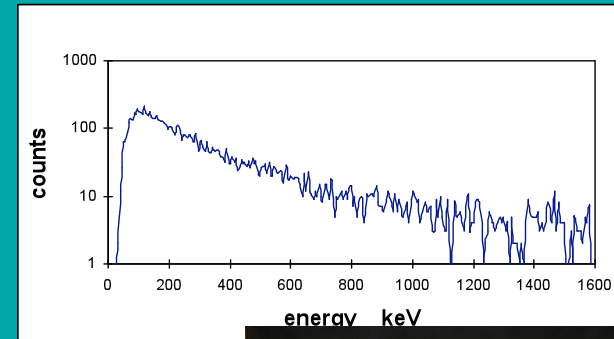
Inspectors will be looking to verify against a declaration made by the host.

This may include attributes such as:

- Fissile material presence.
- Isotopic ratio/weapons grade.
- Fissile material mass.
- Fissile material age.

Usually a lower bound will be given rather than precise numbers – must be non-proliferative.

Difficult to give enough information to satisfy Inspectors without being proliferative, hence the need for Information Barriers



# Information Barriers

An Information Barrier in its simplest state takes data from a measurement device, processes the data and provides a pass/fail answer to a predetermined criteria.

The information barrier must protect the measurement data from being released to one of the operating parties.

This can either be done through hardware engineered controls or by procedures controlled by all parties.

The information barrier is only as good as the level of trust in it by the parties involved.



# Technical Approach

Use of a surrogate material - Co60. Address all the relevant technical challenges but without proliferation issues.

Start with the initial problem of *material presence*.

Do not preclude moving forward to look at isotopic ratios – Co57 or another element.

Starting point of high resolution gamma spectroscopy – measurements facilitate high confidence of the correct result and less chance for being fooled.

Initially the detector will not be part of the project – includes all supporting electronics.



# Prior Assumptions for Project

Very basic assumptions at the start of the project:

Solution will only be trusted through joint development

Complex equipment/computing will be hard to authenticate.

Even if authentication is possible, proving this to non-technical decision makers will be difficult.

Need to keep as simple as possible.

# Current stage of the project

Detailed design requirements are captured

Prototype Barriers for the presence of Co60 are being built

Testing to be undertaken in May/June 09

Methodology review – How simple is it? Can we trust it?

Enhanced prototype at the initial design point

To be capable of looking at more complex spectra and determining an isotopic ratio

We will report on progress at the NPT Review Conference 2010

# VERTIC's role

- Non-technical advisor or facilitator
  - What can be done?
  - How should we proceed?
  - Are there examples from other regimes?
- Public diplomacy component
  - How can our results be understood by a laymen audience?
  - Communicating the status of the project with the broader community.

# VERTIC's role (cont.)

- Observer
  - *Evaluation component*: i.e. how are we fulfilling the goals we set for ourselves?
  - *Assessment component*: i.e. what are the main lessons learned? How can cooperation be improved? Where is there room for further collaboration?
  - *Reporting component*.

# Preliminary conclusions

- Resource intensive. Likely to be intrusive.
- Chain of custody very important.
- Information barrier system is likely critical for warhead dismantlement verification – proved instrumental for December 2008 Luvenian-Torland agreement on monitoring.
- Cooperative vs. non-cooperative verification. Different challenges.

# Preliminary conclusions (cont.)

- Negotiations matter. Technology facilitates discussions, not the other way around. The human-human interface is a subject for further study. The inspected needs to convince the inspector. How is that done?
- The key is to indentify strong links in the chain of custody and shore up weak links – through tamper indicating devices (tags and seals)

# Final thoughts

- Language matters – precise and clear formulations of the norm/statement/declaration to be verified. Unclear language leads to uncertainty, no exceptions.
- The verification system needs to be trusted – by the inspector and by the inspected. Paradoxically, no trust, no verification.

# The Way Ahead

- Monitoring exercise to be held June 2009
  - Aim to integrate managed access and real time diagnostics as part of 'inspection'
- Information Barrier Development
  - Prototype to be trialled in June
  - Further prototype in 2010
- Aim to publish report on these projects for RevCon 2010

