

# CBRN dual-use technologies and transfer risks

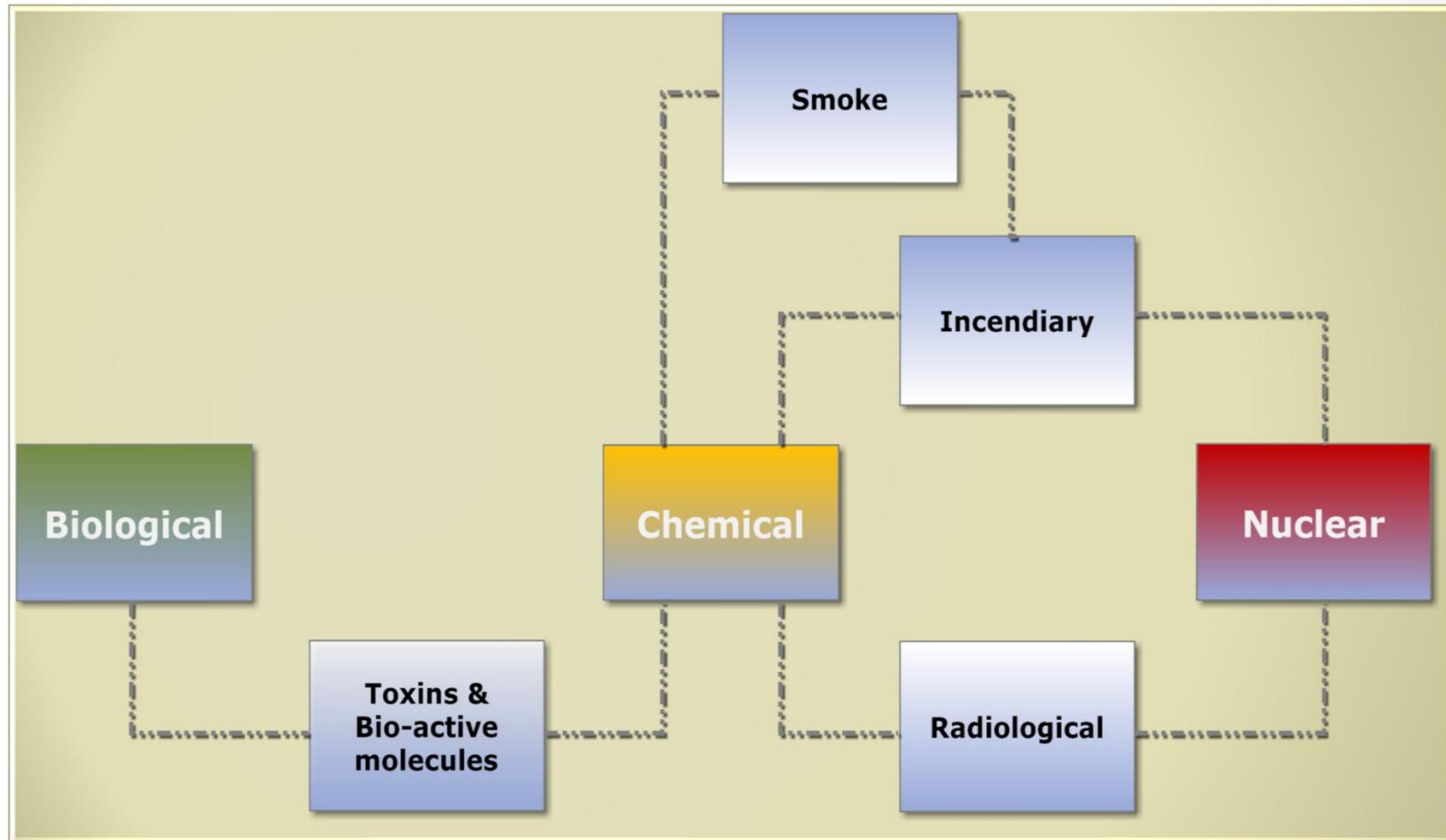
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Training The Trainers Workshop – Lecture 1  
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Part 1

# CHEMICAL, BIOLOGICAL, RADIOLOGICAL & NUCLEAR (CBRN) WEAPONS

# The CBRN spectrum



# What is chemical warfare?

*Intentional* application for *hostile* purposes of *toxic* substances against humans, animals and their environment

- *Blood agents*: prevention of oxygen transfer to tissues (e.g. phosgene)
- *Choking agents*: interfere with breathing (e.g. chlorine)
- *Nerve agents*: attack the central nervous system (e.g. sarin)
- *Vesicants*: produce blisters (e.g. mustard agents)
  
- *Incapacitating agents*: induce temporary physical disability or mental disorientation (e.g. LSD, BZ, Fentanyl)
- *Irritating agents*: induce temporary irritation (e.g. tear gas)
- *Anti-plant agents*: herbicides, growth inhibitors, etc.

# Images of chemical warfare



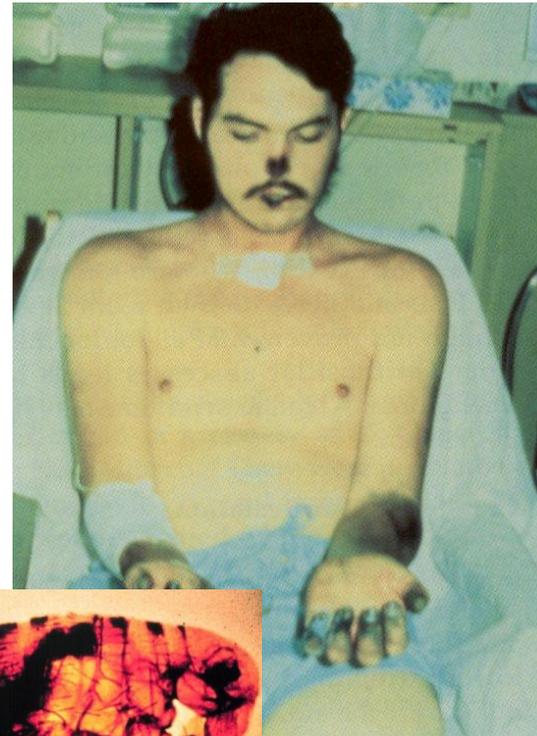
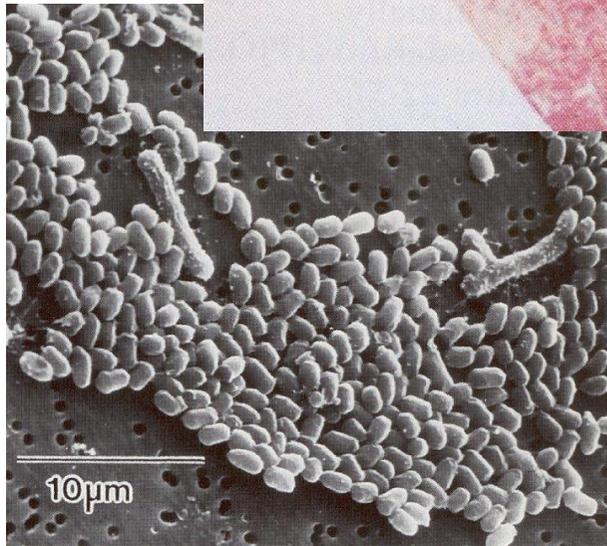
# What is biological warfare?

*Intentional* application against humans, animals or plants for *hostile* purposes of

- *Disease-causing micro-organisms* (e.g. bacteria);
- *Other entities that can replicate themselves* (e.g. viruses, infectious nucleic acids and prions)
- *Toxins*, poisonous substances produced by living organisms (and their synthetically manufactured counterparts), including
  - micro-organisms (e.g. botulinum toxin),
  - plants (e.g. ricin derived from castor beans), and
  - animals (e.g. snake venom)

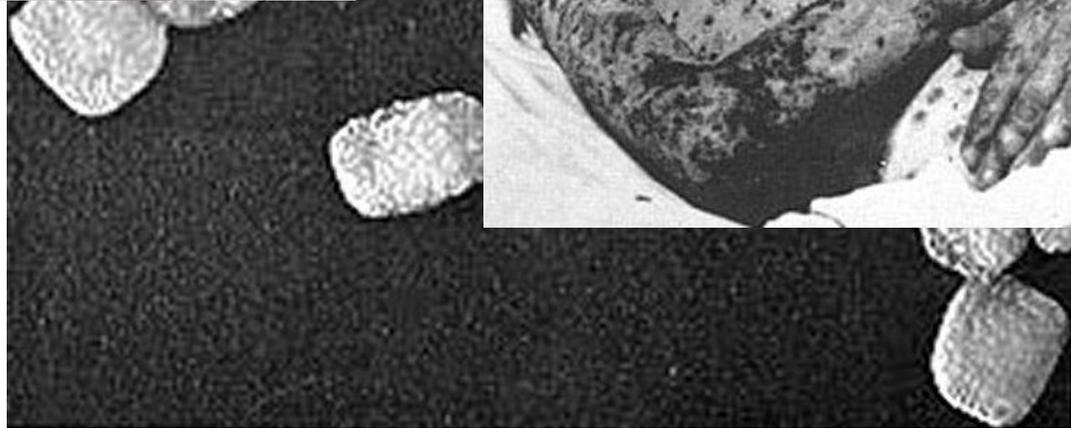
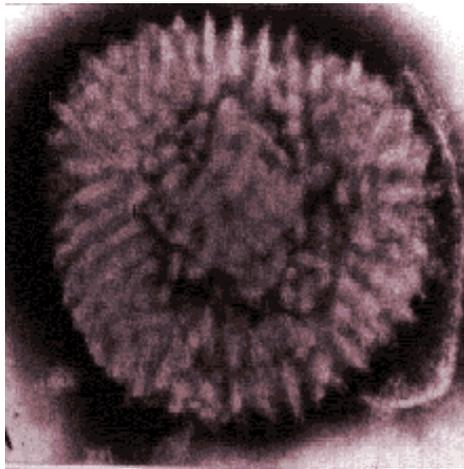
# Visions of biological Warfare

Anthrax



Plague

## Visions of Biological Warfare – 2



Smallpox

# What is radiological warfare?

*Intentional* exposure of living organisms to a radiation source or radioactive contamination of an area for hostile purposes

- *Radiological weaponry* (e.g. enhanced radiation weapon or neutron bomb, proposed by USA in late 1970s);
- *Deliberate targeting of people* (e.g. assassination)
- *Rendering areas inaccessible*, forcing major decontamination operations (e.g. economic warfare or terrain denial)
  - Highly radioactive sources would require major sanitation of area/infrastructure and possibly complete reconstruction of area
    - Possible dispersal by means of an explosive device (so-called 'dirty bomb')
  - Radioactive waste dispersal could also require major decontamination operations (if only to counter psychological impact)

# Visions of radiological warfare



## NEUTRON BOMB: AN EXPLOSIVE ISSUE

**By Wayne Biddle**

Four years ago, the United States triggered a controversy in Europe over its plans to build neutron bombs. In April 1978, Ronald Reagan, then a future Presidential candidate, stepped into the fray. He declared that the new bomb was "the first weapon that's come along in a long time that could easily and economically alter the balance of power. It could be the ideal deterrent." President Carter eventually set the plan aside, but last summer the Reagan Administration decided to go ahead with it. This move raised yet again the problem — and with it the heated, emotional controversy and debate — of how to defend Europe in the atomic age without destroying it.

Was Mr. Reagan right in 1978 when he shared such high hopes for the neutron bomb? And is he still right today? The crux of the neutron-bomb issue is whether the production and deployment of this weapon will somehow push us closer to the threshold between war and peace and war fighting, or pull us back to a position of greater strength and increased deterrence. Resolving the issue requires answering difficult questions: What do neutron weapons add to the West's existing arsenal? How do military commanders foresee using them? How do the weapons fit into the policy that links Americans with Europeans?

Today, the most common rationale for building neutron bombs is to counter the Warsaw Pact nations' huge tank armies in Europe. Indeed, the East German Invasion, which would look a lot like the Warsaw of the search-lights and barbed wire were renewed, all 20,000 Soviet tanks in various states of readiness. Really? For what? Some could conceivably be involved for possible internal use within Eastern Europe; some might be for psychological effect. In an area of the world where military confrontation is largely symbolic, it is hard to know what these tanks really mean, what danger they really pose. (Continued on Page 12)

Within 1,200 acres, half the animal population would eventually be killed by the intense radiation.

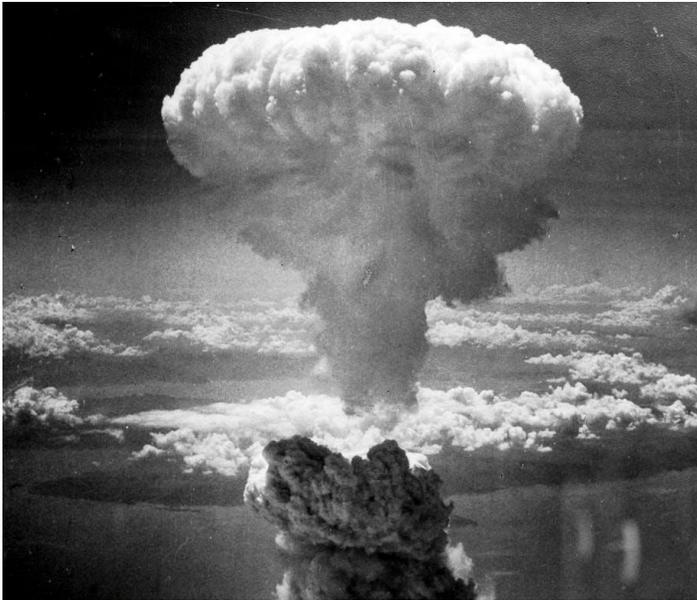
Within 25 acres, virtually every unshaded living thing would be killed instantly in the blast of buildings and some tanks, destroyed or damaged.

On 500 acres, trees, as well as most animals, would eventually be killed by radiation. 200 acres also all insects, 100 acres also all bacteria, fungi, algae.

# What is nuclear warfare?

- Use of nuclear weapons in an armed conflict
  - In a *limited* way
    - Tactical use on the battlefield
    - Escalation prevention (intra-war deterrence)
    - Escalation dominance (part of 'flexible' deterrence)
  - In an *unrestricted* way
    - Pre-emptive (decapitating) strike
    - General nuclear warfare
- Limited past use
  - Hiroshima and Nagasaki (August 1945)
  - However
    - Nuclear testing and its human cost and environmental legacy
    - Nuclear deterrence, strategy of non-use based on willingness to use NW

# Visions of Nuclear Warfare



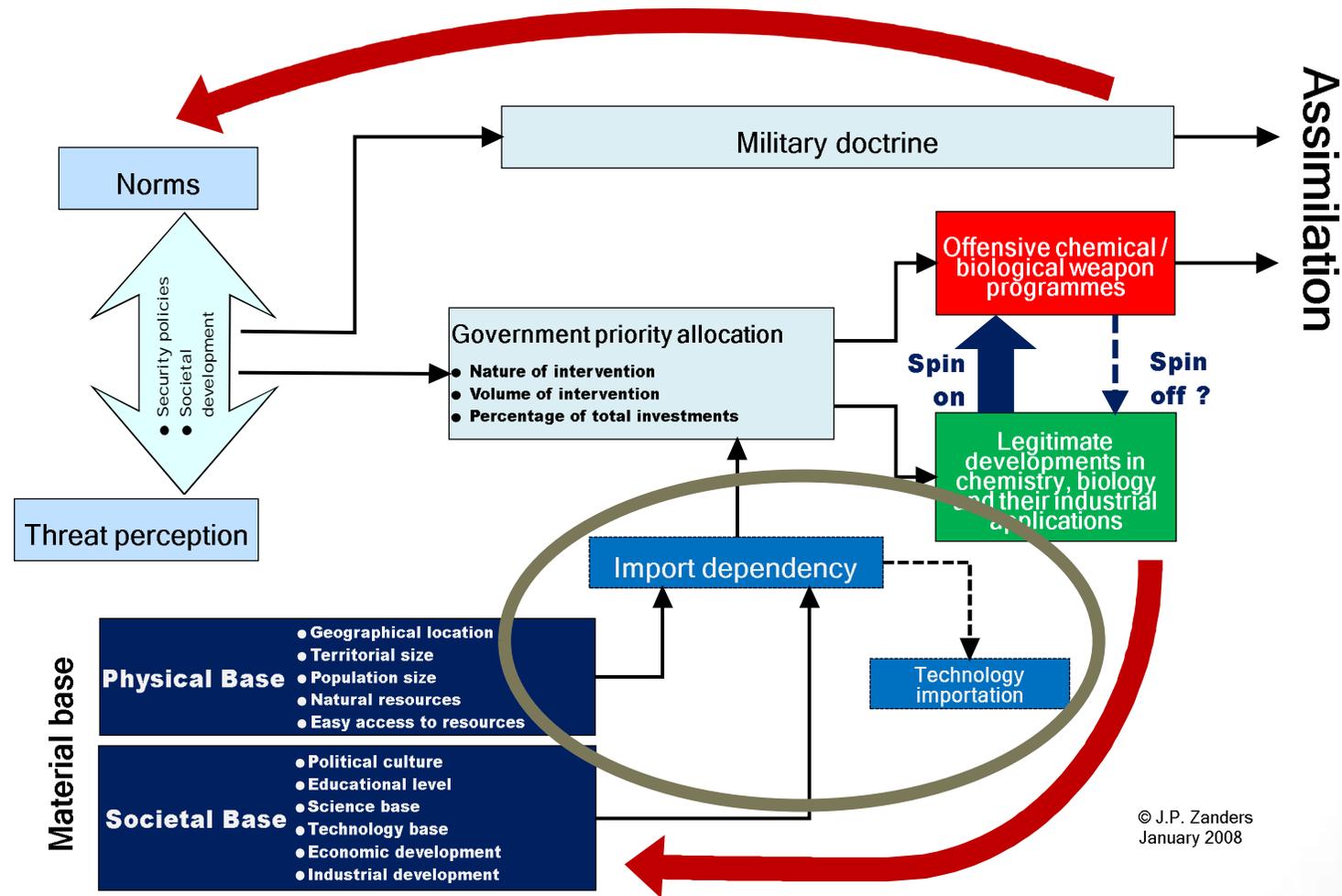
Part 2

## OUR CHALLENGE: TECHNOLOGY TRANSFERS

# CBRN weapons & transfers

- There is no or hardly any trade in CBRN weapons
  - Extremely dangerous for the people involved in trafficking
  - 'Weapons' are bulky (munitions; storage containers) and therefore difficult to move
    - Requires specialised equipment
    - In some instances, large volumes would have to be transported (e.g. CW)
  - Complex & highly specialised networks required
    - Unusual requests become visible to intelligence agencies
    - Activities at weapon research, production and storage are under observation (e.g. satellites)
- Transfers therefore mostly involve technologies underlying CBRN weapons
  - Materials: toxic agents & their precursors, pathogens, radioactive sources, ...
  - People: scientists, engineers, technicians, ... (education, experience & expertise)
  - Research: equipment, software, methodologies and results
  - Production: equipment and processes
- Consequently, there are many dimensions to controlling technology transfers

# Place of technology transfers in the armament dynamic (Demand side)



Part 3

## TECHNOLOGY AND DUAL-USE

# What is '*technology*'?

'Technology comprises

- the *ability* to recognise technology problems,
- the *ability* to develop new concepts and tangible solutions to technical problems,
- *the concepts and tangibles* developed to solve technical problems, and
- the *ability* to exploit the concepts and tangibles in an effective way.'

Errko Autio and Tomi Laamanen, 'Measurement and evaluation of technology transfer: Review of technology transfer mechanisms and indicators', *International Journal of Technology Management*, Vol. 10, Nos. 7/8 (1995)

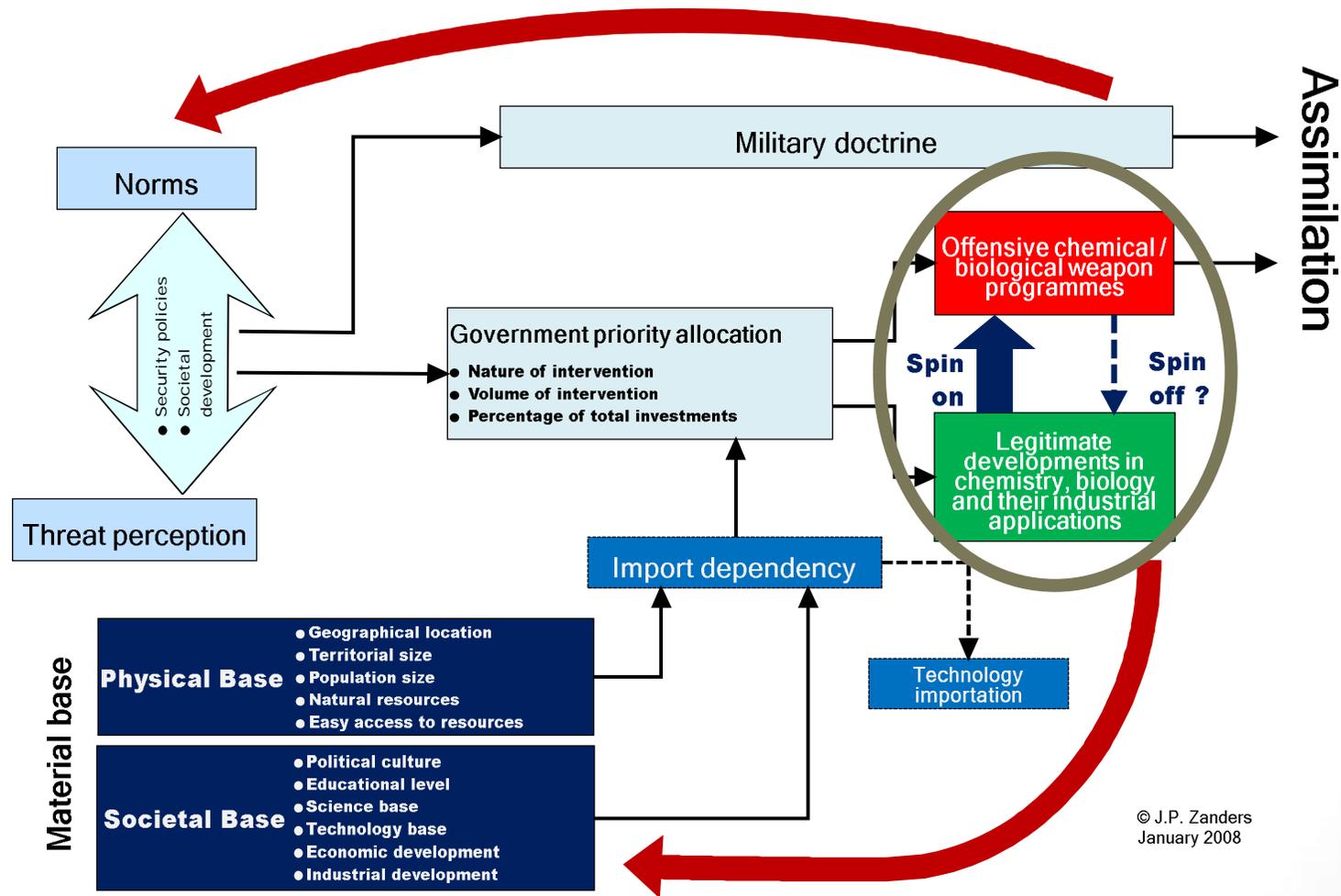
# Tangible and intangible technology

- **Tangible objects or artefacts**
  - Pathogens, chemicals (including precursors), toxins, radioactive sources
  - Laboratory equipment
  - Fermenters, centrifuges, production equipment, installations and facilities
  - Delivery systems, special equipment associated with weapon use
  - Etc.
- **Intangible technologies**
  - Data
  - Processes
  - Knowledge
  - Expertise and skills
  - Etc.

# What is 'dual-use' technology?

- **Dual-use technology**: a technology that has the *potential* to be applied for a *purpose* other than the one for which it was originally intended
  - *Spin-on*: military application of technology originally intended for civilian purposes
  - *Spin-off*: civilian application of technology originally intended for military purposes
- **Single-use technology**: a technology that lacks such potential
  - e.g. the weapon itself

# Long-term technology transfers in the armament dynamic



Part 3

# OBJECTIVES OF A COURSE IN TECHNOLOGY TRANSFER CONTROLS

# Technology transfer types to consider

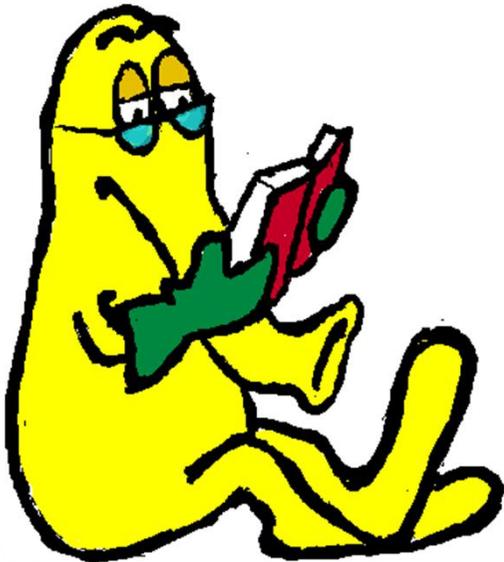
- Across borders between different economic units
  - Export
  - Import
  - Transit
- Across borders within the same economic unit
  - e.g. intranet
- Between economic units inside state borders
  - No export or import
    - Relevant to counter terrorist or criminal use of CBRN-relevant dual-use technologies

# Challenges before us ...

- Huge range of technologies to capture in technology transfer controls
  - Lachrymatory agent; salmonella ↔ Vanya (Tsar Bomba – 58 megaton detonation in 1961)
  - Many aspects we may not immediately think of
  - Many aspects may not be of immediate relevance to everyday activities
- Technology transfer controls
  - Many different tools and approaches, often depending on weapon category under consideration
  - Each weapon category has its own legal regime, whose characteristics differ from each other
- **Question:** how to build a *shared* strategy to prevent proliferation?

# Elements to consider in a course

- Having basic knowledge about CBRN and underlying technologies
- Identifying and understanding threats and risks
- Knowing relevant international prohibitory and regulatory frameworks
- Understanding transfer patterns and controls
- Knowing the country to whom you intend to transfer (dual-use) technology
- Knowing clients and transaction partners
- Understanding personal responsibilities





# THE TRENCH

**Recalling** where science, industry and military art converged  
**Challenging** entrenched positions

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