

# Physics 280: Session 29

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Questions

Final: Thursday May 14<sup>th</sup>, 8.00 – 11.00 am

ICES

News

Module 9 “The Future”

Video Presentation: Countdown to Zero

# Physics/Global Studies 280: Final

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The **final exam** will take place on

**Thursday May 14<sup>th</sup> from 8-11am**

**Location will be announced Tuesday and by e-mail.**

## **Scope of exam:**

120 multi-choice problems

70 questions on arsenals, Future, arms control + news

50 questions on material covered before midterm

50% of the questions will be taken from the final exams of the last 3 years (available from the course web-page)

# Suggestions for Final Prep

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- (1) Study old final exams and use slides + posted reading assignments to verify your answers.
- (2) Review all news discussed in class.
- (3) Bring questions to review session.
- (4) Review course slides.
- (5) Review reading materials.

# ICES Course Evaluation Forms Available Online

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ICES forms are available online

To use **ICES Online**, click the following URL:

<https://ices.cte.uiuc.edu/>

Please participate! Your feedback will help us

- (1) to further improve the class and to
- (2) make the case for the support needed from the physics department to continue the course in the future: TAs, lecturer, IT support. The Physics department does not receive funds from the campus to teach PHYS/GLBL-280.

14 of 61 so far (deadline is Thursday, May 7<sup>th</sup>)

# News: NPT Review Conference at the UN in NYC



[2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons \(NPT\) \(index.shtml\)](#) | 27 April to 22 May 2015

## 2015 NPT Review Conference

### Background information

The 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) will be held from 27 April to 22 May 2015 at UN Headquarters in New York. The President-designate of the Review Conference is Ambassador Taous Feroukhi from Algeria.

The NPT is a landmark international treaty whose objective is to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament. The NPT represents the only binding commitment in a multilateral treaty to the goal of disarmament by the nuclear-weapon States.

Conferences to review the operation of the Treaty have been held at five-year intervals since the Treaty went into effect in 1970. Each conference has sought to find agreement on a final declaration that would assess the implementation of the Treaty's provisions and make recommendations on measures to further strengthen it.

The 2015 Review Conference is expected to consider a number of key issues, including: universality of the Treaty; nuclear disarmament, including specific practical measures; nuclear non-proliferation,

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including the promoting and strengthening of safeguards; measures to advance the peaceful use of nuclear energy, safety and security; regional disarmament and non-proliferation; implementation of the 1995 resolution on the Middle East; measures to address withdrawal from the Treaty; measures to further strengthen the review process; and ways to promote engagement with civil society in strengthening NPT norms and in promoting disarmament education.

## Council for Foreign Relations Closing Rifts in the Nuclear Order

Author: Oliver Meier, Deputy Head of Research Division, German Institute for International and Security Affairs  
Apr 30, 2015

# News: NPT Review Conference at the UN in NYC

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## Council for Foreign Relations Closing Rifts in the Nuclear Order

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Author: Oliver Meier, Deputy Head of Research Division, German Institute for International and Security Affairs  
Apr 30, 2015

Twenty-five years after the end of the Cold War, the threat of nuclear weapons use is again moving up the political agenda. Russian nuclear posturing over the Ukraine crisis, **an accelerating nuclear arms race in Asia**, and substantial investments by nuclear weapon possessor states in the **upkeep and modernization of their nuclear postures** are indicators of a comeback of the nuclear factor in international politics.

For a growing number of nonnuclear weapon states, these developments indicate a failure of

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Apr 30, 2015

For a growing number of nonnuclear weapon states, these developments indicate a failure of established arms control and disarmament efforts. They are increasingly skeptical whether nuclear weapon states (China, France, Russia, the United Kingdom, and the United States) that are recognized under the Nuclear Nonproliferation Treaty (NPT) are committed to fulfilling their disarmament commitments.



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## Council for Foreign Relations Closing Rifts in the Nuclear Order

Author: Oliver Meier, Deputy Head of Research Division, German Institute for International and Security Affairs  
Apr 30, 2015

Many issues drive NPT members apart. **Russian violations of the security guarantees given to Ukraine** in the 1994 Budapest Memorandum weaken the credibility of security guarantees. North Korea, which is the only state to have announced its withdrawal from the NPT, **continues to defy calls for a return to the nonproliferation regime**. The nuclear suppliers group provoked questions about **double standards applied by the nuclear technology holders** when it exempted India from its rules in 2008.

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### Lausanne as a Starting Point on Nonproliferation

Progress made toward a resolution of the twelve-year old dispute over Iran's nuclear program provides a glimmer of hope for the review conference. The **April 2, 2015, agreement** reached by the P5+1 (China, France, Russia, the United Kingdom, and the United States, plus Germany) and Iran at Lausanne demonstrates that it is possible, in principle, to bring a violator back into compliance with nonproliferation rules, through diplomacy and without regime change. Saudi Arabia, Iran's main regional competitor, **has reacted cautiously but positively** to the Lausanne agreement, raising hopes that a comprehensive accord with Iran could reduce the risk of a regional nuclear race.

# Video Presentation

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## Countdown to Zero

# Physics 280: Session 29

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Questions

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Module 9 “The Future”

Video Presentation Cont'd: Countdown to Zero

# Physics/Global Studies 280: Final

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**Roger Adams Lab, Room 116**

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28 of 61 so far [we are hoping for >60% (>36), the deadline is Thursday, May 7<sup>th</sup>]

# News: North Korean Yongbyon Reactor Update

theguardian

## North Korean nuclear reactor may be operating again, say experts

Institute for Science and International Security says there are signs that a centrifuge plant at the Yongbyon nuclear complex is active again

Reuters

Wednesday 29 April 2015 21:51 EDT

Satellite images taken between January and April show a North Korean nuclear reactor that can yield material for atomic bombs may be operating again at low power or intermittently, US experts said on Wednesday.

A report from David Albright and Serena Kelleher-Vergantini at Washington's Institute for Science and International Security said the imagery also suggested that a centrifuge plant at the Yongbyon nuclear complex had been operated and that North Korea may be preparing to conduct renovations at this plant.

The ISIS think tank said last year that satellite imagery from late August and late September indicated the Yongbyon reactor may have been partially or completely shut down.

The latest ISIS analysis comes at a time of rising concern about North Korea's nuclear and missile capabilities.

# Video Presentation

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Countdown to Zero cont'd



# The Future: Some recommendations

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- Securing the Bomb 2008 (by Matthew Bunn, for the Nuclear Threat Initiative)
- Unilateral U.S. actions (Union of Concerned Scientists)
- President Obama's approach (outlined in his Prague speech)

*See the reading assignments on these topics*

# The Future: Securing the Bomb

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## Some threats —

- Insecurity of Pakistan's nuclear stockpile
- Security weaknesses in Russia
- many research reactors around the world still use HEU
- The United States “lost” six nuclear weapons

# The Future: Securing the Bomb -> GTRI

Since 2004 GTRI (Global Threat Reduction Initiative National Nuclear Security Administration) has accomplished:

## Convert

- Successfully **converted to LEU fuel or verified the shutdown of 49 HEU research reactors in 25 countries**, including Argentina, Australia, Bulgaria, Canada, Chile, China, the Czech Republic, France, Germany, Hungary, India, Japan, Kazakhstan, Libya, the Netherlands, Portugal, Poland, Russia, Ukraine, the United Kingdom, United States, Uzbekistan, and Vietnam; and verified the cessation of the use of HEU targets for isotope production in Indonesia.
- **Accelerated the establishment of a reliable supply of the medical isotope molybdenum-99 (Mo-99) produced without HEU** by establishing partnerships with South Africa, Belgium, and the Netherlands to convert Mo-99 production from HEU targets to LEU targets, and with four domestic commercial entities to produce Mo-99 in the United States with non-HEU technologies.

## Remove

- Successfully **removed or confirmed the disposition of more than 4,100 kilograms of HEU and plutonium** (more than enough material for 165 nuclear weapons);
- **Removed all weapons-usable HEU from 16 countries and Taiwan**, including: Greece (December 2005), South Korea (September 2007), Latvia (May 2008), Bulgaria (August 2008), Portugal (August 2008), Romania (June 2009), Taiwan (September 2009), Libya (December 2009), Turkey (January 2010), Chile (March 2010), Serbia (December 2010), Mexico (March 2012), Ukraine (March 2012), Austria (December 2012), and Czech Republic (April 2013); and
- Removed more than 36,000 disused and unwanted radiological sources from sites across the United States.

## Protect

- **Completed physical protection upgrades at more than 1,700 buildings** in the United States and internationally with high-activity radiological sources; and
- **Provided Alarm Response Training to more than 3,000 site security, local law enforcement officers and other first responders** from across the country on responding to a potential incident involving radiological material.

# The Future: Nunn-Lugar Cooperative Threat Reduction Program

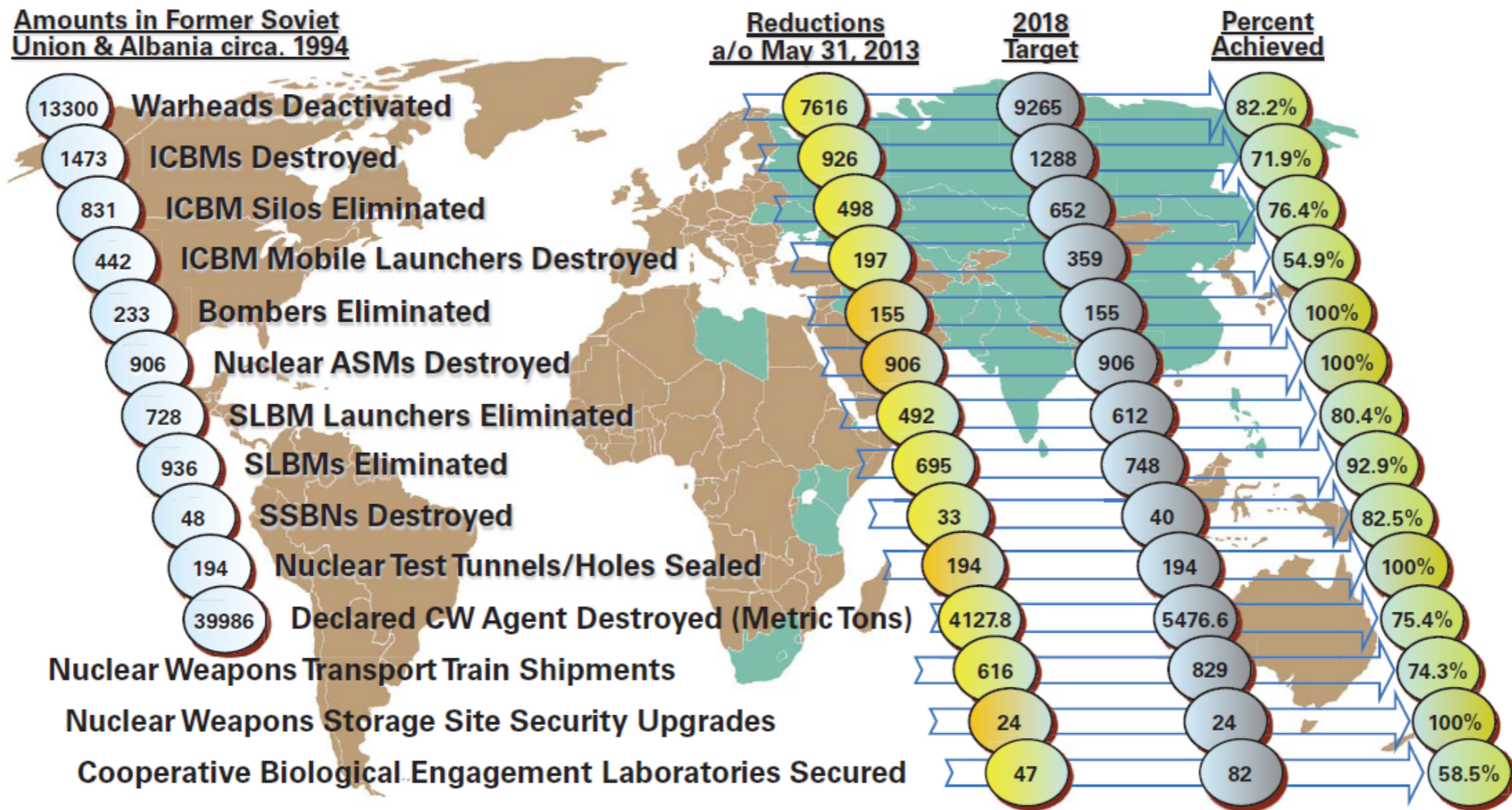


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## Nunn-Lugar CTR Scorecard

Ukraine, Kazakhstan, & Belarus are Nuclear Weapons Free  
Albania is Chemical Weapons Free

Amounts in Former Soviet Union & Albania circa. 1994



■ CTR partner states  
■ Rest of the world

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# The Future: Securing the Bomb

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## Achieving effective and lasting nuclear security —

- Launch a fast-paced global security campaign
- Seek to ensure that *all* nuclear weapons, plutonium, and highly enriched uranium are secure
- Expand and accelerate efforts to consolidate nuclear stockpiles
- Gain agreement on effective global nuclear security standards
- Build sustainability and a security culture

# The Future: Securing the Bomb

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In addition to nuclear security —

- Disrupt: focus counter-terrorism efforts on nuclear risks
- Interdict: counter the nuclear black market
- Prevent and deter: reduce the risk of nuclear transfers to terrorists by states
- Respond: global nuclear emergency response
- Impede: impede recruitment of nuclear personnel by terrorists
- Reduce: reduce stockpiles and end production
- Monitor: monitor nuclear stockpiles and reductions

# The Future: Securing the Bomb

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## Leadership and commitment —

- Build the sense of urgency and commitment worldwide
- Put someone in charge
- Develop a comprehensive, prioritized plan
- Assign adequate resources
- Provide information and analysis to support policy
- Reduce: reduce stockpiles and end production
- Monitor: monitor nuclear stockpiles and reductions

# The Future: Securing the Bomb

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Put the United States' own house in order —

- Put more stringent nuclear security measures in place
- Convert U.S. research reactors to LEU
- Upgrade security on HEU research reactors
- Phase out HEU research reactor security exemptions
- Reverse the rule exempting HEU from almost all security requirements if it is radioactive enough to produce a dose rate of more than 1 Sv/hour at a distance of 1 m
- Convert medical isotope production using HEU to use LEU
- Increase preparations for nuclear mass casualties



# Possible U.S. Unilateral Actions

(from the Union of Concerned Scientist and others)

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## 10 Steps the United States Could Take Without Waiting for Others

# Possible U.S. Unilateral Actions

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The following recommendations were authored by analysts from the Federation of American Scientists (FAS), Natural Resources Defense Council (NRDC), Union of Concerned Scientists (UCS), and independent experts with long experience in nuclear weapons policy issues.

For further information, go to:

[http://www.ucsusa.org/global\\_security/nuclear\\_weapons/trueseconomy.html](http://www.ucsusa.org/global_security/nuclear_weapons/trueseconomy.html)

The greatest nuclear dangers to the United States are an accidental, unauthorized or mistaken Russian nuclear attack, the spread of nuclear weapons to more nations, and the acquisition of nuclear materials by terrorists. U.S. nuclear weapons policy fails to adequately address these risks and too often exacerbates them.

By taking 10 unilateral steps, the next president would bring U.S. nuclear weapons policy into line with today's political realities, and demonstrate to the rest of the world that the United States is serious about addressing what remains one of the gravest threats to human civilization.

# Possible U.S. Unilateral Actions

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1. Declare that the sole purpose of U.S. nuclear weapons is to deter and, if necessary, respond to the use of nuclear weapons by another country. Making it clear that the United States will not use nuclear weapons first would reduce the incentive for other nations to acquire these weapons to deter a potential U.S. first strike.
2. Reject rapid-launch options by changing U.S. deployment practices to allow the launch of nuclear forces within days instead of minutes. Increasing the amount of time required to launch U.S. weapons would ease Russian concerns about the vulnerability of its nuclear weapons and in turn give it the incentive to take its weapons off alert, reducing the risk of an accidental or unauthorized Russian launch on the United States.
3. Eliminate preset targeting plans, and replace them with the capability to promptly develop a response tailored to the situation if nuclear weapons are used against the United States, its armed forces, or its allies.

# Possible U.S. Unilateral Actions

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4. Promptly and unilaterally reduce the U.S. nuclear arsenal to no more than 1,000 warheads, including deployed and reserve warheads. There is no plausible threat that justifies maintaining more than a few hundred survivable nuclear weapons, and no reason to link the size of U.S. nuclear forces to those of any other country. The United States would declare all warheads above this level to be in excess of its military needs, move them into storage, begin dismantling them in a manner transparent to the international community, and begin disposing—under international safeguards—of all plutonium and highly enriched uranium beyond that required to maintain these 1,000 warheads. By making the end point of this dismantlement process dependent on Russia's response, the United States would encourage Russia to reciprocate.

5. Halt all programs for developing and deploying new nuclear weapons, including the proposed Reliable Replacement Warhead.

6. Promptly and unilaterally retire all U.S. nonstrategic nuclear weapons, dismantling them in a transparent manner, and take steps to induce Russia to do the same.

# Possible U.S. Unilateral Actions

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7. Announce a U.S. commitment to reducing its number of nuclear weapons further, on a negotiated and verified bilateral or multilateral basis.

8. Commit to not resume nuclear testing, and work with the Senate to ratify the Comprehensive Test Ban Treaty.

9. Halt further deployment of the Ground-Based Missile Defense system, and drop any plans for space-based missile defense. The deployment of a U.S. missile defense system that Russia or China believed could intercept a significant portion of its survivable long-range missile forces would be an obstacle to deep nuclear cuts. A U.S. missile defense system could also trigger reactions by these nations that would result in a net decrease in U.S. security.

10. Reaffirm the U.S. commitment to pursue nuclear disarmament, and present a specific plan for moving toward that goal, in recognition of the fact that a universal and verifiable prohibition on nuclear weapons would enhance both national and international security.

# Priorities of the Obama Administration

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As outlined by President Obama in his 2009 Prague speech

- Hosting a Global Summit on Nuclear Security, (2010 Washington, 2012 Seoul)
- Strengthening the Nuclear Non-Proliferation Treaty, achieved in part by actions at the NPT Five-Year Review Conference in 2010
- To “immediately and aggressively” pursue ratification of a Comprehensive Nuclear Test Ban Treaty
- Ending the production of fissile materials that can be used in nuclear weapons
- Expanding international inspections to detect treaty violations
- Securing all vulnerable nuclear material around the world within four years

# The Future

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**What will you do to reduce the  
threat of nuclear weapons?**