SIS 490C & SIS 590A
Nuclear Energy, Nonproliferation, & International Safeguards
Thompson Hall 119
Tuesday/Thursday 0830 - 1020
Syllabus/Course Outline

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Course Description & Objectives

President Eisenhower's original Atoms for Peace speech envisioned wide contributions to medicine, agriculture, science, and industry, not just generating electricity. Over the next decade this vision motivated efforts to build a global regime for peaceful uses of nuclear energy. At the same time, many countries, such as Sweden, started secret nuclear weapons programs. Due to strategic, political, and economic realities, neither this global regime nor many weapons programs came to fruition. But for many countries, nuclear weapons remained a national objective, even as the U.S. and the USSR joined forces to lead strong international nonproliferation efforts, including the Nuclear Non-Proliferation Treaty (NPT) and the International Atomic Energy Agency (IAEA), entrusted with responsibility to verify the peaceful use of nuclear energy in signatory States. South Africa stunned the world by destroying its nuclear weapons, while today Iran and North Korea aggressively pursue nuclear weapons in the face of vigorous United Nations Security Council efforts to stop them. And today terrorists strive to pose nuclear threats. This course will examine the technologies of "nuclear energy," the institutions that have been developed to address the security threats, and the issues and challenges confronting those institutions today.

Course Requirements and Grading

Students are expected to keep up with the required reading and lecture material, and participate in class discussions. Class time will be split between lectures and seminar style discussions. Active participation in discussions, and ***active questioning during lectures***, is expected. To help promote active participation, the class will be organized in part around three simulation exercises. For each exercise, students will be required to write a very short (1-2 page) paper. In

addition, a longer (12–15 page) paper on a topic relevant to the course is also required. A final exam will be given on June (7–11).

Simulation Exercises

To provide realistic hands-on experience in applying each of the three basic IAEA safeguards regimes, three simulation exercises will be conducted. In each exercise, you will apply the concepts and methods of a particular IAEA safeguards regime to a model national nuclear complex (which will be defined for you) and document how the strategies and techniques of that nuclear safeguards regime can be applied to this nuclear complex. The three IAEA nuclear safeguards regimes are:

INFCIRC/66 Safeguards (Facility Safeguards)
INFCIRC/153 Full-Scope Safeguards (Comprehensive Safeguards)
INFCIRCs/153 & 540 (Integrated Safeguards)

One class will be devoted to readings & lecture material on each of the specific safeguards regimes. The following class will be devoted to the conduct of the exercise. On the exercise day, each of you will come to class with a 2–3 page paper, based on the readings and lecture material, providing a description of how you believe the specified safeguards regime should be applied to the model national nuclear complex. During class, students will be divided into small groups of about four persons each. During the first portion of the exercise, each group will, based on your individual work, as a group develop a safeguards approach for the model complex. During the second portion of the exercise, the group will critique the safeguards approach you developed from the perspective of a national authority that has been tasked to use the national nuclear complex in a covert nuclear weapons program.

Longer Term Paper

This is a standard research & analytical paper, examining a key issue or topic of your choice. Students may draw from the list of potential paper topics offered by the instructors (Annex A) or develop an idea of their own. For topics not listed in the Annex, prior approval of the topic by one of the instructors is required. This paper should be written using standard academic format, citations (foot- or end-notes), and independent authorship.

All papers are to be type-written. Good writing skills, organization, structure, and grammar are important. Papers may be handed in either in hard copy or electronically, but are to be turned in on time. Hard copies with comments will be returned.

Elements of Final Grade

Grades will be assigned using the UW 4.0 point scale. Grade will be composed of:

Class/exercise participation	20%
Short papers	20%
Term paper	30%
Final exam	30%

Required Reading

The course will use many readings collected in a Course Pack for sale at the UW book store, and other readings which are identified in the syllabus as either on reserve in the Odegaard [Suzzallo] Library, distributed as hand-outs, distributed electronically, or identified as specific website addresses in the syllabus.

Due Dates for Papers

Short Papers

First	Thursday April 15th
Second	Tuesday, April 27th
Third	Tuesday, May 18th

Long Paper

Due in class at final exam

Final Exam

Tuesday, June 08, 2010, 1030-1220

Week 1

Mar 30 Introductions & review syllabus & course requirements

- Instructors' introductions
- Students – introductions - who & why
- Walk through syllabus
- Course requirements & expectations

Apr 1 Introduction to Nuclear Technology

Lecture & Discussion

The nuclear fuel cycle

Uranium from the mine to UF_6
Enrichment technologies – all of them, emphasis on centrifuges
Reprocessing – U.S. makes the technology public 57 conference

Nuclear reactors & their products

Research & isotope production reactors
Power reactors
Fast & breeder reactors
Thorium cycles
Isotopes & their uses

Readings (or Viewings today):

- View Texas A&M Univ. Course Online
  http://nsspi.tamu.edu/NSEP/fuel_cycle/index.php?course=0000
  Left side vertical bar
  - "Introduction" – watch all videos in this section
  - "Front end of the fuel cycle" – watch "enrichment" & "fuel fabrication" videos
  - "Fuel irradiation & fuel storage" – watch "introduction" & "Fuel irradiation" skip "Spent Fuel storage"

  OR -- Start with "Take this course" button at bottom of screen
  Watch videos 1, 2, 3, 7, 8, 9,
  Review all written material to the end (spent fuel reprocessing)

Week 2

Apr 6 Atoms for Peace – bilateral assistance programs & bilateral safeguards

Lecture & Discussion

- Eisenhower's speech & vision
- Many supplier programs & competition
- Network of bilateral safeguards – the growing problem
- Eisenhower's vision as a treaty – the Statute
- The Global regime that would not be

Readings:

- President Eisenhower. Atoms for Peace Speech. UNGA December 1953. Course Pack or Online http://web.archive.org/web/20070524054513/http://www.eisenhower.archives.gov/atoms.htm
  Audio file available: http://www.world-nuclear university.org/html/atoms_for_peace/index.htm
- Lawrence Scheinman. Chap. 1 "Introduction & Overview" and Chap. 2 "From New York to Vienna: The Genesis of the IAEA" in *The International Atomic Energy Agency & World Nuclear Order* Odegaard Reserve
- Allan McKnight. Chapter 1, "The United Nations Atomic Energy Commission." *Atomic Safeguards: A Study in International Verification.* Unitar. Course Pack

Further Reading:

- Acheson – Lillienthal Report. Odegaard Reserve or Online http://www.fissilematerials.org/ipfm/site_down/ach46.pdf
- David Fischer. History of the International Atomic Energy Agency: The First Forty Years. Online http://www-pub.iaea.org/MTCD/publications/PDF/Pub1032_web.pdf

Apr 8 IAEA Statute – concept of a global regime, INFCIRC/66 safeguards

Lecture & Discussion

- INFCIRC/66 safeguards – concepts, approach, requirements
- Safeguards Agreements & Facility Attachments – what are they?
- Safeguards methods & technologies
  - Facility inventories – items & materials
  - Containment & surveillance
  - Types & purposes of inspections under INFCIRC/66

Readings:

- IAEA Statute, Course Pack or Online http://www.iaea.org/About/statute_text.html
- INFCIRC/66, Course Pack or Online http://www.iaea.org/Publications/Documents/Infcircs/Others/inf66r2.shtml
- Lawrence Scheinman. Chap. 4 "The Agency's Safeguards System Before the NPT" in *The International Atomic Energy Agency & World Nuclear Order.* Odegaard Reserve

- Allan McKnight. Chapter 2 "Creation of the International Atomic Energy Agency," Chapter 7 "The Safeguards Document," Chapter 8 "The Inspectors Document" & Chapter 9 "The Safeguards Agreement." *Atomic Safeguards: A Study in International Verification*. Unitar and Annex 1. Course Pack

Further Reading:

- Allan McKnight. Chapter 3, "The Legislative History of Safeguards in the IAEA Board of Governors (1957 – 1969)." *Atomic Safeguards: A Study in International Verification*. Unitar. Course Pack
- Laura Rockwood, "Safeguards & Nonproliferation: The First Half-Century from a legal perspective" in *ESARDA Nuclear Safeguards and Non-Proliferation*, pp. 79-83. To be provided
- Alex R. Burkart & J. Christian Kessler. *History & Current Trends in Nuclear Safeguards*,. Sections I – VI. Course Pack
- David Fischer. "International Safeguards" Chap. 11.1, in David Fischer & Paul Szasz, Safeguarding the Atom: A Critical Appraisal, Josef Goldblat, ed. Odegaard Reserve

Week 3

Apr 13 Defining the Model National Complex & Exercise Methodology

Lecture & Discussion

- Model complex – facilities & capabilities – Handout & discussion
- Covert weapons program – required kinds of capabilities
- How the exercises will work

Readings:

- Allan McKnight. Chapter 10, "Safeguards Methods & Techniques" & Chapter 11 "Organization for Safeguards" *Atomic Safeguards: A Study in International Verification*. Unitar Course Pack
- "New Safeguards Equipment Systems: Teaming IAEA Inspectors with Technology." Course Pack or Online http://www.iaea.org/Publications/Booklets/TeamingInspectors/teaming_inspectors.pdf

Apr 15 INFCIRC/66 Safeguards Regime Exercise One

Small Group Exercises – 1st paper due

- Applying INFCIRC/66 to the Model National Complex
- Methods to conceal a covert weapons program

Week 4

Apr 20 NPT – Ireland's initiative, negotiations, the grand compromise (safeguards, nuclear cooperation & assistance, disarmament), the Tlatelolco alternative

Lecture & Discussion

- Nuclear disarmament again – Ireland's UN General Assembly Resolution
- Negotiations in the Conference on Disarmament
- The U.S. – USSR compromise draft
- Elements of the grand compromise
- Tlatelolco – the first nuclear weapons free zone

Readings:

- NPT - Treaty on the Non-Proliferation of Nuclear Weapons Course Pack http://www.iaea.org/Publications/Documents/Treaties/npt.html
- Tlatelolco – Treaty on the Prohibition of Nuclear Weapons in Latin America Course Pack http://www.iaea.org/Publications/Documents/Treaties/tlatelolco.html
- Allan McKnight. Chapter 4, "The Non-Proliferation Treaty & The Treaty on the Prohibition of Nuclear Weapons in Latin America." *Atomic Safeguards: A Study in International Verification*. Unitar. Course Pack

Further Readings:

- David Fischer, "International Safeguards" Chap. 11.2 – 11.4, in David Fischer & Paul Szasz, Safeguarding the Atom: A Critical Appraisal, Josef Goldblat, ed. Odegaard Reserve

Apr 22 Art. III & INFCIRC/153 – the full scope safeguards compromise;

Lecture & Discussion

- Full-scope safeguards – the concept
- Negotiations to define it operationally
- Accounting of materials, versus facility use requirements
- Model safeguards agreement – INFCIRC/153
- New Safeguards methods & technologies
  - State System of Accounting & Control
  - Subsidiary Arrangements & Facility Attachments
  - Design Information Questionnaires
  - "Significant Quantity" of nuclear material
- Zangger Committee – NPT nuclear suppliers & full-scope safeguards

Readings:

- INFCIRC/153 The Structure and Content of Agreements between the Agency and States required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons. Course Pack http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc153.pdf
- Lawrence Scheinman, Chap. 5 "NPT Safeguards" in *The International Atomic Energy Agency & World Nuclear Order.* Odegaard Reserve
- David Fischer. Chap. 6 "Limits in the Present Approach," Chap. 7 "Problems with Safeguards Methods," & Chap. 8 "Problems with Safeguards Procedures" in David Fischer Paul Szasz, Safeguarding the Atom: A Critical Appraisal, Josef Goldblat, ed. Odegaard Reserve
- Alex R. Burkart & J. Christian Kessler. *History & Current Trends in Nuclear Safeguards*, Sections IX – XII. Course Pack

Week 5

Apr 27 INFCIRC/153 Safeguards Regime Exercise Two

Small Group Exercises – 2nd paper due

- Applying INFCIRC/153 to the Model National Complex
- Methods to conceal a covert weapons program

Apr 29 Who stood outside – India's PNE test (1974) – France & China – London Suppliers' Group

Lecture & Discussion

- Why France & China did not join NPT
- India's "PNE" test – Canadian & U.S. facilities
- Suppliers' response – London Club

Readings:

- Scheinman. Chap. 6 "Nuclear Policies in Transition" in *The International Atomic Energy Agency & World Nuclear.* Odegaard Reserve

Further Reading:

- David Fischer, "International Safeguards" Chap. 13.1 – 13.5, in David Fischer & Paul Szasz, Safeguarding the Atom: A Critical Appraisal, Josef Goldblat, ed. Odegaard Reserve

Week 6

May 4 Who stood outside the 1980's – Argentina & Brazil, ABACC; Israel

Lecture & Discussion

- Argentina & Brazil – nuclear weapons, nuclear submarines, open options

- Creation of ABACC – Tlatelolco full-scope safeguards & regional inspectorate
- Israel & the unspoken program

Readings:

- Leonard S. Spector. Chap 6 "India" pp. 63 – 88, & Chap 7 "Pakistan" pp. 89-117 in *Nuclear Ambitions: The Spread of Nuclear Weapons 1989 – 1990.* Odegaard Reserve
- Peter Pry. Chap. 1 "A History of Israel's Nuclear Weapons Program" in Israel's Nuclear Arsenal. Odegaard Reserve

Further Reading:

- K. D. Kapur. Nuclear Non-Proliferation Diplomacy: Nuclear Programmes in the Third World. Chap 4 "Argentina: Diplomacy of Regional Nuclear Pre-Eminence," Chap 5 "Brazil Challenging Argentina's Nuclear Supremacy," & Chap 6 "Argentina & Brazil: From Nuclear Rivalry to Cooperation" pp. 111–221. Odegaard Reserve

May 6 Hexapartite Safeguards Project – IAEA, Euratom, & Sensitive Technology

Lecture & Discussion

- New technology, new challenges, new relationships
- Limited Frequency Unannounced Access
- Drawing a material balance with black box assay technology

Readings:

- David Fischer, "International Safeguards" Chap. 10.2 – 10.4 in David Fischer & Paul Szasz, Safeguarding the Atom: A Critical Appraisal, Josef Goldblat, ed. Odegaard Reserve
- Other Readings to be provided

Week 7

May 11 South Africa – secret programs & public disarmament

Lecture & Discussion

- Development of a covert nuclear weapons program
- The political decision
- Verifying dismantlement – the international challenge

Readings:

- Frank V. Pabian. South Africa's Nuclear Weapons Program: Lessons for U.S. Nonproliferation Policy. The Nonproliferation Review. Fall 1995 Odegaard Reserve or http://cns.miis.edu/npr/pdfs/31pabian.pdf

May 13 Saddam's weapons program – International Response Program 93+2 & the Additional Protocol

Lecture & Discussion

- Osirak reactor bombing (1982)
- Saddam's network of suppliers
- Discovering the dimensions of Iraq's enrichment programs
- Political consensus on need to expand scope of safeguards – 93+2
- New Safeguards methods & technologies of the Additional Protocol
  - Environmental sampling – outside declared facilities
  - Satellite imagery – remote sensing
  - Inspection of undeclared facilities
  - Comprehensive inventories
  - Supplier declarations of exports

Readings:

- IAEA's Iraq Nuclear Verification Office (INVO). "Iraq's Nuclear Weapon Programme." http://www.iaea.org/OurWork/SV/Invo/factsheet.html
- Leonard S. Spector. Chap 11 "Iraq" pp. 186 – 202 in *Nuclear Ambitions: The Spread of Nuclear Weapons 1989 – 1990.* Odegaard Reserve
- Richard Hooper "The Changing Nature of Safeguards." IAEA Bulletin 45/1. June 2003. Course Pack
- Theodore Hirsch "The Additional Protocol: What it is & Why it Matters" Nonproliferation Review. Fall/Winter 2004, pp. 140 – 152. Odegaard Reserve or http://cns.miis.edu/npr/pdfs/113hirsch.pdf
- Alex R. Burkart & J. Christian Kessler. *History & Current Trends in Nuclear Safeguards*, Sections XIII – XVII. Course Pack
- INFCIRC/540 – The Additional Protocol. Course Pack or Online http://www.iaea.org/Publications/Documents/Infcircs/1997/infcirc540c.pdf

Week 8

May 18 Additional Protocol (INFCIRC/540) Safeguards Regime Exercise Three Small Group Exercises – 3rd paper due

- Applying INFCIRC/540 to the Model National Complex
- How to conceal a covert weapons program

May 20 India & Pakistan – A Nuclear Proliferation Arms Race

Lecture & Discussion

- India's 1974 "Peaceful Nuclear Explosive" test
- Pakistan "we will eat grass" -- plutonium or HEU?
- A.Q. Khan builds a covert supply network
- Evolution of Pakistan's nuclear weapons program
- Indian politics & the 1998 decision to test
- Pakistan responds
- International community responds – sanctions & not

Readings:

- Leonard S. Spector. Chap 6 "India" pp. 63 – 88, & Chap 7 "Pakistan" pp. 89 - 117 in *Nuclear Ambitions: The Spread of Nuclear Weapons 1989 – 1990* . Odegaard Reserve
- Feroz Hassan Khan. " Challenges to Nuclear Stability in South Asia" *The Nonproliferation Review*, Spring 2003. Odegaard Reserve or Online. http://cns.miis.edu/npr/pdfs/101khan.pdf

Week 9

May 25 North Korea -- Board of Governors, Security Council, 6 Party Talks

Lecture & Discussion

- NK's nuclear program
- Kim accedes to the NPT in Moscow
- The nuclear weapons program caught – Board of Governors 2nd violation finding, to the Security Council
- Crisis, hints of war, the Agreed Framework
- Bush retrenches, & 6 Party Talks
- Where do we go from here?

Readings:

- Chapters 12, 13, & 24 in *The North Korean Nuclear Program: Security, Strategy, and New Perspectives from Russia.* James Clay Moltz & Alexandre Y. Mansourov, eds. Odegaard Reserve
  - "North Korea's Decision to Develop Independent Nuclear Programs" by Natalya Bazhanova Chap. 12

  - "North Korea and the Nuclear Nonproliferation Regime" by Vladimir F. Li Chap 13
  - "North Korea's Negotiations with the Korean Peninsula Energy Development Organization (KEDO) by Alexandre Y. Mansourov Chap. 14
- Carol Kessler "A Quick History of North Korea and Nuclear Weapons Proliferation." Course Pack
- GlobalSecurity.org – Inventory of North Korea's nuclear facilities.Online http://www.globalsecurity.org/wmd/world/dprk/yongbyon.htm
- Testimony Robert. Gallucci on US-DPRK Agreed Framework before House International Relations Committee. February 1995. Course Pack or Online http://dosfan.lib.uic.edu/ERC/bureaus/eap/950223GallucciUSDPRK.html

Further Reading:

- IAEA website on North Korea http://www.iaea.org/NewsCenter/Focus/IaeaDprk/
- ISIS (Institute for Science & International Security) North Korea page http://isis-online.org/countries/category/korean-peninsula/

May 27 Iran -- Board of Governors, EU-3, & Security Council

Lecture & Discussion

- Bushehr & civil nuclear power
- Iran's enrichment program
- EU-3 response
- Safeguards violations & Security Council Resolutions
- The Stand-off & where do we go from here?

Readings:

- Leonard S. Spector. Chap 12 "Iran" pp. 203– 218- in *Nuclear Ambitions: The Spread of Nuclear Weapons 1989 – 1990.* Odegaard Reserve
- INFCIRC/724. Communication dated 26 March 2008 received from the Permanent Mission of the Islamic Republic of Iran to the Agency. Course Pack or Online http://www.iaea.org/Publications/Documents/Infcircs/2008/infcirc724.pdf
- GOV/2008/15. Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), and 1803 (2008) in the Islamic Republic of Iran. Course Pack or Online http://www.isisnucleariran.org/assets/pdf/IAEA_Iran_Report_26May2008.pdf

- GOV/2009/74 Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008), and 1835 (2008) in the Islamic Republic of Iran. Course Pack http://isis-online.org/uploads/isis-reports/documents/IAEA_Report_Iran_16November2009pdf_1.pdf
- INFCIRC/779 Communication dated 3 December 2009 received from the Permanent Mission of the Islamic Republic of Iran to the Agency concerning statements made by the Islamic Republic of Iran in the Board of Governors. Course Pack or Online. http://www.iaea.org/Publications/Documents/Infcircs/2009/infcirc779.pdf
- GOV/2010/10 Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran. Course Pack or Online http://isis-online.org/uploads/isis-reports/documents/IAEA_Report_Iran_18Feb2010.pdf
- ISIS analysis of the February 18, 2010 IAEA safeguards report on Iran's nuclear program. Online http://www.isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_Analysis_18Feb2010.pdf

Further Reading:

- IAEA website on Iran - http://www.iaea.org/NewsCenter/Focus/IaeaIran/index.shtml
- ISIS (Institute for Science & International Security) Iran page http://isis-online.org/iaea-reports/category/iran/

Week 10

Jun 1 Tying it all together: Key components of nonproliferation regime

Lecture & Discussion

Key components of nonproliferation regime:

- Physical Protection (CPPNM & INFCIRC/225)
- Export Control
- Safeguards
- Interdictions of covert shipments
- Sanctions (Security Council, national & multilateral)

Readings:

Physical Protection

- INFCIRC 274 Convention on the Physical Protection of Nuclear Material. Online

http://www.iaea.org/Publications/Documents/Infcircs/Others/inf274r1.shtml

- INFCIRC/225/Rev.4 (Corrected) The Physical Protection of Nuclear Material and Nuclear Facilities. Online http://www.iaea.org/Publications/Documents/Infcircs/1999/infcirc225r4c/rev4_content.html

Interdictions of covert shipments

- Proliferation Security Initiative: Backgrounder. Council on Foreign Relations. Online http://www.cfr.org/publication/11057

Jun 3 Global Regime Redux (continued)

Global nuclear energy "renaissance" - increases magnitude and nature of both challenges and response

Group Discussion

- Changing Role of the IAEA (20/20 Vision Report)
- Seeking compromise between "haves" and "have nots" on sensitive nuclear technologies
- President George W. Bush – Speech on Weapons of Mass Destruction Proliferation 12 February 2004
- GNEP and attempts to Limit Enrichment and Reprocessing
- Assured Fuel Supply: International Nuclear Fuel Cycle Centers & International Fuel Banks *(IAEA Fuel Bank, Angarsk Proposal)*
- NPT RevCon (April 2010)

Readings:

Challenges to the IAEA

- IAEA. *20/20 Vision for the Future.* February 2008. Course Pack or Online http://www.iaea.org/NewsCenter/News/PDF/20-20vision_220208.pdf

Bush Speech & GNEP

- George W. Bush. *Speech at National Defense University*. 11 February 2004. Course Pack or Online http://www.pircenter.org/data/npr/Bush120204.pdf
- World Nuclear Association. *GNEP Overview*. November 2009. Online http://www.world-nuclear.org/info/inf117_gnep.html

Assured Fuel Supply

- Mary Beth Nikitin, Anthony Andrews and Hark Holt. *Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power.* Congressional Research Service Report RL 34234. Odegaard Reserve and Online http://ncseonline.org/nle/crsreports/09July/RL34234.pdf
- INFCIRC/640. *Multilateral Approaches to the Nuclear Fuel Cycle. Expert Group Report Submitted to the Director General of the IAEA*. 22 February 2005. Odegaard Reserve or Online. http://www.iaea.org/Publications/Documents/Infcircs/2005/infcirc640.pdf

Further Reading:

Nuclear Energy Expansion

- Carnegie. *Interactive Map on Nuclear Energy Expansion.* Online http://www.carnegieendowment.org/publications/special/maps/globalReactorCapacities/index.cfm?fa=mapGlobalExpan

Public Debate on Nuclear Power

- Sharon Squassoni. *Nuclear Renaissance: Is it Coming? Should it?* October 2008. Online http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=22334

Assured Fuel Supply

- IAEA. *12 Proposals on the Table*. IAEA Bulletin 49-2. March 2008. Online http://www.iaea.org/Publications/Magazines/Bulletin/Bull492/art13-subart1.pdf

Week 11

June 8 – Final Exam (10:30–12:20)

Annex A
Model National Nuclear Program

Two University Programs

- a nuclear physics program
- a nuclear engineering program with a small research reactor (3 MW_t)

One National Nuclear Research Center

- 1 research reactor – 40 MW_e producing medical isotopes
- 3 hot cells with manipulators, one large enough to hold spent fuel assemblies from the power reactors
- Biological research laboratory & large library building on far side of the same site (1.7 km from research reactor, 2.2 km from hot cell building)

Nuclear Power Generation

Nuclear Generating Station Alpha

- 2 CANDU power reactors, 355 Mw(e) each

Nuclear Generating Station Beta

- 1 Pressurized Light Water Reactor (operating) – VVER 440
- 1 Pressurized Light Water Reactor (under construction) – VVER 1000

Fuel Cycle

Uranium mining
1 mine – located remote high desert & mountainous area

Uranium milling facility - producing U_3O_8 (capacity 150t/yr)

Uranium conversion plant (producing UO_2) (capacity 60t/yr)
7 km distance from milling plant

Fuel Fabrication plant (producing fuel pellets for CANDUS)
Co-located with Conversion Plant

Spent Fuel and Nuclear Waste Management/Disposal

- Low and intermediate-level waste from research reactors and CANDUs is handled at a central nuclear waste facility operated by the Federal Agency for Atomic Energy.
- Spent fuel from the CANDUs is stored at each power plant then transported to a central waste handling facility.

- Spent fuel from the PWR is held 3-5 years at the reactor site then the spent fuel is returned to Russia.
- There is no national nuclear waste repository

Legal and Regulatory Infrastructure

- Federal Agency for Atomic Energy (FAAE)
- Electricity production is largely privatized and regulated by the Federal Agency for Nuclear Energy Regulation (FANER)

Nonproliferation

- Party to the NPT since 1975 as a Non-nuclear weapon state
- Signed an Additional Protocol in 1998 (entered into force 2005)

Annex B –Some Suggested Research Paper Topics

- The India – U.S. nuclear cooperation agreement – Implications of a back-door for Non-parties to the NPT becoming accepted de facto nuclear weapons states
- Additional Protocol – how to balance sovereignty versus knowing what your neighbor is up to
- Going to Zero – Is the Additional Protocol enough?
- Going to Zero – Role of the Fissile Material Cut-off Treaty
- Going to Zero – What really stops the next Saddam Hussein, or other tyrant?
- India – U.S. nuclear cooperation – Should the IAEA have accepted this safeguards agreement?
- India – U.S. nuclear cooperation – Should the NSG have agreed to waive full-scope safeguards? What comes next?
- Zangger Committee – Why did they interpret Article III.2 as not requiring full-scope safeguards?
- Additional Protocol – Are environmental monitoring & spy satellites a violation of sovereignty?
- Is the NSG requirement for full-scope safeguards a violation of the recipient's sovereignty?
- Why did the measures of the Additional Protocol take so long?
- Why have a large number of states not yet adopted or implemented an Additional Protocol?
- Sovereignty versus Certainty? Why did the NPT settle for nuclear materials accountancy?
- International nuclear fuel cycle facilities – Why has the Baruch Plan still failed today?
- How has the debate over enrichment and reprocessing affected attempts to implement international fuel cycle facilities?
- Is asking non-nuclear weapons states to buy into multilateral fuel services a violation of their rights under the NPT?
- How and why has U.S. policy on multinational fuel cycle centers changed over the past few years with regard to the requirement that states formally forego the sensitive nuclear technologies?
- Do any of the proposals for international fuel assurances have a greater chance of reaching fruition than others?

- What are the implications of the US-India nuclear cooperation on other non-NPT states? What are the implications for NPT states?
- What are the main issues to be addressed at the 2010 RevCon and what outcomes can be expected?
- What are the limitations of the Additional Protocol and Integrated Safeguards?
- Is the current nuclear nonproliferation regime – with its combination of safeguards, physical protection and export controls - enough to prevent proliferation?
- What is the legitimacy of Iran's claim to pursue enrichment and what is the solution?
- How has the nuclear nonproliferation regime changed to address non-state actors?
- What is the Small Quantities Protocol and how does it hold in abeyance the implementation of the Additional Protocol?
- What has been the experience with integrated safeguards in Japan and other states? Are integrated safeguards an appropriate model for all states?
- How has the changed nature of international safeguards affected the work of the IAEA and its ability to carry out its safeguards mission?
- How has the role of an IAEA inspector changed with strengthened safeguards?
- What are the key safeguards technologies and to what degree can these technologies be relied upon to detect proliferation or the intent to proliferate? (balance between safeguards technologies and inspectors, analysts, etc)
- What is the role of SSACs and RSACs? How has ABACC worked to deter Argentina and Brazil from choosing to go nuclear? Has it?
- Would a RSAC such as that between Argentina and Brazil be effective in other regions, such as India and Pakistan? Why or why not?
- In what ways are Generation III nuclear technologies more proliferation-resistant than their predecessors?
- Safeguards by Design
- Should the U.S. reconsider reprocessing? What are the pros and cons from a proliferation perspective?
- Would a non-nuclear weapons treaty similar to the Treaty of Tlatelolco work in the Middle East?

- What are the major factors that have driven North Korea's current status with regards to the nonproliferation regime? What would it take to fully integrate North Korea into this system?
- Does the international safeguards system provide adequate assurance to states not to pursue nuclear weapons development?

Annex C – Useful Web Sites

International Atomic Energy Agency
http://www.iaea.org/Publications/Documents/index.html

Arms Control Association **http://www.armscontrol.org/**

GlobalSecurity.Org **http://www.globalsecurity.org/**

Institute for Science & International Security **http://www.isis-online.org/**

James Martin Center for Nonproliferation Studies, Monterey Institute for International Studies **http://cns.miis.edu/**

Nuclear Threat Initiative **http://www.nti.org/index.php**

World Nuclear Association **http://www.world-nuclear.org**

Nonproliferation Policy Education Center. **http://www.npec-web.org/**

Carnegie Endowment for International Peace.
http://www.carnegieendowment.org/topic/

Center for Strategic and International Studies. **http://csis.org/**