

# Critical Issues Forum

## Nuclear Disarmament: Challenges, Opportunities and Next Steps

Benchmark II

March 19, 2009

Revised April 2, 2009



JANESVILLE  
ACADEMY FOR  
INTERNATIONAL STUDIES

Teacher: Katherine Conover

Contributing Students: Rebecca Amstutz, Aaron Bagley,  
Cheyane Blevins, Phil Bothun, Mollie Brady, Alyssa  
Brandt, Garrick Jannene, Dylan Moriarty

## **Table of Contents**

<b>Articles of the Nuclear Non-Proliferation Treaty (NPT)</b>	<b>3</b>
<b>Other Nuclear Nonproliferation Treaties and Agreements</b>	<b>7</b>
<b>Role of the International Atomic Energy Agency (IAEA)</b>	<b>10</b>
<b>NPT and Other Treaty Violations</b>	<b>13</b>
<b>Laws and Agencies That Regulate Nuclear Weapons</b>	<b>15</b>
<b>Non-governmental Organization Goals Regarding Nuclear Weapons</b>	<b>19</b>
<b>Various International Perspectives on Nuclear Disarmament</b>	<b>21</b>
<b>Problems with Nuclear Armed Countries</b>	<b>27</b>
<b>Modernization of Nuclear Weapons: Technology and Treaty Ramifications</b>	<b>31</b>
<b>Safety, Security, Protection and Accountability of Nuclear Weapons</b>	<b>35</b>
<b>Approaches to Maintaining Safety and Security of Nuclear Weapons and Ways Around Such Approaches</b>	<b>39</b>
<b>Works Cited</b>	<b>42</b>

## **Articles of the Nuclear Non-Proliferation Treaty (NPT)**

The treaty on the Non-Proliferation of Nuclear Weapons is a treaty designed to limit the spread of nuclear weapons. The treaty was first proposed by Ireland and became open for signatures on July 1, 1968. Finland was the first country to sign and currently there are 189 countries party to the treaty. There are only four recognized independent states that are not parties to the treaty India, Israel, Pakistan, and North Korea. The treaty consists of eleven separate articles (Treaty on Non-Proliferation of Nuclear Weapons.” 2000).

- Article One states that any countries who are party to the treaty are not to transfer nuclear weapons or other explosive devices or possession of weapons or explosive devices directly or indirectly to any other country. They are also not to help, encourage, or provoke any non-nuclear-weapon State to manufacture or acquire nuclear weapons or other explosive devices, or gain possession of such weapons or explosive devices.
- Article Two says that any country party to the treaty that does not already have nuclear weapons is not to receive or seek nuclear weapons or explosives or assistance in the manufacturing of nuclear weapons and other explosives.
- Article Three stipulates that countries without nuclear weapons are to accept safeguards to prevent diversion of nuclear energy from peaceful uses to nuclear weapons. It is also stated that countries are not to provide material used in the design of nuclear weapons or equipment especially

designed or prepared for the processing, use or production of that material to any non-nuclear-weapon state.

- Article Four guarantees that the countries party to the treaty have the right to develop research, production and use of nuclear energy for peaceful purposes and have the right to participate in the exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy.
- Article Five ensures that potential benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear- weapon states party to the treaty.
- Article Six states that involved countries are to pursue negotiations on effective measures relating to the termination of the nuclear arms race at an early date and to nuclear disarmament, and toward a treaty on general and complete disarmament.
- Article Seven states nothing in this treaty affects the right of any group of States to arrange regional treaties in order to assure the total absence of nuclear weapons in their respective territories.
- Article Eight allows any state party to this treaty to suggest amendments to this treaty. Any amendment to this treaty must be approved by majority of the votes of all the parties to the treaty.
- Article Nine states that this treaty will be open to all States for signature. This treaty shall be registered by the Department Governments pursuant to Article 102 of the Charter of the United Nations.

- Article Ten allows any independent state to withdraw from the treaty if it decides that unexpected events, related to the subject matter of this treaty, have jeopardized the supreme interests of its country. The country must provide a statement of the events three months in advance of withdrawing.
- Article Eleven states this treaty, the English, Russian, French, Spanish, and Chinese texts of which are equally authentic, will be placed in the archives of the depositary Governments. Also, certified copies of this Treaty will be transmitted by the Depositary Governments to the Governments of the signatory and acceding States (Treaty on Non-Proliferation of Nuclear Weapons.” 2000).

We believe the Nuclear Non-Proliferation Treaty strongly promotes but does not guarantee nuclear disarmament. The treaty provides non-nuclear-weapons states opportunities for developing technology in peaceful uses of nuclear energy without having to do actual testing. It also is designed to stop the spread and passing on of nuclear weapons and explosive technology. Optimistically, the treaty puts an early end to the nuclear arms race and overall eliminates any need at all for a state to have nuclear weapons and other forms of massive explosives.

However, the treaty is not perfect. After discussion, our group came to the conclusion that there always seem to be more problems than solutions. The NPT is based on an honor code, but it does not have “teeth.” When a country is in violations of the terms, nothing more can be done but to insist the country stops whatever action is in violation. The problem that occurs when enforcements are applied is it becomes a police action, and in that case the country could simply withdraw from the treaty. An embargo

cannot be put in effect against countries in violation because it would cause harm to the people rather than persuade the government. Another major concern is, “What do we do about the countries that refuse to sign the treaty?” Incentives to be part of the treaty and honor it would seem to be more effective than punishments and intimidation; but what kind of incentive could be offered and where would it come from? Nuclear energy for peaceful purposes is highly beneficial in many countries; but it is easily converted to produce weapons. “How can the switch from peaceful uses of nuclear technology to weapons be prevented?” When the treaty is reviewed and discussed every five years, an agenda is sometimes not put together until several days into the conference. Would it be possible to get more accomplished during the conference if an agenda can be prepared ahead of time? How else could the five year reviews be improved? Unfortunately, the same questions are presented time after time and solutions are yet to be found.

## **Other Nuclear Nonproliferation Treaties and Agreements**

Over the past fifty years there have been a large number of treaties and agreements put in place in order to prevent the spread of nuclear weapons. One of the first is the Antarctic Treaty (Antarctic Treaty System or ATS). Ratified in 1961, this treaty does not allow for any military activity of any sort, thus including nuclear, on the continent of Antarctica. To date, this treaty has been signed by 46 countries, and “was the first arms control agreement established during the Cold War” (Diehl & Moltz, 2008, p. 216-7).

Two years later the US, USSR and the UK signed and ratified the Limited Test Ban Treaty. The purpose of this treaty was to stop the testing of nuclear bombs undersea, above ground, and in outer space. “But it does allow testing to occur underground as long as the radioactive fallout is not widespread” so far 116 countries have signed the LTBT. The 1967 Outer space treaty furthered the LTBT by eliminating all nuclear weapons in orbit, and has been signed by 86 nations (“Nuclear Treaties and Agreements,” 1998). The most well known nuclear non proliferation treaty which was established in 1968, subsequently signed and ratified by 189 nations, and was eventually made a permanent treaty, is the Nuclear Non Proliferation Treaty (NNPT or NPT). There are three pillars under this treaty which are strictly enforced, non proliferation, disarmament, and a peacefully use of nuclear energy (“Nuclear Non-Proliferation Treaty,” 2009).

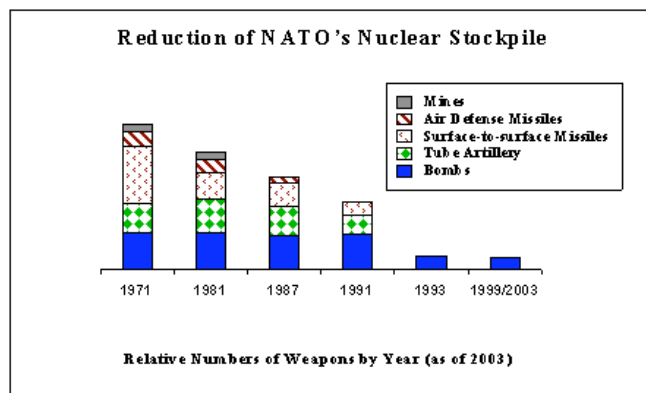
Under the NPT, nuclear states may not “transfer nuclear weapons, devices or technologies to any recipient under any circumstances”. Also “non-nuclear states agree not to receive, acquire, or develop them. In return, non-nuclear states are guaranteed

equal access to all benefits from any peaceful applications of nuclear energy, including the right to research, produce, and use nuclear technologies” (Nuclear Non-Proliferation Treaty, 2009). The NPT is the most powerful and influential nuclear weapons treaty to-date.

Continuing on, in 1972 the two major nuclear superpowers the USSR and the US signed the Strategic Arms Limitation Treaty I ABM Treaty. This treaty limited each states Anti-Ballistic Missile Systems to 100 each and was the first attempt at a bilateral effort between two major super powers to reduce the number of nukes. Another treaty signed during the Cold War, the Strategic Arms Limitation Treaty I Intern Agreement, forced the US and USSR to keep their number of strategic nuclear missiles at a constant. The Strategic Arms Limitation Treaty II was also put into effect during the cold war (later made void by the US in 1986); it limited the number of missiles that could be placed on certain vehicles and MIRV (multiple independently targetable reentry vehicle) devices ("Multiple Independently Targetable," 2009). Along with other Cold War treaties, the Intermediate-Range Nuclear Forces Treaty (1987) banned all intermediate ranged and short range missiles. ("Nuclear Treaties and Agreements," 1998).

In 1991 and 1993 two treaties were signed in an effort to reduce the number of warheads between the US and Russia left over from the Cold War. The

Strategic Arms Reduction



[http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/nato-nuclear-policies/2004-06-00\\_new-security-environment.html](http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/nato-nuclear-policies/2004-06-00_new-security-environment.html)

Treaty, and the Strategic Arms Reduction Treaty II both forced the US and Russia to reduce its number of bombs. The second treaty forced both states to reduce their numbers of warheads to 4,250 by 2001, and 3,500 by 2002. Russia formally withdrew from START II in 2002 due to its preservation of the 1972 ABM Treaty (*Strategic Arms Reduction Treaty II*. n.d.)

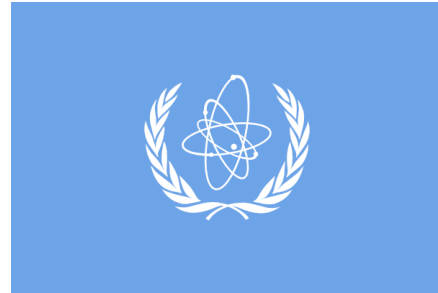
Even more recently, the Comprehensive Test Ban Treaty (1996) dictates that none of the signed countries will carry out a nuclear test, and encourages states to refrain or causing other states to test a warhead. The CTBT has been signed by 180 countries.

Along with the major nuclear treaties, there are also several small ones that deal more with creating free zones, and do not affect the US so directly. The Rarotonga Treaty bans nuclear tests in the South pacific (Diehl & Moltz, 2008)). The Bangkok Treaty includes the 10 countries of the region and stops them from acquiring a nuclear bomb ("Southeast Asian Nuclear-Weapon-Free," 2008). And the Pelindaba Treaty (signed by 32 countries of Africa) prohibits any country in the area from acquiring a nuclear weapon ("African Nuclear Weapons," 2008).

There are also some treaties that have yet to be ratified. The FMCT, or Fissile Material Cut-Off Treaty would help prevent the production of weapons grade uranium and plutonium ("Fissile Material Cut-off," n.d.). This treaty has huge support from the US and has been a major topic of interest at recent Global Security Institute summit meetings ("Global Security Institute," 2008).

## Role of the International Atomic Energy Agency (IAEA)

IAEA is an acronym for the International Atomic Energy Agency. There are three main “pillars” that IAEA programs are focused on: safety and security, science and technology and safeguarding and verification. While IAEA is not a part of the UN there is an important relationship between the two. The organization reports annually and will council with the UN in situations of international peace and security (International Atomic Energy Agency). The relationship with the United Nations is a very specialized one. It is an agency under the UN, but it is not under the control of any of the UN body. The agency also reports to both the General Assembly and the Security Council.



This is all defined under the document of IAEA’s Statute. This includes the structure of the body: there are the Governors, the General Conference, and the Secretariat (structure, IAEA wiki).



[http://www.thewashingtonnote.com/archives/2007/08/the\\_iaea\\_iran\\_r/](http://www.thewashingtonnote.com/archives/2007/08/the_iaea_iran_r/)

The current director of IAEA is Director General Mohamed ElBaradei; he won the Nobel Peace Prize in October 2005. When ElBaradei was awarded the Noble Peace Prize, he said that only one percent of the money in the budget would be spent on new weapons. Director General ElBaradei is only in office until the end of this year, so it should be interesting to see how a new director will deal with all the nuclear problems today. He leads the agency with six deputies that are the heads of the major departments. There are

thirty-five members of the board of governors that decide the budget and programs. A normal budget is around 283 million Euros per year. Also about eighty million is given to the agency by contributions.

President Eisenhower sought to create an agency in his speech “Atoms for Peace,” in December of 1953. In 1957, the International Atomic Energy Agency was founded. IAEA was thought to be useless after 1958 due to politics and the status of IAEA was quite weak. The agency was not funded well and was not working toward the three pillars. After the Cuban missile crisis in 1952, both the United States and USSR wanted more nuclear arms control and IAEA became the common ground for both nations. With the Nuclear Non-Proliferation Treaty in 1968 the IAEA became a large part of the nuclear weapons security program, and the search for nations’ nuclear reactors was enforced. Then in 1973 there was a high demand for nuclear energy because of the oil crisis, which promoted the search for more nuclear power, but the 1986 Chernobyl accident occurred, and the demand for nuclear power declined to almost none because of the fear of nuclear waste. In 1988, IAEA joined with the UN Food and Agricultural Organization to destroy a deadly livestock worm, and the radiation-based technology that killed the worms was found in IAEA’s labs. In 1991, the Nuclear Non-Proliferation Treaty was violated by North Korea. Also Iraq’s weapons program showed flaws in the safeguarding system. These incidents also brought about the strengthening of IAEA’s nuclear safety role. In 1995, the Nuclear Non-proliferation Treaty was made permanent. The agency was able to better deal with: the security of the nuclear reactors, verification of the peaceful use or storage of nuclear material from dismantled weapons and surplus military stocks of fissile material (‘Atoms for Peace’, n.d.).

Some of the current non-weapons programs the IAEA oversees include working with nuclear power and radiation to help the world and its people. They are finding ways to help boost crop production and livestock reproduction. The programs are backing twenty-four Africa countries in partnership with the Food and Agriculture Organization. Another program is to eradicate pests, such as worms, moths, and more that are harming livestock and crops. IAEA is also helping in human health. Nuclear medicine is used in Chemotherapy for cancer patients and to help vitro and in-vitro for diagnosing and managing diseases ('Atoms for Peace' n.d.). The agency is headquartered in Vienna, Austria, but it has many other regional offices in the United States, Japan, Switzerland and Canada.

## **NPT and Other Treaty Violations**

There have been countless violations of the terms of nuclear non-proliferation and disarmament treaties and agreements and there are even more that are assumed and unconfirmed. North Korea is one of the most noted countries for violating the terms and being the first to withdraw from the Treaty on the Non-Proliferation of Nuclear Weapons. North Korea's reason for withdrawal was "supreme interests of its country," but no exact reasons were given. North Korea ratified the treaty on December 12, 1985 and gave notice of withdrawal from the treaty on January 10, 2003 after accusations that it had started an illegal enriched uranium weapons program and the withdrawal became effective April 10, 2003. In 2005, North Korea openly declared that it possessed nuclear weapons and pulled out of the six-party talks hosted by China. Later in 2005, they agreed to get rid of all nuclear weapons and facilities, but in October 2006, North Korea's government announced they had successfully completed an underground test of a nuclear fission device. It is still believed that North Korea has uranium conversion facilities (Weapons of Mass Destruction." 8 Jan. 2007).

Libya ratified the Nuclear Non-Proliferation Treaty but undertook a secret nuclear weapons development program in violation of the terms of the treaty. Libya obtained materials illegally and developed actual weapons. Later they agreed to eliminate all weapons of mass destruction. All missiles were removed from Libya and all chemical weapons were destroyed on site with international verification ("Fact Sheet: Violations of U.N. Sanctions and Nuclear Non-Proliferation Treaty." 2007).

Iran is also a country that has been in violation of the terms of the Nuclear Non-Proliferation Treaty, but it has not given a notice of withdrawal. Iran announced to the

International Atomic Energy Agency its plans to advance its nuclear program, specifically planning on a long-term program to construct nuclear power plants. Upon inspection, extensive enrichment programs were discovered; later, two undeclared nuclear production facilities were discovered. Over the past couple of years, more facilities were found and it has been requested of Iran to discontinue activity. Currently Iran continues to proceed with its nuclear program (“Fact Sheet: Violations of U.N. Sanctions and Nuclear Non-Proliferation Treaty” 2007).

India, Israel, and Pakistan have all declined to sign the NPT . India and Pakistan have publicly announced having nuclear weapons and have successfully tested them. Israel’s government refuses to confirm or deny possession of nuclear weapons. It is believed that they have stockpiled between 100 and 200 warheads. Israel’s nuclear program is considered an open secret after a nuclear technician leaked information (“Fact Sheet: Violations of U.N. Sanctions and Nuclear Non-Proliferation Treaty.” 2007).

## **Laws and Agencies That Regulate Nuclear Weapons**

Possibly the first agency that restricted nuclear activity in America was the Atomic Energy Commission. After World War II the US Atomic Energy Commission (AEC) was created by Congress in order to control the production and research of atomic energies for peaceful purposes. The Atomic Energy Act also transferred control of nuclear research from the military to civil personal. Under the AEC, all research was done by non-governmental groups ("United States Atomic Energy Commission," 2009). All factories used for the production of nuclear material was still controlled by the government for security purposes. In 1954, the AEC was amended to control all forms of nuclear energy and its safety. The AEC has the right to inspect any nuclear power plant, assuring that the people located in proximity of the plant were kept safe. However, by 1974, the Commission had come under strong attack by critics who deemed it unnecessary, that it hampered the growth and development of the nuclear industry, and was disbanded. The Energy Reorganization Act of 1974 handed off the regulatory duties of the old AEC to the new US Nuclear Regulatory Commission (NRC), and placed research and development in the newly created Energy Research and Development Commission (ERDC) ("Energy Research and Development," 2008)

The Nuclear Regulatory Commission, after the dissolve of the AEC, took control of all oversight into matters regarding nuclear energy and safety. "Like its predecessor, the AEC, the NRC oversees reactor safety, reactor licensing and renewal, radioactive material safety and licensing, and waste management (storage and disposal). The NRC's mission is to regulate the nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, to

promote the common defense and security, and to protect the environment.” (“Nuclear Regulatory Commission,” 2009)

The Energy Research and Development Commission was created to handle all operations not assumed by the NRC. Such activities include management of “energy research and development, nuclear weapons, and naval reactors programs.” In 1977, the ERDC was dissolved and incorporated into the US Department of Energy (“Energy Research and Development,” 2008).

The United States Department of Energy was began its operation on the first of October of 1977. Primarily, the Department of Energy’s (DOE) is responsible “for energy policy and nuclear safety. Its responsibilities include the nation's nuclear weapons program, nuclear reactor production for the United States Navy, energy conservation, energy-related research, radioactive waste disposal, and domestic energy production.” There are three main operating units of the DOE. The Energy Information Administration (EIA), which collects data and statistics about nuclear energy here in the United States and publishes it, allowing for more governmental control and informed decision making. The second branch is known as the National Nuclear Security Administration (NNSA). The NNSA “works to improve national security through the military application of nuclear energy. The NNSA also maintains and improves the safety, reliability, and performance of the United States nuclear weapons stockpile, including the ability to design, produce, and test, in order to meet national security requirements.” The final independent agency of the DOE is the Office of Secure Transportation (OST). The OST is responsible for all transportation of nuclear related

materials, components, or waste material throughout the United States, and has been in operation since 1974 ("United States Department of Energy," 2009).

Throughout the years other countries have developed their own Atomic Energy Commissions. The United Nations had an AEC that lasted for two years. Their goal was to set up an agreement in which the United States (the only country with nuclear bombs at the time) would destroy its arsenal of nuclear warheads, in return the UN would prevent any other nation from acquiring a nuclear bomb. Soviet Russia abstained from the proposal, and the commission adjourned indefinitely in 1948 ("United Nations Atomic," 2008).

PAEC or the Pakistan Atomic Energy Commission was established in 1956 and is responsible for governing all of Pakistan's nuclear research and development. PAEC is the largest Science and Technology organization in the country ("Pakistan Atomic Energy," 2009).

India also has nuclear programs set up inside its government. India's Department of Atomic Energy was established in 1954 under a direct presidential order ("Department of Atomic Energy (India)," 2009). The DAE is responsible for all nuclear research and development, and power. Under the DAE is India's Atomic Energy Commission ("Atomic Energy Commission of India," 2008).

The Atomic Energy Commission of Japan has been around since 1955 and is solely responsible for all forms of nuclear energy in the country, research and development. Japan has never done research into nuclear energy for military purposes due to the States ban on nuclear weapons ("Japanese Atomic Energy," 2008).

Russia has had two nuclear energy organizations. Under the USSR, the Ministry of Nuclear Energy and Industry controlled all forms of nuclear energy, production, and

research. After the USSR's dissolve, Russia created MinAtom, or the Ministry for Atomic Energy of the Russian Federation. The ministry's job is similar to that of the United States NRC (Nuclear Regulatory Commission). MinAtom controls all industries surrounding nuclear energy, research, development, and transportation ("Rosatom," 2008).

## **Non-governmental Organization Goals Regarding Nuclear Weapons**

Non-government organizations (NGOs) help governments and people learn about how to make the world a more peaceful place. Although there are numerous NGO's that deal with nuclear non-proliferation, they all are reaching for the same goal: peace.

The Committee on Disarmament, Peace and Security is an NGO that started more than thirty years ago and is a liaison to the UN. The main purpose is to inform other NGOs on the status of negotiation, country positions, major obstacles and opportunities. They are the primary ally for the international movement of arms control, peace and disarmament and they have a worldwide constituency (NGO Committee on Disarmament, Peace, and Security, n.d.). Their major goal is the disarmament of nuclear weapons in the United States.



<http://disarm.igc.org/>

There are also research NGO's, like the British American Security Information Council. They examine security issues, nuclear and biological policies and military strategies. They are the first security group to cross the Atlantic ("About BASIC" n.d.)

Friends of the Earth is a very green NGO that believes differently than some of the others. They do not approve of nuclear energy and other uses of nuclear reactors. The energy is very clean, but FOE thinks it is very expensive and is too risky when there are other uses for it that are destructive and other options are available ("Friends of the Earth: Who We Are" n.d.). They site the Chernobyl Reactor accident as a prime example, stating, "The 20th anniversary of the nuclear meltdown at Chernobyl is a stark reminder that nuclear



power is the last technology in the world we should be pursuing to lessen global warming” (“Thoughts on Chernobyl Nuclear Power as the Worst Solution to Global Warming” 10/31/2008)..

Global Zero is an action plan that aims for the elimination of all nuclear weapons and was founded in 2008 by political, military, business, faith and civic leaders. They will bring leaders of the world together to discuss disarmament (“AboutGlobal Zero.” n.d.).



There are over thirty five different NGO groups dedicated to only working for disarming nuclear weapons or for complete nuclear non-proliferation and/or disarmament. They all want peace on the planet and they all attempt to affect how governments and peoples use nuclear weapons. These NGOs want to make people and governments aware of nuclear disarmament in order to bring about change. The more the public knows about this issue, they believe, the better.

## **Various International Perspectives on Nuclear Disarmament**

Many issues exist that cause strife in the world, but not many are as dangerous and important as the disarmament of nuclear weapons. With that said, it is imperative that all nations be able to agree upon terms for disarmament because it will only take one nation to meander from the path to plunge the world into another Cold War. Many countries differ in their opinions, some wanting disarmament, some wishing to arm with more weapons. A few of these countries, such as South Africa, India, Pakistan, Iran, Brazil, and Japan are able to shape policy just by what they say or believe.

### **SOUTH AFRICA**

Once a nuclear power, South Africa has shown true potential as a guiding light in the fight for disarmament. South Africa has been a country with a shady political past, with problems like apartheid and corrupt rulers populating their history. During this difficult time the regime in power had begun to join the upper echelons of military society by constructing a nuclear research facility at Pelindaba to fuel its nuclear plant at Koeberg. Along with the constructing of this facility, a secret nuclear weapons program was beginning, and fuel was also needed to build weapons grade material for bomb production. The psychology behind this bold move was to use the weapons as leverage with the United States and other Western countries. This leverage would work two ways: first it would demonstrate to these Western powers the existence of South Africa as a country of enormous power and it would, secondly, allow South Africa to threaten these Western powers if assistance for South Africa were not provided (Mbekelu, n.d.).

Another indicator of South Africa's desire for nuclear weapons is shown in the international dealings it had with Israel in the trade of over 300 tons of uranium. The country of South Africa, in return for this uranium, received top-notch help from the Israeli equivalent of the Manhattan Project, a group headed by genius Ernst David Bergmann. The relationship prospered and from 1967, when Ernst arrived, throughout the 70's a close relationship accrued between the two nations. When Israeli Chief of Staff Moshe Dayan made a secret visit to South Africa in 1974, he discussed weapon cooperation and the distinct possibility of a nuclear test ("Nuclear Weapons Program – South Africa." n.d.).

After this discussion of a nuclear test, two shafts were built in 1976 and 1977 that would be used for tests of these bombs without the potent uranium-235. Another presumed test is the rumored test of a joint Israeli-South African weapon, once again lacking uranium-235, that was exploded over the Indian Ocean. This event has been well documented in the form of rumor, but very few facts have surfaced. This possible detonation was dubbed the "Veal Incident" by the United States, which had picked up the double flash of the explosion via satellite ("Nuclear Weapons Program – South Africa." n.d.).

With the construction of the first totally weaponized device, created in August 1987, the eventual downfall of the South African nuclear program had begun. A total of seven nuclear bombs were created until, in February of 1990, the uranium enrichment plant, Y Plant in Valindaba, was shut down. Besides fueling the two reactors, the Koeberg power plant supplied much of the nuclear material needed to drive the South African nuclear program. Shortly afterward, in 1991, the African Ambassador to the

United States, Harry Schwarz, signed the Nuclear Non-Proliferation Treaty, prior to which all nuclear weapons had been dismantled. In 1994 the International Atomic Energy Agency also declared the nuclear program of South Africa finished and destroyed (South Africa: Nuclear Case Closed? 12/13/94).

## **INDIA AND PAKISTAN**

The India- Pakistan conflict has been publicly present for a long time, so it came as no surprise that this issue escalated once more with the introduction of nuclear arms. India tested its first nuclear weapon in 1974 in a flashy show of saber-rattling. Then, in 1998, after another Indian missile test, Pakistan replied with a nuclear test of its own (Operation Shakti: 1998, n.d.).

This situation deepens with the knowledge that India is believed to have enough fissile material for over 150 warheads, and the knowledge that Pakistan is slightly behind, holding somewhere between 80 and 120 warheads. With these stockpiles building, the fear of nuclear conflict is heightened by the thought of Pakistan being one of the few nations that do not have a “no first use” policy. This means that Pakistan reserves the right to launch nuclear missiles upon other nations without being attacked first. Pakistan’s main reason is based upon the any threat, mostly India, its neighbor of somewhat terse relations, is a nuclear power also (Nuclear Weapons: Nuclear Policy, 2005).

However, steps in the right direction have been taken. One such move is the United States-India Peaceful Atomic Energy Cooperation Act that was signed into law by the President of the United States of America on October 8, 2008. This agreement allowed the transfer of civilian nuclear technology from the United States into India. One

of the stipulations was that of India's 22 nuclear facilities, 14 of them must become civilian facilities, thus opening their doors to the IAEA for inspection. Unfortunately, such a happy ending was not in Pakistan's future. A similar agreement was hoped for by Pakistan, but when Pakistan attempted to reach such an agreement, the United States, along with the international community, found this to be a dangerous plan. Another controversial agreement was the India Safeguards Agreement, an agreement formed with the Nuclear Suppliers Group, that outlined India's plan to not share sensitive nuclear information and supplies with other countries along with a continuance of India's voluntary moratorium on the testing of nuclear weapons (IAEA Board Approves India-Safeguards Agreement, 8/2008).

Although this problem is far from resolved, several steps have been made to push for disarmament between India and Pakistan, two countries on the brink.

## **BRAZIL**

Another country that has had its policy affected by its past nuclear history is Brazil. While under military rule in 1978, the Brazilian government began the creation of a nuclear program in secret. Shortly afterward, in 1985, the civilian government was restored, although a heavy military presence still remained. Because of this dual rule, the nuclear program has followed suit with a double purpose. An open civilian system is underway that abides by the laws, rules and safeguards of the IAEA and is taken care of by the Brazilian Nuclear Corporation; this exists alongside a secretive and hidden military program that undoubtedly draws from the civilian program's success. Brazil has two civilian power reactors that supply energy to many people (Kingstone, 5/6/2006).

Unfortunately, a larger plant, operated by the Brazilian Navy, was inaugurated in 1988 at the Aramar Research Center. This enormous facility supplies energy to the community just like the above listed reactors at Angra nuclear power plant, but this facility also has the capability to produce weapons-grade enriched uranium, although Brazil has never been known to use this capability. Along with this facility, Brazil has built a heavy water production plant (Aramar Experimental Center, Iperó, n.d.).

Then, in 1991, the governments of both Brazil and Argentina ratified an inspection agreement that founded the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials. Three years later, in 1994, Brazil ratified the Treaty of Tlatelolco, a treaty that bans all nuclear weapons in South America. In 1998, Brazil joined five other nations in a pro-disarmament international initiative, then followed up by signing the Nuclear Non-Proliferation Treaty and the Comprehensive Test Ban Treaty, thrusting Brazil forward into the world as a pro-disarmament power.

## **JAPAN**

Japan has had a devastating experience with nuclear weapons, so it is no surprise that once seeing the power these weapons have, Japan has renounced the construction and development of these weapons. Although Japan wants no dealings with nuclear weapons, the nuclear power program in Japan is booming. As of 2005, Japan had 55 nuclear reactors that generated almost 30% of its electricity. Japan has projections stating that 60% of its electricity will be generated by nuclear reactors by the year 2050. This shows that even though Japan is strongly against the use of nuclear weapons, it is on the forefront of nuclear technology with its massive reliance on nuclear power (New Japanese nuclear power reactors delayed, 3/26/2006).

That is not to say that Japan does not have the technology or the materials to construct nuclear weapons. Many Japanese officials have stated that Japan has the capability to become a thermonuclear power. Japan, by the year 2000, held over 55 tons of separated reactor grade plutonium, enough plutonium to create approximately 10,000 warheads. Currently the situation surrounding Japan is deteriorating slowly with the increased growth of China and North Korea as nuclear powers (Large, 5/2/2005).

The country of Japan established the Three Non-Nuclear Principles, forbidding the ability to own or create weapons or even to allow the technology or weapons to be introduced into the country. Then in 1976, Japan joined several nations by signing the Treaty on the Non-Proliferation of Nuclear Weapons and once again stated its intention to adhere to its Three Non-Nuclear Principles, a policy that still stands today (Sublette, 8/2001).

## PROBLEMS WITH NUCLEAR ARMED COUNTRIES

Countries desire nuclear weapons because that raises their role in the world theater dramatically. It is inherently hypocritical for countries that refuse to eliminate their nuclear weapons to tell the rest of the world they should not bother trying to get some for their own defenses. For one nation to say it needs a newer, better bomb to defend it from its neighbors, but turn around and say that other countries do not and should not need it is hypocritical. These are the complaints that countries without nuclear weapons make, and sometimes rightly so. To many nations, the Nuclear Non-Proliferation Treaty is more a façade than actual deterrent of the production of nuclear weapons. It lacks the teeth to force countries with weapons to discard them, and it focuses more on preventing countries without nukes from obtaining them.

As C. Paul Robinson, the director of Sandia National Laboratories (one of the nations three primary nuclear weapons labs) and former chief negotiator at the U.S.-U.S.S.R. Nuclear Testing Talks in Geneva put it; “It seemed to me that the end state of total nuclear disarmament that the treaty envisions will occur around the same time that the lamb lies down with the lion. And I always argued that even at that point, the lamb still won’t get much sleep” ( IAEA Board of Governors: “Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran” September 2005)



Drawing by Dylan Moriarty

## NUCLEAR WEAPONS: WAR DETERRENT

Most countries do not want to go to war, but all are in constant fear of their neighbors. All nations strive for good national defenses and war deterrents. As of the 21<sup>st</sup> century, there are a few greater war deterrents than the possession of nuclear warheads. This is most recently shown through the United States actions to invade Iraq, which was claimed to be developing nukes, whereas no action was taken towards North Korea, which fully admitted having nuclear weapons. The only attacks *on* countries with these weapons have also almost been strictly limited to small radical groups, not imperialistic countries.

Issues regarding the enforcement of the Nuclear Non-Proliferation Treaty have sparked between countries developing nuclear power and existing nuclear states. With Iran in 2003, the U.N. declared that Iran had a fully operational nuclear program that was deemed “non-consensus decision to find Iran in noncompliance with its NPT Safeguards Agreement and to report that non-compliance to the UN Security Council.” Iran responded by defending their programs, citing that the United States and three European countries provided false and erroneous information regarding their peaceful nuclear weapons, and that the sanctions were unjust.

Unfortunately, to this day no compromise has been made, except some half hearted agreements on both sides. Iranian President Mahmoud Ahmadinejad has for the most part ignored orders to shut down Iran’s nuclear programs, exclaiming; "If they say that we should close down our fuel production facilities to resume talks, we say fine, but those who enter talks with us should also close down their nuclear fuel production activities” (Heinrich, 21 February 2007). The conflict going on between Iran and the

nuclear states continues, but may perhaps be a glaring example of what is to come with the other nations.

### **NUCLEAR PROLIFERATION AND STABILITY**

In the event of Nuclear Proliferation in non-armed countries, the consequences are heavily circumstantial. Some countries are relatively non-active and could probably handle the responsibility of nuclear programs for power, but there are others that would be more dangerous to the world if they were to obtain such weapons. As far as stability goes, it would only change in the event of a radical leader deciding to use such weapons in a small petty war. Nuclear weapons have been around for over 60 years and have only seen play two times, in a landmark decision that was implemented in an effort to end the worst war mankind ever endeavored.

In areas of high tension, like the Middle Eastern region, nuclear proliferation could be deadly. Most of the bigger countries there (Iran, Iraq, Lebanon, Israel, Syria) have ancient feuds and grudges, that with just the right tick could set off another conflict. After one of them obtained nuclear weapons, it would be safe to assume that the rest would do their most to appease them, while, of course, pushing their own nuclear development programs as quickly as they could.

Another region that would be greatly impacted from nuclear proliferation would be the Koreas. North Korea has tested one known nuclear bomb, and was working towards dismantling their nuclear program, but recent evidence may suggest that they are working towards constructing nuclear weapons again “What If North Korea Has Nuclear Weapons? Feb. 12, 2009). Even if North Korea were to develop nuclear weapons, though, it seems that it would serve mostly as an attention grabber than actual threat. For

the bulk of countries this is true, they do not want to kill mass amount of people, but they  
o desire some assistance from other nations. The easiest way to do so is to give them a  
reason to want to be your ally, and in the modern world, nuclear weapons seem to offer a  
sure fire way to do so.

## **Modernization of Nuclear Weapons: Technology and Treaty Ramifications**

When nuclear weapons first appeared on the international stage, they changed the face of warfare forever. War as our ancestors knew it was over. Nuclear weapons have, however, not stopped changing since Hiroshima. The most significant change to occur to the world's nuclear stockpiles is really not in the way the weapons are made, but in how they are deployed. This is the switch from “dumb” bombs (that were dropped from airplanes) to strategic weapons (that are used as warheads upon ballistic missiles). This new type of delivery changed the game completely, as large-scale, multi-megaton bombs became essentially obsolete. Even the mighty Tsar Bomba, the 50-megaton bomb created by the Soviet Union is no match for weapons such as the “Minuteman” the United State's intercontinental ballistic missile (ICBM for short) that is capable of speeds up to 15,000 miles per hour (LGM-30 Minuteman, 2009; The Tsar Bomba, 2007). Despite the fact that the Minuteman's warhead (most recently the W87) only has a yield of 300 kilotons, the fact that this payload can reach across oceans in mere minutes is a game-changer (The W87 Warhead, 2001). While one would think that less death and destruction would be caused in the event of a nuclear war with these advanced weapons, that is simply not the case. The bomb that was dropped on Hiroshima measured 21 kilotons, an order of magnitude lower than the “small” W87. In addition to this, the tactics of bombing have changed. In the event of a nuclear assault, a nuclear power combatant would calculate the placement of warheads to form a “carpet” of explosions in a practice called carpet bombing. This is a quantity over quality philosophy, using multiple weapons in case of failure instead of a single bomber carrying a massive bomb.

<u>Country</u>	<u>Nuclear Stockpiles</u>	
	<u>Strategic</u>	<u>Non-Strategic</u>
Russia	2,800	2,050
United States	2,200	500
France	300	N/A
China	180	?
United Kingdom	160	N/A
Israel	80	N/A
Pakistan	60	N/A
India	60	N/A
North Korea	<10	N/A

<http://www.fas.org/programs/ssp/nukes/nukestatus.html>

If anything, a hypothetical nuclear war has only become more destructive and devastating. The United States, though, is not the only state to possess ICBMs. Russia and

China also have ICBMs. India has ICBMs that are currently under development. Both France and the United Kingdom have long-range ballistic missiles that are launched from nuclear submarines. These weapons, the M45 and the Trident, could be considered intercontinental (Godsberg, A. 2008, March). North Korea is also rumored to be developing an ICBM, but the project has not been confirmed as of yet (Vick, C. P. (2008, May 30). These nations make up an elite inside of an elite, an “ICBM club” within the nuclear club. Missile-based weaponry does not stop here, however, as shorter range ballistic missiles and cruise missiles are common to all nuclear powers, with the only exception being the United Kingdom. The UK’s nuclear stockpile consists solely of long-range sea-based Trident missiles on board the Royal Navy’s four Vanguard-class submarines (Godsberg, A. 2008, March).

The newer nuclear powers (read: everybody besides the US and Russia) do not have any of the traditional non-strategic, “dumb bomb” weapons (Kristensen, H. M. 2009, February 27). The two original nuclear powers maintain large stockpiles of both types of weapons, but the majority of those weapons are currently inactive. In addition to land-based and sea-based missiles, air-based missiles are also commonplace. Since these missiles are launched from planes, they are generally smaller than the other two types.

These types of missiles are launched from bombers that would have, in the past, carried simple gravity bombs such as the US's B-52 and Russia's Tu-95. These bombers can be outfitted with relatively short-range cruise missiles and other small tactical nukes. All of the nuclear powers have aircraft capable of carrying nukes in this manner, but the United Kingdom does not have any outfitted, and the status of North Korea's weapons is uncertain.

Since the weapons have changed dramatically over the years, new treaties have emerged on the scene. The treaties were meant to limit ballistic weapons, but most were only between the United States and the Soviet Union. Since the dissolution of the Soviet Union, the United States has withdrawn itself from some of the treaties it signed earlier, such as the Anti-Ballistic Missile Treaty. This treaty, signed in 1972, was designed to keep the balance of power by stopping the development of the Strategic Defense Initiative, or SDI. The US government unilaterally withdrew from the treaty in 2002 . The Strategic Arms Reduction Treaty, or START I, was designed to limit the number of nuclear weapons between the two powers (Nuclear Arms Race, 2009). It is still in effect to this day, and is being honored by the United States and Russia, Belarus, Ukraine, and Kazakhstan. The latter three have all disposed of their nuclear weapons. START I is set to expire on December 5, 2009, but the Obama administration is interested in renewing the treaty (Nuclear Arms Race, 2009). There are two other START treaties, START II and START III, both with the goal of further reducing nuclear stockpiles, but both failed to become ratified. Other treaties between the two powers have included the Intermediate-Range Nuclear Forces Treaty, the SORT or Moscow Treaty which sought to further reduce the number of nuclear weapons, and the SALT talks, which were

agreements that were a precursor to bilateral talks between the two nations. Treaties about reducing nuclear stockpiles have, so far, been only between the United States and Russia (Nuclear Arms Race, 2009).

## **Safety, Security, Protection and Accountability of Nuclear Weapons**

According to the Los Alamos and Lawrence Livermore National Laboratories, there are a great many steps that have been taken by these laboratories to protect, control and account for the nuclear weapons within the United States and, to some extent, those that are outside of the U.S. The majority of these control resources fall under the categories of specific detection technologies and domestic control entities.

Detection and remote-sensory equipment includes an array of technological gadgets and machines including infrasonic sensors, tomography scanners, handheld isotope identification and stealth planes. The infrasonic sensor program (also known as the International Monitoring System) was developed by scientist ReVelle of the Los Alamos National Laboratory. Perfected to detect infrasonics (sound waves below the range of human hearing) that are produced by meteors, volcanoes, missile launches and man-made explosions, this program utilizes special microphones and other methods of detection – such as radar and seismic and satellite sensors – to predict, locate and pinpoint potential nuclear explosions (*Hear No Evil*, 2008-09).

Los Alamos National Laboratory also developed the muon tomography scanners to “rapidly and reliably identify and locate radioactive materials” (*Detecting Dangerous Substances*, 2008-09). Muons, which are subatomic particles produced naturally by cosmic ray interaction, enable the scanner to pick up radiation that may be hidden in cargo containers or shielded by lead. The scanner can find and report the threat without exposing anyone or anything to the perils of radiation (*Detecting Dangerous Substances*, 2008-09).

Another emerging method of detection that differentiates between innocent and potentially-harmful sources of radiation is the handheld isotope identification technology known as RadScout. The handheld RadScout is the first portable unit to use gamma ray detectors to pinpoint radioactive substances, and it is likewise the first device of its type designed and licensed to be distributed to entities that include the Department of Energy and the Department of Defense. The Lawrence Livermore National Laboratory stresses that the use of these units at “airports, border crossings, and seaports” will enable detection and accurate synopsis of the seriousness of radioactive substances in a way that will protect military personnel, medical workers, public health officials, and police (among numerous others) and likewise enable them to “protect the nation against further terrorist attacks, guard U.S. borders and airports, and protect the nation's infrastructure.” (*Handheld Isotope Identification*, 2008-09).

One of the most sci-fi (but real) detection technologies is the development of a stealth plane, ASPECT, or the Airborne Spectral Photometric Collection Emergency Response Project. This plane, developed by researchers at Los Alamos National Lab, is a twin-engine Aerocommander 680 with a built-in multi-spectral infrared mapping system as well as an ASPECT package, or a Fourier Transform Infrared spectrometer system. The plane is designed to go into emergency environments (i.e. areas hit by hurricanes) and provide the first responders “with critical information regarding the size, shape, composition, and concentration of gas clouds” while the second sensor, an Infrared Line Scanner, shoots a picture of the ground beneath the plane and records information on the smoke/gas plumes. GPS is then used to create a map from all of the data and the images; this is then used to predict where air full of toxins might accumulate. This technology,

while not necessarily useful in the controlling of nuclear arms, may very well serve to be of use in saving people in the future should an attack take place (*Protection from the Sky*, 2008-08).

Ultimately, the most effective control over the nuclear weapons lies not in the wiring of advanced technology, but rather in the hands and the heads of those who hold the secrets of the technology. Domestic control groups, based at the National Laboratories at Los Alamos and Lawrence Livermore, include the Weapons and Complex Integration (WCI) Principal Associate Directorate, Homeland Defense Operational Planning System (HOPS), the Forensic Science Center (FSC), and the National Atmospheric Release Advisory Center (NARAC). The Weapons and Complex Integration Principal Associate Directorate, or WCI, is the administration out of Lawrence Livermore responsible for “ensuring the safety, reliability, and security of the U.S. nuclear stockpile without nuclear testing, for developing advanced manufacturing and materials technologies to maintain our nation's stockpile, and for ensuring the safe dismantlement of retired weapons” (Goodwin, 2008).

Another domestic control group is the Homeland Defense Operational Planning System (HOPS), which utilizes the most cutting-edge technologies and brilliant minds to develop and provide susceptibility reviews of crucial infrastructures associated with numerous things from the military to agriculture. HOPS, according to Lawrence Livermore National Lab, is being used more and more by the National Guard in the evaluation and response-planning to the unleashing of weapons of mass destruction threats upon important – “critical” – infrastructures in the United States. Essentially, this

preparedness also incorporates constant updates and knowledge as to the condition (and whereabouts) of the stateside stockpile (*Operational Planning Tools*, 2008).

The Forensic Science Center – or FSC – has, according to Lawrence Livermore, achieved national recognition in its combination of modern science and technological savvy to aid national-security programs with counter-terrorism tactics (i.e. chemical, nuclear, and biological). While collaborating with these programs and providing for “the immediate, short-term needs,” the FSC also pursues fundamentally basic research in the domains of “analytical science and instrument development, nuclear forensic analysis, and the synthesis of new molecular and tailored nanostructured materials” – in other words, it is the job of this department to keep the stockpiles updated while not necessarily increasing the sizes (*Forensic Science Center (FSC)*, 2008).

The final domestic control entity is NARAC, or the National Atmospheric Release Advisory Center. NARAC, located at the Lawrence Livermore National Laboratory, supplies equipment and services to the government that calculate and map the most-likely spread of harmful matter that has been accidentally or intentionally put into the atmosphere. This information is then used to decide upon the best course of action for the protection of people in the affected vicinities. NARAC acts as “a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions” (*National Atmospheric Release Advisory Center*, 2006).

## Approaches to Maintaining Safety and Security of Nuclear Weapons and Ways Around Such Approaches

If one had a gun located in a house with small children, one would want to make sure that the gun was properly secured. In the same way, the world's leaders want to be sure that nuclear weapons are properly secured and not easily accessible to would-be world conquerors and terrorists. To this end, many international controls and multilateral treaties attempt to maintain the safety and security of nuclear weapons and weapons locations, but this is no easy task.

One of the major organizations created to ensure this security is the International Atomic Energy Agency, or the IAEA. The role of the IAEA is to safeguard the nuclear activities and nuclear materials of member states and to make sure that the non-nuclear



Collecting samples from trees as part of the environmental monitoring program  
[http://www.iaea.org/Publications/Factsheets/English/S1\\_Safeguards.pdf](http://www.iaea.org/Publications/Factsheets/English/S1_Safeguards.pdf)

states are not developing weapons. It does so by monitoring the quantities of nuclear material in a facility and the changes in the quantities over time. Safeguarding activities take place in over 900 facilities in over 70 countries (*IAEA Safeguards*, n.d.).

However, the effectiveness of the IAEA depends largely on the member nations' willingness to comply with the regulations and allow access for inspections.

Obviously, not all countries do this. Iran is one example. Iran, although a member country, has not agreed to provide access to the IAEA to some locations related to uranium mining, milling, and enrichment, leading the IAEA to say they are unsure

about the presence of undeclared nuclear materials and activities and the possibility of a weapons program (ElBaradei, 2009).

Countries with covert nuclear weapons programs use various techniques to cover up their weapons work. Syria constructed a non-descript building in a remote area near al

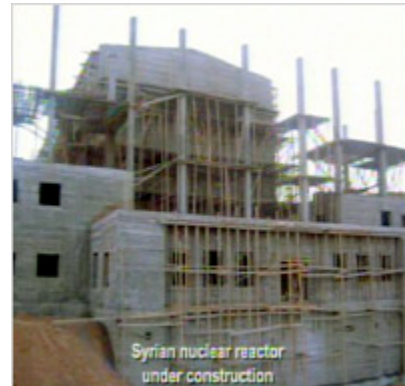
Kibar that was home to a nuclear reactor. It was built in a canyon to maintain its secrecy and a light roof and curtain walls were added to disguise the building.

United States' intelligence reports suggest that North Korea helped the Syrians construct this reactor.

Unfortunately for the Syrians, satellite imaging

revealed this suspicious-looking building and, on September 6, 2007, Israel bombed it.

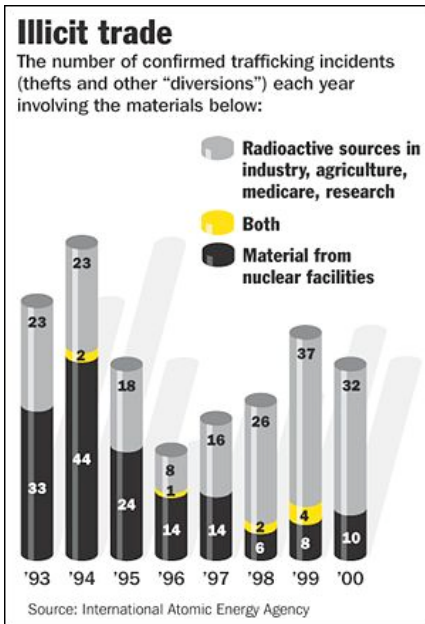
Syria then attempted to cover up the fact that this was a nuclear reactor by destroying the rest of the building on October 10, 2007 (*Background Briefing*, 2008).



[http://photos.state.gov/libraries/usinfo/3234/Week\\_4/042508\\_080424027771\\_200.jpg](http://photos.state.gov/libraries/usinfo/3234/Week_4/042508_080424027771_200.jpg)

A similar instance occurred in Iran in 2004. The US accused Iran of razing a site in the suburb of Tehran to hide banned nuclear activity, but Iran said it was simply razing the building in order to build a park (*Iran Says*, 2004). More recently, North Korea has said that it plans to launch a “satellite” into orbit. Other countries suspect that this “satellite” is actually a missile (*North Korea to Launch*, 2009).

So, although treaties and sanctions are in place to stop the spread of nuclear weapons, they are spreading anyway. A possible cause of this is the presence of “loose nukes,” or unsecured nuclear material or weapons. As of 2005, there was enough nuclear material in the former Soviet Union to make 80,000 nuclear weapons, and only half of it was secured. Some sites in Russia were protected by simple locks or just wax and some



<http://www.csmonitor.com/2001/1205/csmimg/1205p12a.jpg>

string (*Hunting Loose Nukes*, 2005). In the US, in 2005, barrels of nuclear waste containing 5,000 pounds of plutonium were stored in a tent outside of the Los Alamos laboratory. Nuclear research reactors on college campuses also have poor security, guarded by unmanned guard booths and unlocked doors (Ross, 2005). One cannot imagine that it would be overly difficult for a terrorist or spy to steal some valuable

information or material. Ultimately, the only

foolproof way to make sure that nuclear weapons and materials do not get into the wrong hands is to destroy it. This is why disarmament is such an important issue.

## Works Cited

“About BASIC”. (n.d.). Retrieved March 13, 2009, from BASIC Website:

<http://www.basicint.org/about.htm>

“AboutGlobal Zero.” (n.d.). Retrieved March 13, 2009, from Global Zero Website:

<http://www.globalzero.org/>

African Nuclear Weapons Free Zone Treaty. (2008, December 29). *Wikipedia*. Retrieved

March 13, 2009, from [http://en.wikipedia.org/wiki/Pelindaba\\_treaty](http://en.wikipedia.org/wiki/Pelindaba_treaty)

*Antarctic Treaty System*. (2009, March 11). Retrieved March 12, 2009, from

[http://en.wikipedia.org/wiki/Antarctic\\_Treaty](http://en.wikipedia.org/wiki/Antarctic_Treaty)

“A Brief History of the NPT.” (n.d.) Retrieved 17 Mar. 2009 from BASIC Website:

<http://www.basicint.org/nuclear/NPT/history.htm>.

“Aramar Experimental Center, Iperó” (28 April 2005) Retrieved from Global Security

Website: <http://www.globalsecurity.org/wmd/world/brazil/aramar.htm>

Atomic Energy Commission of India. (2008, February 15). *Wikipedia*. Retrieved March

16, 2009, from

[http://en.wikipedia.org/wiki/Atomic\\_Energy\\_Commission\\_of\\_India](http://en.wikipedia.org/wiki/Atomic_Energy_Commission_of_India)

“The ‘Atoms for Peace’ Agency.” (n.d.) Retrieved March 13, 2009 from the

International Atomic Energy Agency Website:

<http://www.iaea.org/About/index.html>

*Background briefing with senior U.S. officials on Syria’s covert nuclear reactor and*

*North Korea’s involvement*. (2008, April 24). Retrieved March 17, 2009, from

[http://www.dni.gov/interviews/20080424\\_interview.pdf](http://www.dni.gov/interviews/20080424_interview.pdf)

Department of Atomic Energy (India). (2009, January 6). *Wikipedia*. Retrieved March 16, 2009, from [http://en.wikipedia.org/wiki/Department\\_of\\_Atomic\\_Energy\\_\(India\)](http://en.wikipedia.org/wiki/Department_of_Atomic_Energy_(India))

Diehl, S. J., & Moltz, J. C. (2008). Data and Documents. In *Nuclear Weapons and Nonproliferation* (pp. 216-217). Santa Barbara, California: ABC-CLIO, Inc.

ElBaradei, M. (2009, February 19). *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*. Retrieved March 16, 2009, from <http://www.iaea.org/Publications/Documents/Board/2009/gov2009-8.pdf>

Energy Research and Development Administration. (2008, December 17). *Wikipedia*. Retrieved March 13, 2009, from [http://en.wikipedia.org/wiki/Energy\\_Research\\_and\\_Development\\_Administration](http://en.wikipedia.org/wiki/Energy_Research_and_Development_Administration)

Energy Research and Development Administration. (2008, December 17). *Wikipedia*. Retrieved March 13, 2009, from [http://en.wikipedia.org/wiki/Energy\\_Reorganization\\_Act\\_of\\_1974](http://en.wikipedia.org/wiki/Energy_Reorganization_Act_of_1974)

“Fact Sheet: Violations of U.N. Sanctions and Nuclear Non-Proliferation Treaty.” The Israel Project. (2007) Retrieved 16 Mar. 2009 from The Israel Project Website: [http://www.theisraelproject.org/site/c.hsJPK0PIJpH/b.2948043/k.95B6/Irans\\_Violation\\_of\\_Nuclear\\_NonProliferation\\_Treaty\\_and\\_UN\\_Sanctions.htm](http://www.theisraelproject.org/site/c.hsJPK0PIJpH/b.2948043/k.95B6/Irans_Violation_of_Nuclear_NonProliferation_Treaty_and_UN_Sanctions.htm).

Fissile Material Cut-off Treaty. (n.d.). *Wikipedia*. Retrieved March 13, 2009, from <http://en.wikipedia.org/wiki/FMCT>

“Friends of the Earth: Who We Are” (n.d.). Retrieved March 13, 2009, from Friends of the Earth Website: <http://www.foe.org/who-we-are>

Global Security Institute. (2008, July 23). *Wikipedia*. Retrieved March 13, 2009, from [http://en.wikipedia.org/wiki/Global\\_Security\\_Institute](http://en.wikipedia.org/wiki/Global_Security_Institute)

Godsberg, A. (2008, March). *Nuclear Forces Guide*. Retrieved March 16 2009, from Federation of American Scientists Website:  
<http://www.fas.org/nuke/guide/summary.htm>

Goodwin, B. T. (2008, July 3). Basic Science is Creative Science. In *Weapons and Complex Integration (WCI)* [Letter from Principal Associate Director for WCI]. Retrieved March 17, 2009, from Lawrence Livermore National Security, LLC Web site: <https://wci.llnl.gov/>

Heinrich Mark. (21 February 2007) “Iran bullish on threat to force climbdown on its nuclear projects.” Retrieved March 18, 2009 from News.scotsman at their Website: <http://news.scotsman.com/iran/Iran-bullish-on-threat-to.3348353.jp>

*Hunting loose nukes in Eastern Europe*. (2005, October 15). Retrieved March 17, 2009, from <http://abcnews.go.com/Nightline/LooseNukes/story?id=1208241>

“IAEA Board Approves India-Safeguards Agreement” (1 August 2008) Retrieved from IAEA Website: <http://www.iaea.org/NewsCenter/News/2008/board010808.html>

*IAEA safeguards: stemming the spread of nuclear weapons*. (n.d.). Retrieved March 16, 2009, from [http://www.iaea.org/Publications/Factsheets/English/S1\\_Safe\\_guards.pdf](http://www.iaea.org/Publications/Factsheets/English/S1_Safe_guards.pdf)

India’s Nuclear Weapons Program: Present Capabilities (5 April 2001). Retrieved from Nuclear Weapon Archive Website:  
<http://nuclearweaponarchive.org/India/IndiaArsenal.html>

“International Atomic Energy Agency: Structure and Function.” (n.d.). Retrieved March 13, 2009, from Wikipedia Website:

[http://en.wikipedia.org/wiki/International\\_Atomic\\_Energy\\_Agency](http://en.wikipedia.org/wiki/International_Atomic_Energy_Agency)

*Iran says making a park, not hiding nuclear activities.* (2004, June 28). Retrieved March 17, 2009, from <http://www.smh.com.au/articles/2004/06/28/1088274636494.html?from=moreStories>

Japanese Atomic Energy Commission. (2008, April 6). *Wikipedia*. Retrieved March 16, 2009, from [http://en.wikipedia.org/wiki/Japanese\\_Atomic\\_Energy\\_Commission](http://en.wikipedia.org/wiki/Japanese_Atomic_Energy_Commission)

Kingstone, Steve. “Brazil Joins Nuclear Club” (6 May 2006) Retrieved March 16, 2009 from BBC News Website:

<http://news.bbc.co.uk/1/hi/world/americas/4981202.stm>

Kristensen, H. M. (2009, February 27). *Status of World Nuclear Forces*. Retrieved March 16 2009, from Federation of American Scientists Website:

<http://www.fas.org/programs/ssp/nukes/nukestatus.html>

Large, John H. (2 May 2005) “The Actual and Potential Development of Nuclear Weapons Technology in the Area of North East Asia” Retrieved from Large Associates Website: <http://www.largeassociates.com/R3126-A1-%20final.pdf>

Lawrence Livermore National Security, LLC. (2008, June 23). Forensic Science Center (FSC). In *Global Security*. Retrieved March 17, 2009, from National Nuclear Security Administration Web site: <https://www-gs.llnl.gov/.html>

Lawrence Livermore National Security, LLC. (2008, June 23). Handheld Isotope Identification. In *Global Security* [ORTEC RadScout]. Retrieved March 17, 2009, from National Nuclear Security Administration Web site: <https://www-gs.llnl.gov/.html#>

Lawrence Livermore National Security, LLC. (2008, June 23). Operational Planning Tools. In *Global Security* [Homeland Defense Operational Planning System (HOPS)]. Retrieved March 17, 2009, from National Nuclear Security Administration Web site: <https://www-gs.llnl.gov/html>

LGM-30 Minuteman. (2009). Retrieved March 16 2009, from Wikipedia Website: [http://en.wikipedia.org/wiki/LGM-30\\_Minuteman](http://en.wikipedia.org/wiki/LGM-30_Minuteman)

Los Alamos National Security, LLC. (2008-09). Detecting Dangerous Substances. In *Security* [Muon tomography scanner]. Retrieved March 17, 2009, from U.S. Dept. of Energy Web site: [http://www.lanl.gov//\\_tomography\\_scanner](http://www.lanl.gov//_tomography_scanner)

Los Alamos National Security, LLC. (2008-09). Hear No Evil. In *Security* [Infrasonic sensors]. Retrieved March 17, 2009, from U.S. Dept. of Energy Web site: [http://www.lanl.gov//\\_no\\_evil](http://www.lanl.gov//_no_evil)

Los Alamos National Security, LLC. (2008-09). Protection from the Sky. In *Security* [Stealth plane]. Retrieved March 17, 2009, from U.S. Dept. of Energy Web site: [http://www.lanl.gov//\\_airplanes](http://www.lanl.gov//_airplanes)

Mbekelu, Wendy, "Tracking Nuclear Proliferation" (n.d.) Retrieved March 16, 2009 from News Hour Website: [http://www.pbs.org/newshour/indepth\\_coverage/military/proliferation/countries/s-africa.html](http://www.pbs.org/newshour/indepth_coverage/military/proliferation/countries/s-africa.html)

Multiple independently targetable reentry vehicle. (2009, March 13). Retrieved March 13, 2009, from Wikipedia Website:

[http://en.wikipedia.org/wiki/Multiple\\_independently\\_targetable\\_reentry\\_vehicle](http://en.wikipedia.org/wiki/Multiple_independently_targetable_reentry_vehicle)

National Atmospheric Release Advisory Center. (2006, November 9). National

Atmospheric Release Advisory Center. In *NARAC*. Retrieved March 17, 2009, from Lawrence Livermore National Laboratory Web site:

<https://narac.llnl.gov/.php>

“New Japanese nuclear power reactors delayed” (26 March 2008) Retrieved from World

Nuclear News Website: [http://www.world-nuclear-news.org/NN-](http://www.world-nuclear-news.org/NN-New_Japanese_nuclear_power_reactors_delayed-260308.htm)

[New\\_Japanese\\_nuclear\\_power\\_reactors\\_delayed-260308.htm](http://www.world-nuclear-news.org/NN-New_Japanese_nuclear_power_reactors_delayed-260308.htm)

NGO Committee on Disarmament, Peace, and Security. (n.d.). Retrieved March 13,

2009, from NGO Committee on Disarmament, Peace, and Security Website:

<http://disarm.igc.org/>

“North Korea’s Nuclear Weapons Program.” (25 Oct. 2006). Retrieved 17 Mar. 2009

from the Nuclear Weapon Archive Website:

<http://nuclearweaponarchive.org/DPRK/index.html>.

*North Korea to launch satellite*. (2009, February 24). Retrieved March 17, 2009, from

[http://www.usatoday.com/news/world/2009-02-23-north-korea\\_N.htm](http://www.usatoday.com/news/world/2009-02-23-north-korea_N.htm)

Nuclear Arms Race. (2009). Retrieved March 17 2009, from Wikipedia Website:

[http://en.wikipedia.org/wiki/Nuclear\\_arms\\_race](http://en.wikipedia.org/wiki/Nuclear_arms_race)

Nuclear Non-Proliferation Treaty. (2009, April/May 3). *Wikipedia*. Retrieved March 13,

2009, from <http://en.wikipedia.org/wiki/NNPT>

Nuclear Regulatory Commission. (2009, February 18). *Wikipedia*. Retrieved March 16, 2009, from [http://en.wikipedia.org/wiki/Nuclear\\_Regulatory\\_Commission](http://en.wikipedia.org/wiki/Nuclear_Regulatory_Commission)

Nuclear Treaties and Agreements. (1998). *Think Quest*. Retrieved March 13, 2009, from <http://library.thinkquest.org/17940/texts/timeline/treaties.html>

“Nuclear Weapons: Nuclear Policy” (2005) Retrieved March 18, 2009 from comeclean.org Website: <http://www.comeclean.org.uk/articles.php?articleID=25>

“Nuclear Weapons Program - South Africa.” (n.d.) Retrieved March 17, 2009 from Global Security Website: <http://www.globalsecurity.org/wmd/world/rsa/nuke.htm>

“Operation Shakti: 1998” (n.d.) Retrieved March 16, 2009 from Nuclear Weapon Archive Website: <http://nuclearweaponarchive.org/India/IndiaShakti.html>

Pakistan Atomic Energy Commission. (2009, March 13). *Wikipedia*. Retrieved March 16, 2009, from [http://en.wikipedia.org/wiki/Pakistan\\_Atomic\\_Energy\\_Commission](http://en.wikipedia.org/wiki/Pakistan_Atomic_Energy_Commission)

Rosatom. (2008, December 29). *Wikipedia*. Retrieved March 16, 2009, from [http://en.wikipedia.org/wiki/Federal\\_Atomic\\_Energy\\_Agency](http://en.wikipedia.org/wiki/Federal_Atomic_Energy_Agency)

Ross, B. (2005, October 15). *Loose nukes: Inadequate security measures*. Retrieved March 17, 2009, from <http://abcnews.go.com/WNT/Technology/Story?id=1200705&page=1>

Southeast Asian Nuclear-Weapon-Free Zone Treaty. (2008, December 8). *Wikipedia*. Retrieved March 13, 2009, from [http://en.wikipedia.org/wiki/Bangkok\\_Treaty](http://en.wikipedia.org/wiki/Bangkok_Treaty)

“Thoughts on Chernobyl Nuclear Power as the Worst Solution to Global Warming.” (April 25, 2006) Retrieved March 18, 2009 from BASIC Website: <http://www.foe.org/thoughts-chernobyl-nuclear-power-worst-solution-global-warming>

“South Africa: Nuclear Case Closed?” (n.d.) Retrieved March 17, 2009 from Website:

<http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB181/sa34.pdf>

*Strategic Arms Reduction Treaty II.* (n.d.) Retrieved March 13, 2009, from Atomic

Archive Website: <http://www.atomicarchive.com/Treaties/Treaty20.shtml>

Sublette, Carey. (9 August 2001) “Nuclear Weapons and Arsenals” Retrieved March 18, 2009 from Nuclear Weapon Archive Website:

<http://nuclearweaponarchive.org/Nwfaq/Nfaq7.html>

“Treaty on Non-Proliferation of Nuclear Weapons.” (2000) Retrieved 16 Mar. 2009 from

United Nations Website: <http://www.un.org/events/npt2005/npptreaty.html>.

*The Tsar Bomba.* (2007, September 3) Retrieved March 17 2009, from Nuclear Weapons

Archive Website: <http://nuclearweaponarchive.org/Russia/TsarBomba.html>

United Nations Atomic Energy Commission. (2008, November 22). *Wikipedia*. Retrieved March 16, 2009, from

[http://en.wikipedia.org/wiki/United\\_Nations\\_Atomic\\_Energy\\_Commission](http://en.wikipedia.org/wiki/United_Nations_Atomic_Energy_Commission)

United States Atomic Energy Commission. (2009, March 13). *Wikipedia*. Retrieved March 13, 2009, from

[http://en.wikipedia.org/wiki/United\\_States\\_Atomic\\_Energy\\_Commission](http://en.wikipedia.org/wiki/United_States_Atomic_Energy_Commission)

United States Department of Energy. (2009, March 15). *Wikipedia*. Retrieved March 16,

2009, from [http://en.wikipedia.org/wiki/United\\_States\\_Department\\_of\\_Energy](http://en.wikipedia.org/wiki/United_States_Department_of_Energy)

*U.S.-Soviet/Russian Nuclear Arms Control.* (2002, June) Retrieved March 17 2009, from Arms Control Association Website:

[http://www.armscontrol.org/act/2002\\_06/factfilejune02](http://www.armscontrol.org/act/2002_06/factfilejune02)

Vick, C. P. (2008, May 30). *Taep'o-dong 2*. Retrieved March ,17 2009, from Federation of American Scientists Website: <http://www.fas.org/nuke/guide/dprk/missile/td-2.htm>

*The W87 Warhead*. (2001, September 1) Retrieved March 16 2009, from Nuclear Weapons Archive Website:  
<http://nuclearweaponarchive.org/Usa/Weapons/W87.html>

“Weapons of Mass Destruction.” (8 Jan. 2007). Retrieved 16 Mar. 2009 from Federation of American Scientists Website: <http://www.fas.org/nuke/guide/israel/nuke/>

“What If North Korea Has Nuclear Weapons? Feb. 12, 2009 Retrieved March 18, 2009 from OhmyNews Website:  
[http://english.ohmynews.com/ArticleView/article\\_view.asp?article\\_class=13&no=384791&rel\\_no=1](http://english.ohmynews.com/ArticleView/article_view.asp?article_class=13&no=384791&rel_no=1)