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MONITORED THIS ISSUE:

THE ONGOING FUKUSHIMA NUCLEAR DISASTER AND THE CONTINUING IMPACT

Four months after the earthquake and the resulting tsunami damaged the Fukushima Daiichi Nuclear Power Plant senior engineers at Tokyo Electric Power Co. (Tepco) admit that they knew that a potentially dangerous design flaw in five of the nuclear reactors weren't fully upgraded, the Wall Street Journal reported on July 1. Meanwhile the nuclear power plant continues to leak large amounts of radioactive substances. After initial problems and failures, workers succeeded in setting up a machinery to clean contaminated water and then use it to cool the reactors, while other workers had to repair a leaking hose in reactor 5 and to double the amount of water being injected into unit 1 after the water level decreased. Tepco said it will soon begin injecting nitrogen into reactor 3 to prevent a hydrogen explosion. Medical tests in Fukushima prefecture reveal that almost half of the children tested positive for thyroid exposure. High levels of cesium were found in the soil at four locations of Fukushima city, 60 km away. The scientist who coordinated this soil survey says that these areas have to evacuated.

(730.6151) Laka Foundation – In what could be an attempt to distract attention from generic unsafe nuclear reactors to 'specific unsolved safety problems at Fukushima', former senior and current engineers at Tepco, including those who were involved when the design decisions were made in the 1970s, stated that Tepco knew for years that five of its Fukushima nuclear reactors had a potentially dangerous design flaw. The company, however, didn't fully upgrade them, dooming them to failure when the earthquake hit, according to the statement. Tepco used two different designs for safeguarding its 10 reactors in Fukushima Daiichi and Daini. After the March 11 quake, the five reactors with the newer design withstood the resulting 12-meter tsunami without their vital cooling systems failing. Those reactors shut down safely. The cooling systems of four units with older designs, however, failed, and the backup generators and other equipment for switching were flooded, ultimately causing melt downs in three reactors.

Some of the engineers declared that Tepco had opportunities to retrofit the oldest reactors in the past decades. They blame a combination of complacency, cost-cutting pressures and lax regulation for the failure to do so (not extra-ordinary for Tepco, considering it's history). However, spokesman for Tepco declined to comment for this story, citing the Japanese government's ongoing investigation into the cause of the accident.

Because Tepco's first reactor buildings were small, the generators had to go somewhere else. They put them into neighboring structures that house turbines. The reactor buildings had thick concrete walls and dual sets of sturdy doors. The turbine buildings were far less sturdy, especially their doors. “Backup power generators are critical safety equipment, and it should have been a no-brainer to put them inside the reactor buildings,” one of the senior engineers says. Kiyoshi Kishi, a former Tepco executive in charge of nuclear-plant engineering, says that people thought a large tsunami on Fukushima's Pacific coast was “impossible.” Later Tepco adjusted some parts of the plant to address tsunamis less than half the height of the one that hit in March. “Some of us knew all along and were concerned about the inconsistent placements of

diesel generators at Fukushima Daiichi between reactor No. 6 and the older reactors 1 through 5, and their potential vulnerability," says one of Tepco's top engineers who has guided the company's nuclear division. In 2001, when the original 30-year operating permit for Daiichi's unit 1 reactor was set to expire, Tepco applied for and received a 10-year extension. It got another one earlier this year, just five weeks before the accident. Regulators never reviewed whether the basic blueprint of the older reactors was flawed, the abbreviated minutes of government deliberations show.

Ongoing problems at Fukushima NPP

Meanwhile the crisis at Fukushima Daiichi NPP is far from over. Tepco and the Japanese government have admitted to three 100 percent meltdowns, but can't confirm with any reliability the current state of those cores. There's reason to believe one or more have progressed to "melt-throughs" in which they burn through the stainless steel pressure vessel and onto the containment floor. The molten cores may be covered with water. But whether they can melt further through the containments and into the ground remains unclear. At least three explosions have occurred, one of which may have involved criticality. Unit 4 is cracked and sinking. The status of its used radioactive fuel pool, which has clearly caught fire, is uncertain. Also unclear is the ability of the owners to sustain the stability of reactors 5 and 6, which were shut when the quake/tsunami hit.

Workers have now finally set up a system to clean contaminated water and then use it to cool the reactors. Establishing a closed cooling system is a key step to bringing the crisis under control. Hosing down the reactors from outside has left the facility with 100,000 tons of irradiated water. Tepco said cooling was lost temporarily on July 3 in reactor 5. A shutdown of the cooling system became necessary in order to replace a leaking plastic hose. The cooling operation resumed a few hours later. The temperature of the reactor was 43.1 degrees Celsius at the time of the cooling system shutdown. It continued to rise during the few hours that it took to replace the hose, but did not exceed 48 Celsius degrees overnight, Tepco said. If the leak had not been spotted, the reactor would have reached the boiling point within 24 hours, causing all the water to evaporate, which would expose the rods, placing the reactor in danger of a core meltdown. According to the utility the crack was the result of hydraulic pressure caused by tides and seawater. It plans to install a support structure to prevent the hose from rocking. The leaking hose was the first of two incidents in early July. Workers at the plant had to double the amount of water being injected into unit 1 after the water level decreased from 3.7 tons of water to 3 tons, setting off an alarm. The problem was suspected to be caused by debris that had accumulated inside the hoses resulting in a clog that reduced the water flow.

Meanwhile, Tepco said July 3 that it installed about 50 iron sheets on the floor of the reactor 3 building to shield against radiation. While the inside of the building has high levels of radiation mainly due to a hydrogen explosion on March 14, which is hampering reconstruction work, the utility said it aims to reduce radiation levels by one-third or more. High levels of radiation were detected on the first floor of the reactor building, measuring 58-178 mSv/hr as of June 24. In an effort to lower radiation levels, Tepco used a robot to clean the floor on July 1, but the radiation levels as of July 3 remained as high as 50-186 mSv/hr.
On July 9, Tepco said it will soon begin injecting nitrogen into reactor 3 to prevent a hydrogen explosion. Tepco says it could achieve stable cooling of all the crippled reactors by mid-July as initially planned. The injection of nitrogen into reactor 3 will be carried out as soon as Tepco gets the green light from the Nuclear and Industrial Safety Agency and local governments. Tepco has already began injecting nitrogen into reactors 1 and 2. Tepco began injecting nitrogen in unit 1 in April. This wasn't possible for unit 3 because excessively high radiation prevented workers from laying the necessary groundwork. The utility said it can start the injection after connecting hoses to the necessary pipes at the reactor. Still, high levels of radiation at reactor building 3 could prevent workers from carrying out the nitrogen injection, a Tepco official said.

Thyroid exposure to radiation

About 45 per cent of the children in Fukushima prefecture have experienced thyroid exposure to radiation, according to an investigation led by the Japanese Nuclear Safety Commission.
In late March, the Commission conducted the testing on 1,080 kids from infants to 15 year-olds and maintains the exposure is minimal and doesn't warrant further examination. Among children who tested positive for thyroid exposure, the amounts measured 0.04 microsieverts per hour (μSv/hr) or less in most cases, while the largest exposure was 0.1 μSv/hr, equivalent to a yearly dose of 50 mSv for a one-year-old baby.

Hot spots in Fukushima

A soil survey at four locations in Fukushima city found all samples were contaminated with cesium-137, measuring 16,000 to 46,000 becquerels per kilogram (Bq/kg), exceeding the official limit of 10,000 Bq/kg, citizens groups said. Measured in sieverts the survey showed radiation levels exceeding 13 mSv/yr, more than six times natural levels. The city of 300,000 is located far from the 20-km zone around the plant, about 60 km from Fukushima NPP. The group detected as much as 931,000 Bq/m2 at one location, above the 555,000-Bq limit for compulsory resettlement ordered by Soviet authorities following the 1986 Chernobyl nuclear disaster in Ukraine. Samples from the other three locations measured between 326,000 and 384,000 Bq/m2. The citizens' groups - the Fukushima Network for Saving Children from Radiation and five other non-governmental organizations - have called for the evacuation of

Angry Tepco shareholders.

On June 28, angry shareholders lashed out at Tepco, demanding a retreat from nuclear power and the chairman's resignation over the crisis at the Fukushima nuclear plant.
Anti-nuclear groups rallied around the Tokyo hotel where Tepco's meeting was held, foreshadowing the complaints that would be heard inside. Although the meeting was scheduled to begin at 10 a.m., shareholders were still registering to enter at that time. As of 3:30 p.m., 9,302 shareholders had shown up, far exceeding the previous high of 3,342 who attended last year's Tepco meeting. Many could not enter the room where Tepco management was seated and were forced to use separate rooms with video monitors displaying the meeting.
A proposal submitted by 402 shareholders called on Tepco management to stop operations and decommission nuclear reactors starting with the oldest ones and not to construct new ones. However, the proposal failed to gain the approval of the required two-thirds of shareholders in attendance.
Three other electric utilities had similar experiences at their shareholders' meetings.
Asahi.com, 29 June 2011

pregnant women and children from the town. Kobe University radiation expert professor Tomoya Yamauchi conducted the survey on June 26 following a request from the groups. “Soil contamination is spreading in the city,” Yamauchi said in a statement. “Children are playing with the soil, meaning they are playing with high levels of radioactive substances. Evacuation must be conducted as soon as possible.”

Increasingly panicked residents take matters into their own hands. They scoop up soil from their gardens and dump it in holes dug out in open spaces in the surroundings, scrub their roofs and refuse to let their children play outside. They are scrambling to cope with contamination on their own in the absence of a long-term plan from the government. Experts, however, warn that their do-it-yourself efforts to reduce contamination risk making matters worse by allowing radiation to spread without monitoring and by creating hotspots of high radioactivity where soil is piled high. They say the longer it takes Japanese authorities to organize a clean-up the greater the risk of additional, long-lasting damage. “Such clusters of radiation can also leak into the groundwater and pose more health hazards for a sustained period,” said Takumi Gotoh, a cancer specialist. “That's why Japan urgently needs a comprehensive, long-term plan to deal with the issue,” Gotoh said.

The International Commission on Radiological Protection (ICRP) has issued guidelines that urge governments dealing with a nuclear emergency to set up a radiation monitoring system with a detailed read-out on hotspots and a health monitoring system for the affected population. While checking radiation in schools is now commonplace, health check-ups have only started in the worst-affected areas. Tokyo has promised that the radiation hotspot map will be ready by October - seven months after the disaster.

High levels of cesium in tea leaves
Besides Fukushima prefecture, excessive levels of cesium-137 have been detected in samples of tea leaves in Chiba prefecture. The health ministry asked the Chiba prefecture authority to expand a restriction on shipments of tea leaves produced near Katsuura city in addition to six areas in the prefecture restricted on June 2. Dried leaves from Katsuura city, 78 km from Tokyo, had radiation levels exceeding safety standards, the health ministry said. The leaves had 2,300 Bq/kg, more than the government safety standard of 500 Bq/kg, according to a statement on July 1 by the local government. The country’s tea production, including fresh and dried leaves, was worth 102.1bn yen (US$1.3bn) in 2009, according to the agriculture ministry. Tea from Japan’s Shizuoka prefecture had above-standard cesium levels three months after radiation leaked from the plant about 360 kilometers from the area. Shizuoka, which accounts for about 40 percent of the nation’s tea output and lies southwest of Tokyo, asked farmers in June to recall products and halt shipments. Other products including spinach, mushrooms, bamboo shoots, milk, plums and fish have been found to be contaminated with cesium and iodine as far as 360 kilometer from Fukushima Daiichi nuclear power plant and the London-based World Nuclear Association has warned that prolonged exposure to radiation in the air, ground and food can cause leukemia and other cancers.

UK government 'in bed with nuclear industry'
Officials from the UK government approached nuclear companies to draw up a co-ordinated PR strategy to play down the Fukushima nuclear accident just two days after the earthquake and tsunami and before the extent of the disaster was known. At least 80 e-mails seen by The Guardian are described as “Orwellian”. Two UK government departments were working with nuclear companies to spin one of the biggest industrial catastrophes of the last 50 years, even as people were dying and a vast area was being made uninhabitable for generations. The e-mails show how the business and energy departments worked closely behind the scenes with the multinational companies EDF Energy, Areva and Westinghouse to try to ensure the accident did not derail their plans for a new generation of nuclear stations in the UK. “This has the potential to set the nuclear industry back globally,” wrote one official at the Department for Business, Innovation and Skills (BIS), The Guardian reported. “We need to ensure the anti-nuclear chaps and chapesses do not gain ground on this. We need to occupy the territory and hold it. We really need to show the safety of nuclear.”

The e-mails makes clear how a weak government is controlled by a powerful industry colluding to misinform the public and the media. We now know Fukushima is at least on the same scale as Chernobyl, and likely to be the most expensive accident in the history of industrial accidents. Yet industry and government here want to dismiss it as “not as bad as it looks”. Much more than the facts coming out of Japan, the emails now make the situation far worse for the industry caught with government trying to manipulate the truth.

Or, as John Vidal puts it in his July 1, Guardian article: "These guys –industry and government (Laka)- were not just cosy. They were naked, in bed and consenting. Their closeness now raises questions such as what influence could the industry have had on the chief nuclear inspector's report on Fukushima, and whether speeches by David Cameron, Chris Huhne and other ministers wefre informed or even written by the industry. Can we ever trust government to tell us the thruth on nuclear power, or should we just accept that the industry and government are now as one."

The Guardian, 30 June 2010: Revealed: British government's plan to play down Fukushima (amended 1 July 2011); The Guardian, 1 July 2011: Fukushima spin was Orwellian

Cesium found in Tokyo's tap water
Cesium-137 was found in Tokyo's tap water. The level discovered, 0,14 Bq/kg, was below the safety limit set by the government. According to the Tokyo Metropolitan Institute of Public Health no cesium-134 or iodine-131 was detected. In March, after radioactive iodine was found in the city's supply at levels twice the allowable limit for infants, Tokyo's metropolitan government warned residents not to give tap water to small children.

Compensation and reconstruction budgets
Japan's government has approved a second budget of 2tn yen (US$24.7bn) for reconstruction. The money will be spent on rebuilding, and on compensating victims of the Fukushima nuclear crisis. About 85,000 people have been forced to evacuate the area around the plant. This emergency budget will be sent to parliament for approval this July. In June, Prime Minister Naoto Kan survived a no-confidence motion brought by MPs critical of his handling of the reconstruction process. Mr Kan, who is just over a year

into his post, has vowed to step down soon, but only once several key bills on disaster recovery and renewable energy are passed.

Japanese families who had to flee their homes because of the nuclear disaster will receive additional compensation of up to US$3,700 per person. The money, following earlier payments of US$12,300 per household, is meant to compensate the radiation refugees for their “mental suffering”, Industry Minister Banri Kaieda said, according to the Kyodo News agency. Tepco estimates that the new round of payouts will total up to 48 billion yen (US$592m). The utility will give the new payments to 160,000 people who have fled from a 30-km radius around the NPP, including a 20 km legal no-go zone, and from other radiation hotspots further afield. The new payments take into account the time families have spent away from their homes so far, and amount to 100,000 yen (US$1,234) per person per month. Those who have returned home will be paid for the period they were gone.

Avoiding power shortages

Japan will conduct new safety tests of all its nuclear reactors, the nation’s top energy official said. After the start of the Fukushima nuclear accident, reactors had to be shut down and delays in restarting others already undergoing regular maintenance checks mean that only 19 of Japan's 54 reactors are currently operating, hindering the county's effort to recover. Trade Minister Banri Kaieda said Japan's reactors would undergo "stress tests" to determine how well they can withstand major disasters. The government is worried that unless more rectors are restarted the country could soon experience power shortages. Although safety checks are already being carried out on all of Japan's nuclear reactors, the government said the new round of testing would focus on their resilience to extreme and multiple disasters. The chief cabinet secretary, Yukio Edano, said the tests would be modeled on those under way at 143 reactors in the European Union. Speaking on Japanese television, Mr Kaieda said: "We are planning the stress tests to gain the understanding of local residents. We will get further confidence from the people and will restart operations at some plants." He did not say when the stress tests would begin; however, he promised there would be enough energy available for the peak usage during the summer months.

As said, only 19 of Japan's 54 reactors are currently operating. On July 1, the government imposed restrictions on electricity consumption by large-lot users in eastern and northeastern Japan to avert power shortages. Major companies in Japan began operating on weekends to avoid the concentration of electricity use on weekdays. Although the government's curb on power consumption applies only to large-lot users in the service areas of Tokyo Electric Power Co. and Tohoku Electric Power Co. in eastern and northeastern Japan, respectively, some factories and companies in other regions will also operate on the weekends as the automobile industry's supply chain is spread across the country.

Large-lot users in the areas are required in principle to reduce peak-time electricity consumption by 15 percent from a year earlier. Hospitals that provide emergency treatment and shelters for evacuees from the March 11 disaster are exempted, while the reduction target will be relaxed to up to 10 percent for medical, nursing-care and transportation service providers.

What was that again about nuclear power being necessary for energy security reasons?

Sources: The Asahi Shimbun, 5 July, 2011: Leaky hose temporarily halts reactor cooling system; VPR News, 5 July, 2011: What Went Wrong In Fukushima: The Human Factor; NTI, 5 July 2011: New Equipment Cleaning Japan Plant Coolant; The Huffington Post, 5 July 2011: Fukushima Spews, Los Alamos Burns, Vermont Rages and We've Almost Lost Nebraska; Harvey Wasserman; UPI, 4 July 2011: Fukushima reactor cooling problem fixed; Digital Journal, 5 July 2011: Cooling of Fukushima nuclear reactor interrupted; Wall Street Journal, 1 July 2011: Design Flaw Fueled Nuclear Disaster; Moscow Time, 6 July 2011: Fukushima-1: secrets revealed; International Business Times, 4 July 2011: Fukushima: Radioactive cesium-137 found in Tokyo’s tap water; The Hindu, 5 July, 2011: 45 per cent of Fukushima children had thyroid exposure to radiation; Kyodo, 4 July, 2011; Business Insider, 5 July, 2011: Almost Half The Kids In Fukushima Have Thyroid Radiation Exposure; AFP, 5 July, 2010: Japan Soil Found Radioactive Outside Evacuation Zone; Bloomberg News, 05 July 2011: Japan expands tea restrictions as more radioactive samples found; Reuters, 4 July 2011: Fukushima residents dump radiated soil in absence of plan; BBC News, 4 July, 2011: Life on the edge of Japan's nuclear contamination zone; Channel News Asia, 5 July 2011: Japan radiation refugees to get more compensation; The Japan Times, 9 July 2011: Tepco to soon inject unit 3 with nitrogen; International Business Times, 6 July 2011: Fukushima nuclear crisis: Japan faces power shortages; BBC News, 6 July 2011: Japan to hold stress tests at all nuclear plants; New York Times, 7 July 2011: Japan Plans Safety Tests of Nuclear Plants; Mainichi Daily News, 2 July 2011: Major firms begin operating on weekends to save power

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NEXT PLUTONIUM SPACE LAUNCH SET

The next plutonium enabled space mission, the Mars Science Laboratory (MSL), is scheduled to be launched from Cape Canaveral, Florida between November 25 and December 18 of this year. The MSL rover, known as "Curiosity," will be fueled with 4.8 kilograms (10.56 pounds) of plutonium dioxide. It will be, NASA says, "the largest, most capable rover ever sent to another planet."

(730.6152) GNAW&NPS - Fifty years ago, on June 29, 1961, an electrical generator driven by nuclear energy was launched into space for the first time. NASA sadly appears committed to maintaining their dangerous alliance with the nuclear industry. Both entities view space as a new market for the deadly plutonium fuel.

Back in 1997 the Global Network Against Weapons & Nuclear Power in Space organized an international campaign against NASA and the Department of Energy's launch of 72 pounds of plutonium on the Cassini mission. A man by the name of Alan Kohn volunteered to help GNAW&NPS with that campaign. Kohn had been the Emergency Preparedness Officer at NASA during the Galileo (1989) and Ulysses (1990) plutonium launches at the space center in Florida.

By the time Cassini was to be launched Kohn had retired from NASA and felt free to speak out. He told the New York Times, just prior to the launch, that NASA had no plan to contain and clean-up after an accident on or near the launch pad that released plutonium into the environment. He said the operating plan he had worked with during the two previous nuclear launches was a joke and was only intended to serve as a reassurance to the public. Kohn told that a long-time family friend, working in the White House, had informed him that more people contacted Washington opposing Cassini than any other issue in U.S. history.

While NASA maintains that they are "searching for the origins of life" on Mars, in reality they are mapping the red planet and doing soil sampling which is all intended to serve the ultimate goal of establishing a nuclear powered mining colony there in the future. The Haliburton Corporation, known for their connections to the Bush-Cheney administration and fraud in Iraq, has been working on a drilling mechanism for Mars exploration for some time.

The taxpayers are being asked once again to pay for nuclear missions that could endanger the life of all the people on the planet. As we saw in Louisiana, following the Hurricane Katrina debacle, the federal government is not prepared to do disaster relief and clean-up. A plutonium release over Florida could devastate a 60-mile radius - from the space center to Disney World.

It would only take one pound of plutonium-238 released as dust in the atmosphere to give everyone on the Earth a lethal dose of the toxic fuel. Have we not learned anything from Chernobyl and Fukushima? The Global Network Against Weapons & Nuclear Power in Space believes we don't need to be launching nukes into space. It's not a gamble we can afford to take.

You can send NASA a message opposing the plutonium Mars rover mission using the NASA contact page at: http://www.nasa.gov/centers/hq/about/contact_us.html

Source and contact: Bruce K. Gagnon. Coordinator Global Network Against Weapons & Nuclear Power in Space, PO Box 652, Brunswick, ME 04011, USA
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THE PROLIFERATION DANGERS OF CENTRIFUGE TECHNOLOGY

In early April 2011, a nondescript industrial plant 50km west of Tehran, named TABA, came under public scrutiny when it was revealed as being a significant centrifuge manufacturing site—apparently unbeknownst to the International Atomic Energy Agency (IAEA). As the technology involved has become ever more accessible, centrifuge-driven uranium enrichment has emerged as a significant proliferation risk. It is therefore worthwhile to consider the IAEA's ability to monitor the construction of these specialized machines.

(730.6153) VERTIC - The ability to monitor the construction of centrifuge-driven uranium enrichment is especially illustrative of the added value of the IAEA's Additional Protocol to the process of confirming the exclusively peaceful nature of countries' nuclear energy programs. The Additional Protocol is a powerful legal instrument developed in the 1990s to complement member states' Comprehensive Safeguards Agreements (CSAs). This article considers the proliferation risks involved in centrifuge pro¬duction and the merits of the Additional Protocol with respect to two countries, Iran and Brazil, neither of whom implement the updated safeguards techniques, but who both possess the ability and will to manufacture centrifuges.

It is often considered that the most difficult stage in the production of nuclear weapons is acquiring the necessary fissile material: either plutonium or highly enriched uranium (HEU). In the past, acquiring these materials usually involved building and running a nuclear reactor (to make plutonium), or a gaseous diffusion plant (for HEU). Both required very substantial industrial capabilities. However, with the spread of gas centrifuge technology in the past three decades, the potential route to HEU has become both significantly less challenging—and less conspicuous.

Like the diffusion method, the gas centrifuge technique separates the two isotopes that make up uranium, concentrating the crucial U-235 from the very slightly heavier U-238. In nature,

uranium consists almost entirely of U-238 (at around 99.3 per cent) and therefore requires processing in order for the weapons-usable U-235 to be separated out. To be useful in 'light water' reactors, the raw material must be converted into uranium hexafluoride gas and subsequently 'enriched' in the separation process to consist of 3-5 per cent U-235 particles (known as low enriched uranium, or LEU). Natural uranium can be used in other reactor types after some processing. Nuclear weapons require HEU at about 90 per cent enrichment. Enriching with the centrifuge process involves injecting uranium hexafluoride gas into cylinders rotating tens of thousands of times per minute. The effect of centrifugal force pushes the U-238 closer to the outer wall of the machine, with U-235 particles tending towards the center, which is then siphoned off. Each machine can only perform a very small amount of enrichment. An effective enrichment plant therefore requires large numbers of centrifuges linked together in so-called 'cascades'.

The older gaseous diffusion system requires thousands more painstaking steps, which take place in immense facilities using significant amounts of energy, and emitting large amounts of heat. In contrast, centrifuges on average perform the same amount of enrichment in significantly fewer steps, consuming smaller amounts of electricity. Centrifuge facilities therefore tend to be less conspicuous. They are typically much more compact, without the easily identifi¬able electrical and cooling systems associated with gaseous diffusion plants, or heat emissions detectable to infrared imaging systems. It may be possible to trace uranium hexafluoride gas accidentally released from a centrifuge enrichment plant, but these emissions are normally very small.

The number of centrifuges required to produce enough fissile material for a weapon depends on the design and efficiency of the centrifuges themselves—measured in kilograms of 'separative work units' per year (kg SWU/yr). This can range from lower than two kg SWU/yr for less advanced models to machines (currently confined to Europe or the United States) operating at 100 kg SWU/yr and above.

Centrifuge production and the Additional Protocol

As a rule of thumb, it requires about 100,000-120,000 kg SWU to produce enough LEU per year for an average sized nuclear reactor. In contrast, it requires only 6,000 kg SWU to produce enough HEU for one weapon a year (known as one 'significant quantity', defined by the IAEA as 27.8 kg of 90 per cent enriched uranium).

The potency of gas centrifuge technology in terms of proliferation risks is therefore clear: these are machines capable of producing 'significant quantities' of fissile material in relatively low numbers and with a small footprint, thus making them a good bet for states wanting to develop nuclear weapons-usable material without being detected. However, centrifuges are complicated machines, requiring very specialized technical capabilities. One of the major difficulties is that even the slowest centrifuges spin at rates requiring unusually durable materials—ranging from aluminium alloys for older machines and maraging steel (a particularly strong type of steel) to modern ultra-strong carbon composites. These materials require precision machine tools to shape and strengthen them. The high-speed motors and their variable-frequency power supplies (which adapt the electrical current available from the power grid into an output of much higher frequency) also need to be specifically adapted for use in centrifuges.

Centrifugal safeguards standards

Under the 1968 Nuclear Non-Proliferation Treaty (NPT), non-nuclear-weapon states' obligations on centrifuge manufacturing fall under two IAEA safeguards regimes: those with Comprehensive Safeguards Agreements (CSAs), and those who further implement the strengthened measures of the Additional Protocol to their CSAs.

Though each non-nuclear-weapon state's CSA is individual, all follow the form and content of a standard text, 'IN¬FCIRC/153', which obliges a country to provide information on all nuclear material and facilities, and to allow agency inspectors to verify these declarations. The resulting verification regime focuses largely on nuclear material accountancy to check the accuracy of declared materials in declared facilities. According to Article 8 of INFCIRC/153, this guarantees the IAEA information on only those facilities 'relevant to safeguarding such material'. The definition of 'facility' is articulated in Article 106 to include reactors, conversion plants, fabrication plants, reprocessing plants, isotope separation plants, separate storage installations, or any location where significant amounts of nuclear material is customarily used. As such there are no requirements regarding centrifuge production facilities. CSAs were designed in an age when centrifuge enrichment technology was still in its infancy. The underlying assumption was that the production of HEU through conspicuous gaseous diffusion plants would be readily detectable, and that the proliferation risk came instead from the diversion of material from declared facilities.

With the discovery of Saddam Hussein's secret nuclear weapons program in the aftermath of the 1991 Gulf War, it became clear that it was necessary to address possible clandestine uranium enrichment—with centrifuge production being an important component. Partly as a result of this discovery, the Additional Protocol was developed and opened for voluntary signature in 1997. It is a legal instrument that provides the IAEA with more information and wider access rights, thereby strengthening its ability to verify that a country is not producing material for nuclear weapon purposes.

The document 'INFCIRC/540' describes the standard obligations required under an AP. In contrast with IN¬FCIRC/153, this document specifies in Article 2.a.(iv) that the participating state must provide the IAEA with a description of the scale of operations involved in centrifuge production. According to Annex I of INFCIRC/540, centrifuge production is described as the manufacture of centrifuge rotor tubes or the assembly of gas centrifuges. These activities are further detailed in Annex II, which describes the purpose, general design, and component set of gas centrifuges. Such constituent parts include: rotor assemblies, rotor tubes, bellows, baffles, top and bottom caps, magnetic suspension bearings, molecular pumps, motor stators, centrifuge housings, and scoops, among others.

As well as indigenous manufacturing capabilities, the protocol also brings into focus the other way of acquiring centrifuges (or their constituent parts)—import from foreign trade partners. Article 2.a.(ix) of INFCIRC/540 outlines the state's responsibility, when requested, to provide information to the IAEA on the identity, quantity, and location of the intended use of all the materials and equipment listed in Annex II that have been acquired from abroad. The information generated by these requirements enables the IAEA to develop a fuller understanding of a member state's uranium enrichment program. It thus becomes possible to draw comparisons between centrifuge production rates and

centrifuge deployment in declared facilities: for instance, if more centrifuges are manufactured than deployed, the IAEA will be able to flag the discrepancy for further investigation.

The CSA and the AP differ not only in terms of the information flow that they can generate but also in the level of access for inspectors. According to Article 76.a of the model CSA text (INFCIRC/153), the IAEA is guaranteed access only to 'any location where the initial report or any inspections carried out in connection with it indicate that nuclear material is present.' There is a provision in Article 73 of INFCIRC/153 for 'special inspections', which give the agency the right to visit 'locations in addition to the access specified'—a vague definition which John Carlson, a member of VERTIC's International Verification Consultants Network, interprets as 'anywhere in the state' if there are 'circumstances giving rise to suspicion.' This could conceivably include certain centrifuge manufacturing plants. Historically, though, the special inspection tool (which, according to Article 77, must be obtained in agreement with the inspected state party) has been of little value. It has only been invoked by the IAEA on one previous occasion. This was against North Korea in 1992, and access was then denied. INFCIRC/540 (the model Additional Protocol) makes an important contribution in this area by outlining a system of 'Complementary Access' to inspectors. This expands the rights of the Agency to make visits to centrifuge manufacturing plants according to Article 4.a.(ii), for the purpose of resolving 'a question relating to the correctness and completeness of the information provided [...] or to resolve an inconsistency relating to that information.' There is no need to obtain agreement from the party and notification of a visit can be as short as 24 hours.

Though INFCIRC/540 specifies that the IAEA 'shall not mechanistically or systematically seek to verify' information provided by the state, its ability to make informed judgments about a proliferation risk is substantially increased, and a state's corresponding ability to shield important information from it is substantially diminished. With respect to the monitoring of centrifuge production, the salient points of the Additional Protocol are Article 2.a.(iv)'s enshrined principle of information provision as a matter of routine, and Article 4.a.(ii)'s enshrined principle of Com¬plementary Access as of right.
This has important consequences, explored below, for states that produce centrifuges, as is made clear by the examples of Iran and Brazil, both of whom possess the indigenous capacities to manufacture these machines, but neither of which currently implement the Additional Protocol.

Iran: AP, the option-limiter
The controversy and uncertainties surrounding Iran's uranium enrichment program are well-known and well-documented. The Islamic Republic has signed an AP, but has not yet ratified it. Nevertheless, Iran implemented the protocol on a voluntary basis between 2003 and 2006, but cut off cooperation in retaliation to the IAEA Board of Governors vote to report Iran to the UN Security Council. During this time the Agency learned a great deal about the Iranian nuclear infrastructure; since then, however, relevant knowledge about centrifuge production capabilities has deteriorated markedly.

It is therefore not difficult to appreciate the interest generated, when, at a press conference in Washington, DC, an Iranian opposition group announced the discovery of the previously-undocumented role of a facility named TABA in producing centrifuge parts for Iran's controversial uranium enrichment program. TABA apparently manufactures 'casing, magnets, molecular pumps, composite tubes, bellows, and centrifuge bases' primarily for the current generation of machines—but also for emerging next-generation centrifuges. Ali Asghar Soltanieh, Tehran's envoy to the IAEA, refuted any allegations of concealment, pointing out that Iran's safeguards obligations did not necessitate any provision of information about the plant to the IAEA. Rather, they required only the 'inspection of centrifuge machines.' This is indeed broadly in line with the requirements of the CSA as described above, which strictly speaking concerns itself only with the nuclear materials flowing within the machines.

The disclosure, however, highlights the proliferation risk resulting from the limited reach of the CSA. TABA is located in a nondescript industrial park and offers few distinguishing features. The facility's generic name—a Farsi abbreviation of 'Towlid Abzar Boreshi Iran', meaning 'Iran Cutting Tools Company'—also gives little away. This lack of transparency and openness over their centrifuge manufacturing capabilities offers the Iranian authorities the possibility—should they so choose—of secretly sending centrifuges to a undeclared enrichment installation to produce weapons-grade fissile material, while appearing to fulfill their safeguards obligations.

Enrichment facilities can be relatively small and largely indistinguishable from other industrial plants, or outright hidden as in the case of Iran's underground Qom enrichment facility. The Qom plant was uncovered in September 2009 as a result of Western intelligence-gathering operations; its existence was previously a secret. In an atmosphere so fundamentally degraded by a lack of trust between the principal actors, the possibility that any small and inconspicuous enrichment facility could be discretely producing weapons-usable material is a serious consideration.

It is a possibility that Iran's 2007 decision to suspend an essential commitment to the IAEA regarding the declaration of new facilities has made concerns over undeclared facilities significantly more acute. The commitment in question is set out in the modified Code 3.1 of Iran's Subsidiary Arrangements, to which it acceded in 2003 and which the CSA specifies cannot be unilaterally modified without the IAEA's consent. The result of the suspension, which the IAEA reportedly did not agree to, is that Iran has reverted to an outdated requirement that any new facility need only be declared six months prior to the introduction of nuclear material, rather than as soon as the decision to construct it is taken. The option therefore exists for Iranian authorities to begin construction on sites that can house centrifuge cascades, and even to outfit them with this equipment, without violating any of its safeguards obligations. Of course, if undeclared enrichment begins, this is no longer true. But many of the crucial steps taken to get to this point in op¬erating a clandestine HEU-producing program (the undeclared industrial development of centrifuges and their deployment in undeclared enrichment plants) will have been taken with little risk.

The power of the AP is to close off such windows of opportunity and thereby build confidence among countries. INFCIRC/540 states clearly the IAEA's right to be supplied with information regarding centrifuge production facilities, and its right to access these facilities. The result is an important reversal of responsibility, away from the IAEA having to press for data and onto the state itself to provide the information in a routine manner.

Brazil: AP, an option limited
The Brazilian centrifuge program began

as a covert project in 1979 at the behest of the military government that dominated Brazilian political life until 1985. A research team, under the direction of the Brazilian navy, developed over the next decade a centrifuge technology in which rotors spin not on the usual metal pin bearings, but on electromagnetic bearings, allowing the rotating and fixed parts in the machine to operate without any point of contact. This is designed to eliminate sources of friction which reduce efficiency and durability, and recent enrichment capacities have been placed at 10 kg SWU/yr. Construction of these machines takes place at the navy's Aramar Experimental Center, outside São Paulo. Brazil has ambitious plans to attain an enrichment capacity at its main deployment site at Resende, near Rio de Janeiro, of 300,000 kg SWU/yr by 2014, and up to one million kg SWU/yr by 2030.

The military origins of the program, its secrecy before the advent of democratic government, a late accession to the NPT in 1998, and the 2005 admission by a former president that Brazil had previously sought to develop nuclear weapons to counter competition from Argentina all point to the need for a robust verification regime that instills confidence in the peaceful ambitions of the program as it exists today. Currently, this work is done through the 1991 Quadripartite Safeguards Agreement, which joins together Brazil, Argentina, the IAEA and ABACC (the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials) to mandate the application of nuclear safeguards. Analogous to the CSA, this ad hoc arrangement does not offer the extended measures provided by the AP, as described above, with the exception of some provisions for unannounced inspections. Monitoring, performed by both ABACC and the IAEA, focuses on flows of nuclear material and provides access only to those facilities through which significant amounts of such material passes. It seems likely that another possible route to fissile material may be opened up with the Brazilian navy's development of nuclear-powered submarines, in which uranium enriched as high as 10 per cent by centrifuges at Aramar will power a reactor outside the reach of safeguards. Although the US has made efforts to persuade Brazil to give up on these plans, it was not successful, and negotiations with the IAEA to establish appropriate verification measures are ongoing. This is an eventuality that neither the CSA nor AP address directly, and for which entirely new arrangements will need to be developed.

Despite these substantial capabilities and ambitious plans, implementation of the Additional Protocol has been resolutely dismissed by Brazil, with the country's 2008 National Defense Strategy rejecting it until further progress in disarmament is made by the NPT nuclear weapons countries. Brazilian officials have offered a variety of other reasons—revolving primarily around an unwillingness to allow inspectors access to the commercially sensitive electromagnetic bearing technology, and the fact that it is an unnecessary measure in a country with a solid non-proliferation record which constitutionally prohibits nuclear weapons development (Brazil has also joined the Treaty of Tlatelolco, which establishes a Latin American nuclear-weapon-free zone, and ratified the Comprehensive Test Ban Treaty, which Iran has only signed). Analysts suspect the main reasons for opposition are military in nature, with the navy unwilling to grant extended access rights to the centrifuge manufacturing facilities in Aramar that are co-located with non-nuclear submarine R&D activities. This is despite the fact that Article 7 of the AP outlines clearly a state's right to request 'managed access' to protect proprietary information, and that the IAEA Department of Safeguards (in charge of the practical application of safeguards) has had regular access to sensitive technologies throughout its history without leaking them.

Many of the same clandestine enrichment options are therefore as open to Brazil as they are to Iran - without, however, the associated IAEA reports, UN resolutions or Security Council sanctions. Most observers, such as Jeffrey Lewis, director of the East Asia Nonproliferation Program at the Monterey Institute of International Studies, or Condoleeza Rice during her term as US Secretary of State, seem not to question Brazil's commitment against nuclear proliferation. Ad hoc measures, such as the Quadripartite Agreement and a future system to monitor enriched uranium production for nuclear powered submarines, are deemed to be imperfect but adequate safeguards measures - despite the lack of scrutiny on centrifuge production at Aramar. Crucially though, this type of safeguards development can only occur in an atmosphere with a certain level of trust; such as that which generally characterizes the IAEA's relationship with Brazil.

One of the most important benefits of AP implementation is to lessen the impact of the wider political atmosphere. Should relations take a turn for the worse, the principles of information provision as a matter of routine and Complementary Access as of right allow for confident conclusions to be drawn over the use of centrifuge technology regardless of political context. With the IAEA thus somewhat shielded by the AP from the vagaries of international tensions over policy and intent, it is able to focus with greater freedom on states' technical centrifuge capabilities, allowing for more reliable judgments on proliferation risk to be made. The effectiveness of the IAEA's verification regime is diminished, however, by the selective and voluntary implementation of AP requirements in 'suspect states'—much as the theoretically powerful CSA Special Inspection tool is often rendered impotent in practice. Universalization of the Additional Protocol should therefore be a central goal in strengthening the global nuclear non-proliferation regime.

Source and contact: Mikael Shirazi and Andreas Persbo, Trust & Verify 133, April-June 2011.
VERTIC (the Verification Research, Training and Information Centre) is an independent, non-profit making charitable organization. Established in 1986, VERTIC supports the development, implementation and verification of international agreements as well as initiatives in related areas. It can be reached: Development House, 56-64 Leonard Street London EC2A 4LT, United Kingdom.
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IN BRIEF

Centrifuge crash report allegedly delayed until after financing deadline. SONG (the Southern Ohio Neighbors Group) disclosed on July 6 that a power outage and centrifuge crash happened at USEC's project site near Piketon, Ohio. As reported in that newsrelease, Osiris Siurano, the NRC project manager for USEC's centrifuge project license, told SONG in an interview on July 5 that USEC had notified NRC and DOE "within 24-hours as required." According to NRC's "Event Notification Report" of that day, July 5, however, NRC was not actually notified of the situation until July 1.
July 1 just happened to be one day after USEC's original financing deadline of June 30, by which time USEC needed to secure a "conditional commitment" for a loan guarantee from the Department of Energy. That is, there is now evidence that USEC waited nineteen days before reporting a serious safety incident to NRC, in hopes that DOE would provide the "conditional commitment" before the incident became known. Silence from USEC, from DOE, and from USEC's two financing agents in the United States Senate, as the June 30 deadline neared, is now explained. In nuclear industry lingo, Mr. Siurano's statement that the 24-hour notification requirement had been met could be characterized as having "suboptimal veracity."
There is no decision yet on the Department of Energy's US$2 billion loan guarantee for USEC Inc. to complete the American Centrifuge Project at Piketon. USEC says it is now “most likely” looking at further cutbacks and a reduction of future investment in its planned American Centrifuge Project at Piketon. “We are reaching a critical point regarding continued funding for the American Centrifuge Project. We need to obtain a conditional commitment for the loan guarantee from DOE,“ the company said already in May.
Portsmouth Daily Times, 1 & 13 July 2011 / HuntingtonNews.net, 8 July 2011

Germany’s phase-out by 2022 sealed (again). On July 8, Germany's upper house of parliament, the Bundesrat, passed the amendment to the atomic energy bill sealing Germany's exit from nuclear power by 2022. Ten days before, on June 30, the Bundestag, Germany's lower house of parliament, approved with an overwhelming majority plans to phase-out nuclear power by 2022. The nuclear phase-out bill cleared the lower house with only the far-left voting against, while the opposition Social-Democrats and Green party both supported the bill.
Germany's new energy strategy reverses the extension of nuclear run-times, which became law earlier this year. Seven reactors built before 1980 as well as the Kruemmel reactor, which has not been online since 2007, will remain shut permanently, according to the bill. The nine remaining reactors will be gradually phased-out between 2015 and 2022.
Germany's E.ON feels no pressure to replace nuclear power plants with alternatives after the policy shift. "There is no strategy to replace lost nuclear capacity one-to-one. As an entrepreneur I always ask myself is my investment profitable?," Chief Executive Johannes Teyssen said on June 30. It is one of the four utilities with German nuclear power plants.
E.ON, which in an outcry earlier in June had demanded damages from the government for the closures, was holding on to the legal pursuits but had in the meantime adopted a more conciliatory stance, Teyssen said. But the group will now respect the change in policy towards renewables.
Reuters, 30 June 2011 / Platts, 30 June and 8 July 2011

Finland: inviting bids for construction npp. Finnish company Fennovoima has invited Areva and Toshiba to bid for the construction of a new nuclear power plant, which will be built at one of its greenfield sites Pyhäjoki or Simo, in northern Finland. Bids will be for the delivery and construction of the reactor and turbine islands. Infrastructure work during the first phase of construction and preparatory work such as earthmoving and excavation are excluded from the bid.
Fennovoima has already selected three alternatives for the plant design: Areva’s 1700 MW EPR, its advanced boiling water reactor the 1250 MW Kerena and the 1600 MW ABWR by Toshiba Corporation. The plant supplier and the model of delivery is due to be decided in 2012-2013. Fennovoima is planning to select the site for its nuclear power plant in 2011 and preparatory work could start by the end of 2012.
Nuclear Engineering International, news 5 July 2011

Citigroup: nuclear “uninvestable for public equity markets”. According to Peter Atherton, Citigroup’s head of European utilities research, Britain's nuclear strategy is "uninvestable" for private clients, who are only likely to put money into new plants if the government shoulders more of the risks involved. He says the investment environment is "dire." "Investors are demanding more of their returns up front in cash rather than dividends, indicating they don't trust the capital growth of the sector. "As we stand today, is (new nuclear) an investable option for Centrica, RWE? Simply put, no. The cost of capital based on those risks would be way too high to give you an electricity price which is affordable. "You would be looking at a project cost of capital of at least 15 percent. That would require a power price of about 150-200 pounds per megawatt hour (based on 2017 money) to make that project work," Atherton said, which is three to four times as much as current UK spot power prices.
"If we want (plants) built, the state will have to take on the risks," he added, saying the government could do this through direct subsidies, taxes or building new plants itself. Shares in the European utility sector have fallen about 30 percent since February 2009, according to Citigroup, as EU utilities have been more exposed to commodity price rises than in Asia or the U.S., and, most recently, due to the impact Japan's nuclear crisis.
Reuters, 6 July 2011

U.S.: Reactor proponents are batting 0-6 in state legislatures in 2011. Deep-pocketed nuclear power lobbyists may pack a big punch in Washington, D.C., but they are getting knocked out altogether at the state legislative level. So far in 2011, the nuclear power industry has a record of zero wins and six losses in Iowa, Kentucky, Minnesota, Missouri, North Carolina, and Wisconsin. The nuclear power industry’s dismal track record is in keeping with its history of state legislative failures in 2010 (when it went 0-8) and 2009 (0-6).

The nuclear power industry's 2011 state legislative failures:
* Minnesota – A heavily lobbied bill to overturn the state's moratorium on additional reactors died in conference committee.
* Wisconsin – A push to reintroduce a bill to overturn the Badger State's moratorium on new reactors failed.
* Kentucky – A bill to overturn the state's moratorium on new reactors died in the House.
* Missouri – Despite a major industry push, a bill to charge utility customers in advance to pay for an "Early Site Permit" for the proposed new Callaway reactor died.
* North Carolina – A "Super Construction Work in Progress (CWIP)" bill to eliminate prudence review of CWIP expenses was proposed but never introduced due to strong on-the-ground opposition.
* Iowa – A bill pushed by MidAmerican to charge utility customers in advance for "small modular reactors" as well as potentially larger reactors stalled in the state Senate and cannot be taken up again until 2012.
In 2010, nuclear power lobbyists failed in legislative pushes in Arizona, Illinois, Iowa, Kentucky, Minnesota, Vermont and West Virginia and Wisconsin. In 2009, the industry enjoyed no success whatsoever in its lobbying efforts in Kentucky, Minnesota, Hawaii, Illinois, West Virginia and Wisconsin.
Safe Energy Program at Physicians for Social Responsibility, www.NuclearBailout.org, 6 July 2011

Khan: North Korea paid Pakistan for nuclear secrets. In a letter released by Abdul Qadeer Khan, the disgraced nuclear scientist and 'godfather of Pakistan's atomic bomb', the North Korean ruling party appears to confirm that it paid more than US$3.5m (2.5m euro) to the serving army chief and at least one other senior general for transferring nuclear weapons technology to North Korea. The 1998 letter, was released as part of an attempt by Khan to establish that he was not working on his own when nuclear secrets were passed on to Iran, North Korea and Libya before his fall from grace. The two generals named in the letter fiercely denied the allegation, and denounced the letter as a forgery.
But opinion is divided not just over the authenticity of the documents, but also whether they establish that Khan was not acting alone. The Washington Post quoted unnamed US officials as saying that the letter's contents were "consistent with our knowledge" of the events described. But David Albright, a nuclear proliferation expert with the Institute for Science and International Security in Washington, disputes Khan's claims that top military officials were complicit. "[The letter] shows that Khan was a rogue agent and he colluded to provide centrifuge components to North Korea without Pakistani official approval," the AP quoted him as saying.
More on Khan at www.laka.org/info/publicaties/Khan/Khan.pdf
Independent (UK), 8 July 2011

WISE/NIRS NUCLEAR MONITOR

The Nuclear Information & Resource Service was founded in 1978 and is based in Washington, US. The World Information Service on Energy was set up in the same year and houses in Amsterdam, Netherlands. NIRS and WISE Amsterdam joined forces in 2000, creating a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues.

The WISE/NIRS Nuclear Monitor publishes international information in English 20 times a year. A Spanish translation of this newsletter is available on the WISE Amsterdam website (www.antenna.nl/wise/esp). A Russian version is published by WISE Russia and a Ukrainian version is published by WISE Ukraine. The WISE/NIRS Nuclear Monitor can be obtained both on paper and in an email version (pdf format). Old issues are (after two months) available through the WISE Amsterdam homepage: www.antenna.nl/wise.

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NEW ON NIRS WEBSITE
NRC Staff Task Force Report on Fukushima. Includes NRC analysis of Fukushima accident and recommendations for regulatory changes in the U.S

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