
Burma's Nuclear Programs: The Defectors' Story

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In recent years, a number of unconfirmed reports about illicit nuclear activities in Burma have reached the outside world. This article details the testimony of two defectors who left the country in 2006, and who were extensively interviewed by the author. Both defectors independently claim that they had been involved in aspects of a covert nuclear program with North Korean assistance, with plans for a nuclear reactor not unlike the reactor discovered in Syria in 2007. While their reports remain uncorroborated by additional evidence, they paint a disturbing picture that requires close attention by regional policy makers and intelligence services.

The subject of Burma and nuclear-related programs is surrounded by rumours, speculation, misinformation and probably deliberate disinformation. As Andrew Selth wrote in 2007, "the real picture is difficult to discover and interpret".² In February 2009, he observed that:

There has always been a lot of smoke surrounding Burma's nuclear ambitions. Over the past year or so, the amount of smoke has increased, but still no-one seems to know whether or not it hides a real fire.³

The published 'facts' about Burma's nuclear programs can be gleaned from the public agreements with Russia in 2002 and 2007 concerning the purchase of a 10-megawatt (MW) light-water research reactor. Although such a reactor would not be suitable for a nuclear weapons program, the project raised many questions. The published accounts of the successive agreements were not very helpful.⁴ Even the location of the proposed reactor was not specified.

¹ This article is based on a presentation at a Workshop on *Preparing for Nuclear Expansion in Southeast Asia: Frameworks for Effective Cooperation and Enhanced Security*, organised jointly by the Center for Contemporary Conflict, Naval Postgraduate School, Monterey, California, and the School of Social and Political Sciences, University of Canterbury, Christchurch, New Zealand, and held in Christchurch, 26-28 August 2009.

² Andrew Selth, *Burma and Nuclear Proliferation: Policies and Perceptions*, Regional Outlook Paper No. 12 (Brisbane: Griffith Asia Institute, Griffith University, 2007), p. 3.

³ Andrew Selth, 'Is There a Burma-North Korea-Iran Nuclear Conspiracy?', *The Interpreter*, 25 February 2009, <<http://www.lowyinterpreter.org/post/2009/02/Is-there-a-Burma-North-Korea-Iran-nuclear-conspiracy.aspx>> [Accessed 2 October 2009].

⁴ The single best account is 'Myanmar Signs Deal with Rosatom to Build Nuclear Research Reactor', *WMD Insights*, June 2007, <http://wmdinsights.com/116/116_EA2_MyanmarSigns.htm> [Accessed 2 October 2009].

In 2007-09, I received compelling testimony from two recent defectors from Burma that Burma has a secret program for acquiring a nuclear weapons capability by 2020. Before then, I would have dismissed such a claim as preposterous. For me, the defectors have cleared through a lot of the smoke, but they have also painted an extremely disturbing scenario.

The Defectors

I had the opportunity of extensively and intensively interviewing two defectors who had become involved in Burma's nuclear program from completely different walks of life. They never met; neither of them ever knew of the existence of the other. The interviews were conducted in the Mae Sot area of Thailand.

One of the defectors was a former junior officer in the Burmese Army. I first interviewed him in June 2007, then in March 2008, July 2008 and September 2008, and lastly in July 2009. He has since been resettled in another country. He defected in December 2006, after nearly ten years in the *tatmadaw*. He was a computer specialist with an artillery background. In 2000 he graduated from the Defence Services Academy (DSA) at Pyin Oo Lwin (formerly called Maymyo), where he had spent three years, with his major in computer science. He then spent nine months doing a computer science course at Rangoon University. In March 2003, he was sent to Moscow for training in nuclear physics, a member of the second batch of seventy-five trainees. This group spent most of their time at the Faculty of Experimental and Theoretical Physics at the Moscow Engineering Physics Institute. The defector said that that the group had only been told that they were going to Moscow in a farewell speech by General Maung Aye two days before their departure.

The second defector was a civilian, who had worked for many years for Tay Zar, the business tycoon and close associate of Than Shwe and other senior Generals.⁵ Tay Zar's Htoo Trading Company was directly involved in discussions with officials from Russia and North Korea concerning contracts and memoranda of understanding for the provision of nuclear assistance, as well as the logistic arrangements for the export of uranium and the importation of equipment and materials for various elements of Burma's nuclear program. He defected in late 2006. I interviewed him in March 2008, June 2008 and September 2008. He died in a refugee camp in Thailand in late 2008.

The Burmese Nuclear Program

Quite separately and unbeknownst to the other, both defectors described, in the same terms and with the same data, four key Army facilities: (i) The

⁵ 'Tay Za', *Wikipedia*, <http://en.wikipedia.org/wiki/Tay_Za> [Accessed 2 October 2009].

Military Science and Technology Development Centre No. 2, at Thabike Kyinn (Thabeikkyin) in northern Mandalay Division, where there is a uranium refinery; (ii) the Military Science and Technology Development Centre No. 2, which has been established at Tha Tha Na, on the Myit Nge River, north-east of Kyaukse, also in Mandalay Division, where there are an open-cut mine and associated refinery; (iii) the Nuclear Research and Engineering Centre that has been under construction for the Army near Naung Laing village, south-east of Pyin Oo Lwin township, in Mandalay Division, since about 2002; and (iv) a 'Nuclear Battalion' based near Naung Laing and responsible for the 'weaponisation' aspects of the program.

Overall, the interviews enabled much of the confusion on the public record to be straightened out. But they related a disturbing story. The essence of the defectors' testimony is that Burma has embarked on the creation of key parts of the nuclear fuel cycle, involving separate, partially redundant but complementary Russian and North Korean elements.

THE AGREEMENT WITH RUSSIA

The foundations of Burma's nuclear program were laid by U Thaug, who has been the Minister for Science and Technology since the Ministry was founded, with nuclear technology in mind, in 1997. He is a DSA graduate (Class 1), and an ardent nationalist. He was given responsibility to reach agreement with Russia for construction of a nuclear reactor and other related assistance, and in 1999-2000 he secured an agreement with Russia regarding nuclear cooperation, beginning with the provision of training in nuclear physics and engineering. The first group of 113 trainees went to Moscow in May 2001. Burma informed the Vienna-based International Atomic Energy Agency (IAEA), in September 2000, of its intention to build a nuclear reactor. In February 2001, Russia's Atomic Energy Ministry announced that it planned to build "a 10-megawatt research reactor in central Burma".⁶ Bertil Lintner reported in December 2001 that the groundbreaking ceremony would take place in early 2003 "at a secret location near Magwe".⁷

In May 2002, it was announced in Moscow that agreement had been reached for the provision of a 'nuclear research centre', consisting of a 10 MW 'nuclear research reactor' and two laboratories, to be constructed in Magwe Division. The formal agreement was signed in Moscow in July 2002.⁸ It was widely reported that a site had been selected near Myaing, north-west of Pakhuku, in the north-eastern corner of Magwe Division. The

⁶ 'Myanmar Confirms Plans to Build Nuclear Research Reactor', *AFP*, 22 January 2002, <<http://www.spacedaily.com/news/nuclear-civil-02b.html>> [Accessed 2 October 2009]; William Ashton, 'Burma's Nuclear Program: Dream or Nightmare?', *The Irrawaddy*, May 2004, <http://www.irrawaddy.org/article.php?art_id=968> [Accessed 2 October 2009].

⁷ Bertil Lintner, 'Burma Joins the Nuclear Club', *Far Eastern Economic Review*, 27 December 2001-3 January 2002.

⁸ Ashton, 'Burma's Nuclear Program: Dream or Nightmare?'.

reactor was supposed to have been delivered in 2003. However, the agreement lapsed in 2003 because of disputes over payment. Talks re-started in 2005.

On 15 May 2007, Burma signed another agreement with Russia's Atomic Energy Agency (Rosatom), with U Thaung signing on the Burmese side. Russia is to provide a 10 MW light-water reactor (LWR), using 20 percent enriched uranium-235 fuel, as well as "an activation analysis laboratory", "a medical isotope production laboratory", and "nuclear waste treatment and burial facilities". Russia also agreed to "train 300-350 specialists for the centre".⁹

Rosatom officials stressed that the reactor would be subject to IAEA safeguards inspections. Burmese officials noted that Burma is a signatory to the 1992 Nuclear Non-proliferation Treaty as well as the ASEAN agreement on establishing a Nuclear Free Zone, which prohibits the production, storage and transport of nuclear weapons within the ten-member grouping.¹⁰

AGREEMENTS WITH NORTH KOREA

According to the civilian defector, who attended the meetings in Rangoon, cooperation with North Korea on nuclear matters began in September 2000, when the first Memorandum of Understanding (MoU) was signed by Lieutenant General Thein Hla on the Burmese side and Major General Kim Chan Su on the North Korean side. Four more detailed contracts were signed in 2001-02. These involved Lieutenant General Thein Aung Myint Oo on the Burmese side.

These agreements covered activities at two places. First, they involved North Korean assistance with respect to the installation, maintenance, and supply of some of the equipment, as well as some training, at the uranium refining and enrichment plant at Thabike Kyinn; second, they involve assistance with construction of an underground facility and a reactor at Naung Laing. They also included provisions for the supply of fuel rods for this reactor, as well as the despatch of North Korean engineers and technicians to Naung Laing.

⁹ 'Russia and Burma in Nuclear Deal', *BBC News*, 15 May 2007, <<http://news.bbc.co.uk/2/hi/asia-pacific/6658713.stm>> [Accessed 2 October 2009]; Paul Kerr, 'Russia, Burma Sign Nuclear Agreement', *Arms Control Today*, June 2007, <http://www.armscontrol.org/act/2007_06/Burma> [Accessed 2 October 2009]; 'Myanmar Signs Deal with Rosatom to Build Nuclear Research Reactor', *WMD Insights*, June 2007;

¹⁰ Kerr, 'Russia, Burma Sign Nuclear Agreement'.

Figure 1: Map of Burma showing reactor sites, uranium refineries and uranium mines



Burma's Uranium Deposits

There are many areas in Burma with confirmed deposits of low-grade uranium ore. Five places were identified by the Energy Planning Department of the Ministry of Energy in 2001.¹¹

Two places (Kyaukphygon and Paongpyin) are in the area around Moe Kok (Mogok) in the northern part of Pyin Oo Lwin District in Mandalay Division. The civilian defector said that samples of ore from Moe Kok have been sent to Russia and Iran for assaying purposes. The Ministry also identified two places in Magwe Division—Magwe and Taungdwingyi, about 100 km south-east of Magwe.

The fifth place listed by the Ministry was Kyauksin in Sagaing Division. It is a little more than 100 km north of Sagaing city, directly across the Irrawaddy River from Thabike Kyinn township and about 13 km west of Moe Kok.

In addition to these places, high-resolution GoogleEarth imagery publicised in March 2007 shows an apparent uranium mine (and a related refinery) at Myit Nge Chaung, near the village of Ongyaw, on the Myit Nge River, in Mandalay Division, about 23 km south-east of Mandalay and 28.5 km north-east of Kyaukse.¹² Both the defectors also pointed to this area as an emerging major area of Burma's nuclear program.

In April 2009, it was reported that uranium suitable for use in reactors was being mined for Burma's nuclear program near Lashio in northern Shan State, about 220 km north-east of Mandalay.¹³ Uranium exploration and mining has also been reported in Kachin State, and more specifically in Hpa Kant and Moe Nyin Townships, west of Myitkyina, the capital of Kachin State.¹⁴

In addition, there has been extensive uranium prospecting and perhaps some mining in the Tanintharyi River area in Myeik (Mergui) District in Tennasserim Division in the southern part of Burma. According to transcripts of radio intercepts, there were three exploration missions by Russian prospectors in 2004-05. For example, a set of radio intercepts traces the movement of a Russian uranium exploration party which flew to

¹¹ Myanmar Ministry of Energy, 'Nuclear Energy', 2001,

<<http://www.energy.gov.mm/nuclearenergysubsector.htm>> [Accessed 2 October 2009].

¹² 'Images of Suspected Uranium Mine and Refinery in Burma', *Dictator Watch*, March 2007, <<http://www.dictatorwatch.org/phshows/burmafacity.html>> [Accessed 2 October 2009].

¹³ 'Clandestine Nuclear Projects of Burmese Junta Almost Completed', 15 April 2009, <<http://democracyforburma.wordpress.com/2009/04/15/clandestine-nuclear-projects-of-burmese-junta-almost-completed/>> [Accessed x October 2009].

¹⁴ Khun Sam, 'Russia, Junta Begin Search for Uranium in Northern Burma', *The Irrawaddy*, 12 June 2007, <http://www.irrawaddy.org/article.php?art_id=7448> [Accessed 2 October 2009]; 'Russia Taking Raw Uranium from Burma Since 2007', *Kachin News Group*, 6 August 2009, <<http://www.abitsu.org/?p=5351>> [Accessed 2 October 2009].

Myeik (Mergui) from Rangoon on 8 July 2004, and which explored the area around Theindaw, south-east of Myeik, from 18 July to 5 October 2004.¹⁵

Uranium Refining and Processing Plants

Burma now has at least two uranium refining and processing plants in operation for crushing, grinding, cleaning and milling (refining) the uranium ore into 'yellowcake' (U_3O_8), a concentrate of uranium oxides in powder form. The extent of refining is unclear. The civilian defector said that Tay Za had referred to a "UF6 Project" as a direct responsibility of General Maung Aye, suggesting that an indigenous capability to convert the yellowcake to uranium hexafluoride (UF_6) is planned.

One of the refineries is located at the Tha Tha Na Military Science and Technology Development Centre Site 1 near the Myit Nge River between Mandalay and Kyaukse. It is operated by Nuclear Battalion 1234. High-resolution images published in March 2007 show a facility that looks very much like a uranium refining plant.¹⁶ The defectors said that the only foreign advisers at Tha Tha Na were Russians, of whom there were two.

The second refinery is located at the Military Science and Technology Development Centre Site 2 near Thabike Kyinn township in northern Pyin Oo Lwin District in Mandalay Division. The Army defector said in July 2008 that there were "more than five North Koreans" at the Thabike Kyinn refinery. He said that North Koreans were the only foreign advisers and engineers at the refinery, although he had subsequently heard that a technician from Pakistan had spent some time there in 2007. He said that sixty Burmese Army personnel worked at the Centre. The refinery has Russian cleaning machines, but North Korean engineers did the test-runs and commissioning of the plant. This required a cash payment to Pyongyang. According to the civilian defector, the refinery mills and processes ore from mines at Moe Nyin and Moe Kok, and has provided yellowcake to North Korea and Iran.

A third refinery may be located near Chauk, on the Irrawaddy River, about mid-way between the Magwe/Taundwingyi uranium deposits and the reported Russian reactor site in Pakhuku. GoogleEarth imagery publicised in March 2007 shows a facility with what look very much like four giant 'thickening tanks' in which the uranium-bearing solution is separated from the ground ore before being converted to yellowcake.¹⁷

Two Reactors?

Both defectors were adamant that there are two reactor sites. They confirmed that the Russian reactor is to be installed near Myaing township,

¹⁵ Intercepts in possession of the author.

¹⁶ 'Images of Suspected Uranium Mine and Refinery in Burma', *Dictator Watch*, March 2007.

¹⁷ Ibid.

in Pakhuku District in the northeast of Magwe Division. They said it was called the 'Nyaungone' Project, and that it involves only Russian engineers and technicians. Construction of the reactor has evidently not yet begun, but several related facilities have been in the area for some time. The Army defector said in July 2009 that twelve civilians had died from 'chemical burns' at one building in 2002. The Army unit currently in charge of the site is Engineering Regiment No. 3. Another source in Mae Sot said in July 2009 that Than Shwe had visited the unit in April.

The second, 'secret' or 'military' reactor is being built in an underground facility near Naung Laing village, south-east of Pyin Oo Lwin. Another nearby village is called Pan Eh. There are three mountains in the area; the reactor is inside the smallest one. Both defectors have described the construction of the underground complex in 2002-05, and the delivery of plant from North Korea in 2006-07. They said that this complex will eventually house another 10-megawatt reactor. They both said that there were about seventy North Korean engineers and workers at Naung Laing at the end of 2006. The Army defector also said that three or five Russian 'supervisors' were also stationed at Naung Laing; they live in Pyin Oo Lwin, and rotate every 12 months.

The former Army officer said on 2 July 2008 that the reactor being installed at Naung Laing was the same design as the Syrian reactor being built with North Korean assistance which was bombed by Israel on 6 September 2007; by July 2008, there was a considerable amount of information about the Syrian reactor available to him on the Internet.

The covert Syrian reactor was very similar to the 5 MWe gas-cooled graphite-moderated reactor at North Korea's Yongbyon Nuclear Scientific Research Centre. In April 2008, the CIA released convincing evidence that North Korea was involved in building the Syrian reactor and that its primary purpose was to produce plutonium. The CIA analysis concluded that:

Syria was building a gas-cooled, graphite-moderated reactor that was nearing operational capability in August 2007. The reactor would have been capable of producing plutonium for nuclear weapons. It was not configured to produce electricity and was ill-suited for research. The reactor was destroyed in early September 2007 before it was loaded with nuclear fuel or operated. We are convinced based on a variety of information that North Korea assisted Syria's covert nuclear activities both before and after the reactor was destroyed. Only North Korea has built this type of reactor in the past 35 years.¹⁸

The CIA reported that construction of the Syrian reactor probably began in 2001. It had been preceded by negotiations "between North Korean nuclear-

¹⁸ 'Background Briefing with Senior U.S. Officials on Syria's Covert Nuclear Reactor and North Korea's Involvement', 24 April 2008, <http://www.dni.gov/interviews/20080424_interview.pdf> [Accessed 2 October 2009].

related personalities and entities and high-level Syrian officials”, which probably began “as early as 1997”. Archived imagery examined in 2005 showed that construction was well underway in 2003. It was “completed in the summer of 2007”.¹⁹

A study published by the Institute of Science and International Security (ISIS) in May 2008 described “the astonishing lengths to which Syrian engineers and architects went to ... conceal the building’s true purpose”. The design of the building was masked “using fake upper walls and roof”. The steel reactor liner or vessel was assembled at the site “under a tarp to hide it from overhead surveillance”. The reactor’s ventilation system was “carefully hidden”. Power lines and water pipes were placed in underground conduits. Indeed, a “significant percentage” of the reactor building itself was underground; it was in a large hole reckoned to be “several tens of meters” deep. As the ISIS study noted, the Syrian project raised “difficult questions about the ability of governments and international institutions to detect ... secret nuclear activities”.²⁰ It seems that US and Israeli intelligence agencies only learned of the site from human intelligence (Humint) sources. According to one account, a primary source was Ali Reza Asgari, a retired Iranian General and former Deputy Defence Minister who defected to the United States in February 2007. Israel reportedly sent a twelve-man commando unit to the site to take photographs and soil samples in August 2007.²¹

Graphite moderated, gas cooled reactors such as the North Korean design are very old technology, but a small reactor based on that design has major advantages for prospective proliferants with limited resources and wanting to undertake their quest covertly. First, it uses natural uranium (in a metal form) for fuel. Second, transportation of reactor components and their assembly at the site is much easier than with other designs, and much easier to conceal. The reactor vessel is brought to the site in small pieces; it can be assembled under cover, and does not require a large crane to move the vessel inside. This approach means that a roof can be placed on a building earlier than in some other reactor designs, and it hides whatever is inside the building earlier in the construction time-line.²² Third, substantial fissionable plutonium is produced in the waste.

At Naung Laing, according to both of the defectors, the reactor and associated plant is being built entirely underground. Excavation of a large

¹⁹ Ibid.

²⁰ David Albright and Paul Brannan, ‘The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications’, 12 May 2008, <http://www.isis-online.org/publications/syria/SyriaReactorReport_12May2008.pdf> [Accessed 2 October 2009].

²¹ ‘Iranian Defector Tipped Syrian Nuke Plan’, *Israel News*, 19 March 2009, <<http://www.ynetnews.com/articles/0,7340,L-3689320,00.html>> [Accessed 2 October 2009].

²² Albright and Brannan, ‘The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications’.

cavity and construction of an entrance tunnel began in 2002. A large hole and connecting trench were dug into the mountain-side, steel frames and roofing were erected, and dirt was then put back on top. The entrance is two-lane, sufficiently wide for two 10-wheel trucks to pass each other. Construction of the tunnel was completed around 2005.

The civilian defector noted in September 2008 that the Maeda Corporation, a major Japanese construction company, was also involved in some aspect of the underground construction. He said that a Japanese engineer (Mr Aoki) was present at the site as a 'team leader' in 2004-05. He was paid by Tay Zar, the last payment being in July 2005.

According to both defectors, reactor components were included in the large volumes of equipment and material from North Korea delivered to Naung Laing in 2006-07. This was shipped to Rangoon port, and then transported to Naung Laing by road at night-time. The civilian defector noted in June 2008 that the extension of the runway at the Pyin Oo Lwin airfield will allow large cargo planes to land and hence direct delivery of freight for the site. He said in September 2008 that small parcels for the North Korean engineers were already being air-freighted from Pyongyang; these contained North Korean alcohol, green tea leaves, and 'perfume'.

The civilian defector said in September 2008 that the Naung Laing facility was connected to the national power grid, but that it also had its own 50 KV generators for emergency power. He also said that Captain Kyaw Moe Myint was in charge of security at Naung Laing, and that an air defence system is planned to protect the Naung Laing area. It is planned to consist of two ST 60U air defence radars, one to be deployed at the air base at Pyin Oo Lwin and the other near the reactor site, and S-300 PMU surface-to-air missiles.

A Nuclear Weapons Capability?

In March 2008, the Army defector said that the objective of the program was to have the first deliverable nuclear weapons ready by 2020. The combined evidence of the defectors suggests that the program could well be on schedule. If construction of the reactor inside the underground facility at Naung Laing began in 2006 then, on the Syrian time-line, it could be completed around 2012. It would take perhaps another year for the fuel rods to be loaded and the reactor tested, before it becomes operational. In the case of the reactor at Yongbyon, the reactor operated for about two years before it was shut down for the fuel rods to be extracted and moved to the cooling pond. Removal of the fuel rods can take several months, as can reprocessing the plutonium. This brings us to around 2015-16. A reactor of the North Korean design can produce 7-8 kg of weapons-grade plutonium-239 per year (when it is running), sufficient for an average of about one device per year of reactor operation. Assuming that the Naung Laing reactor

becomes operational around 2013, it might be able to produce sufficient plutonium for a handful of devices by 2020.

A plutonium reprocessing plant would be required to extract plutonium from the spent fuel rods. To be operational by 2015, construction of such a reprocessing plant would have to begin soon. The Army defector said on 2 July 2008 that the Army 'planned' to build a plutonium reprocessing plant at Naung Laing, and that Russian experts were already "teaching plutonium reprocessing" at the Naung Laing site.

The Army defector said that a 'Nuclear Battalion' was established by the Burmese military government in 2000 to work on the 'weaponisation' aspects of the program. It is based near the village of Taungdaw, in Kyaukse township, just southw-est of the Naung Laing complex; the operations area is in another underground complex in the nearby Setkhya Mountains. It includes engineer, artillery and communications elements, and is evidently concerned with research on operational aspects of weapons design, delivery capability and command and control.

Overall, a Burmese nuclear weapons program would require considerable external support, going well beyond the rudimentary Russian training and the North Korean assistance with uranium refining capabilities currently provided, and even with prospective reactor operations. The precise extent of North Korean involvement in the Naung Laing project is impossible to determine. The Syrian project again invites comparison. As ISIS reported in May 2008:

The full extent of North Korean assistance is unclear ... However, it includes design and engineering assistance, the probable supply of reactor components, and assistance in procuring items illicitly from other countries. The North Korean assistance, however, was not as extensive as providing a complete or "turn-key" facility.²³

It seems that the North Korean assistance to Burma goes beyond this, evidently to include a completely assembled reactor and, prospectively, assistance with the operation of the reactor. The defectors suggest that it is more of a 'joint' project, whereby North Korea is not merely providing Burma with the wherewithal to construct its own reactor, as in the Syrian case, but is attempting to replicate in Burma key parts of its indigenous nuclear fuel-cycle, operated and maintained by its own engineers and technicians. North Korea might be interested in construction of a 'secret' plutonium reprocessing plant in the underground Naung Laing complex, complementing the 'secret' reactor, in exchange for access to the fissionable product at some future date.

²³ Ibid.

An Iranian Connection?

According to the civilian defector, two Iranian officers visited Rangoon in February 2004, one from an Iranian intelligence agency and the other a 'nuclear expert'. They came in their own small jet, which landed at an Air Force base about 30 miles from Rangoon. One of them was Major General Mushavi, aged about 46 or 47. The defector was with them when they played golf with Tay Zar and also with Kyaw Thein, the Deputy Director of the Directorate of Defence Services, Intelligence. Mushavi offered his hosts a 'soft loan' to assist in uranium enrichment; the Iranians were given samples of Burmese yellowcake.

The Army defector said in July 2008 that "I have many contacts in this project, and they know nothing about any Iranian involvement". However, he also said in September 2008 that there had been 'many' bearded 'Kalar' or 'Kalar Phyu' technicians at Naung Laing around 2005-06, before he defected, which he thought were from Pakistan.

Conclusions

This is a story recounted from defectors. Defectors are often unreliable, whether intentionally or not. But they are sometimes the only, and they are often the first, source of intelligence about a particular development or activity. Two quite different defectors telling essentially the same story make it very compelling. I personally am convinced that both defectors were entirely truthful, relating the 'facts' as they believed them.

It is too early for the generation and detection of external signatures, since the reactor is not expected to become operational before around 2013. Even then, important traces will be masked by the steel frames and the dirt on top of the complex.

Some corroboration might be obtained from other defectors. I know of three other Army officers who have been involved in Burma's nuclear program who have defected. A class-mate of the Army officer who I have come to know defected in the Shan State area in about December 2006. Another junior officer defected to Mae Sot in July 2008; he was quickly resettled in another country. The most recent, in July 2009, who also defected to Mae Sot, was in the batch of trainees that had just returned from training in Moscow, and had not yet been posted to any of the Army's nuclear facilities.

Further defectors might reasonably be expected, a fraction of the steady stream that comes across the Thai border or joins the ethnic insurgent groups each year. The Moscow training is hated by many of those forced to attend with little notice. Safety at the training facilities used for the Burmese trainees is not good. The Army defector said in September 2008 that three of those in the second batch had been exposed to low-level radiation. He said that fifteen officers from all the courses were "already suffering some

sort of illnesses". And illness meant categorisation as 'B Class' and ineligibility for promotion (mostly from Captain to Major).

Even if additional testimony is received, the Burmese-North Korean cooperation evinces the extreme difficulty of monitoring covert programs by technical means, especially if the facilities are housed underground. Precisely what they are doing together at Naung Laing, at this time in 2009, is impossible to determine. But if a 'secret' North Korean reactor is indeed being installed, as the defectors attest, then the closest scrutiny by all sorts of means is warranted.

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