

## Status of DPRK's Uranium Enrichment Programme(UEP)

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### 1. Introduction

After DPRK's 5th nuclear test (9, Sep. 2016), DPRK's Nuclear Weapon Institute extraordinarily announced the public statement. There was one point that we need to pay attention. It said "The standardization of the nuclear warhead will enable the DPRK to produce at will and as many as it wants a variety of smaller, lighter and diversified nuclear warheads of higher strike power with a firm hold on the technology for producing and using various fissile materials." [1]

The words "various fissile materials" that it mentioned could be a hint of its uranium enrichment programme(UEP) status. Since its first nuclear test, it is known that DPRK had conducted its nuclear test with Plutonium. DPRK is also known that it has and operates uranium enrichment facility that Dr. Hecker has visited in Nov. 2010. Only the existence of the uranium enrichment facility was known. But whether it is operating or not is unclear. So the purpose of this article is to look into its uranium enrichment programme history and recent status.

### 2. Outline of DPRK's UEP

#### 2-1 Brief History of DPRK's UEP

DPRK started its nuclear programme with the direct order of Il-Sung Kim to address its shortage of electricity in mid-1950 from the support of former Soviet Union. At that time, the main programme was related to the plutonium programme but the basic studies of uranium enrichment programme was carried forward at the same time.

From end of 1980s to early 1990s, after collapse of the Soviet Union, DPRK's interest toward uranium enrichment programme was increased because of increased crisis of the regime collapse.

It is known from unclear source that DPRK's UEP became serious after the Geneva agreement(1994), with introducing centrifuges from Pakistan [2]. In April 2009, DPRK implied its UEP publicly and indirectly for the first time. And it announced it has started test of uranium enrichment in June and the test was in the almost final stage in Sep. And in Nov., DPRK invited the U.S. expert group include Dr. Hecker to open the facility to them. Until now, there is no visitor to uranium enrichment facility since the visit of Dr. Hecker.

The characteristic features and specification of the uranium enrichment facility and centrifuges installed are in table. 1 and table. 2. Most of them is based on testimony of Dr. Hecker.

#### 2-2 General Features of DPRK's UEP

DPRK's Uranium Enrichment Facility is located in Yongbyon Nuclear Complex. The building of uranium enrichment used to be an old fuel fabrication facility. After Dr. Hecker visited this facility in 2010, it has been known that the old fuel fabrication was modified to Uranium Enrichment Facility.

Uranium Enrichment Facility is a multi-function complex where mined yellowcake uranium is taken in by rail and processed into Low Enriched Uranium Fuel Rods or (as speculated) processed into Highly-Enriched Uranium for weapons manufacturing.

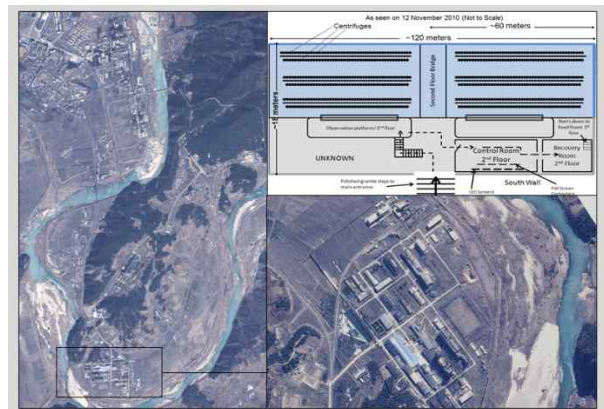


Fig 1. Site Overview of UEF [3]

General features of DPRK's uranium enrichment facility(UEF) and its specification of centrifuge which are known are listed in table 1.

Table 1. Characteristic Features of UEF [4]

Method/ Centrifuge	Gas Centrifuge Method P-2 Type(or modified)
Capacity	Annually 8,000 kg-SWU No. of Centrifuge : 2,000 Capacity of Centrifuge: 4 kg-SWU/yr : Roof size was doubled in 2013
Size	120m X 18m (2 floor building) 1 <sup>st</sup> floor(high-bays area) : cascade hall 2 <sup>nd</sup> floor : control room, observation area, recovery room, etc.
Enrichment	-Product/Tail : average 3.5%(2.2~4%) / 0.27%
Critical Equipment	-Centrifuge

Operation Status	-Started in 2010
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### 3. Current Status of DPRK's UEP

#### 3-1 DPRK's UEF

Visual signatures of operational status at the complex include snow-melt on the roof area of the centrifuge hall; or steam or smoke emanating from the Hydrogen Fluoride Production Building or the Yellowcake Intake and Processing Building.

Activity and operational status was determined from imagery analysis over the Enrichment Facility between January – May 2017. The Centrifuge Hall appears operational during the winter of 2016 - 2017.

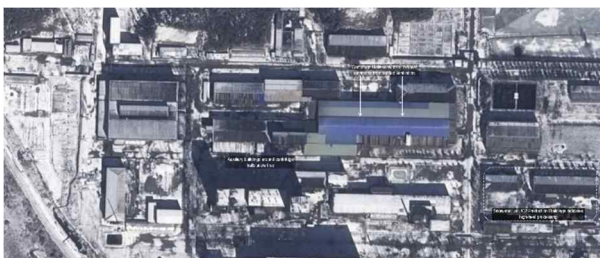


Fig 2. Satellite image, snow-melt at centrifuge hall (17 February 2017)[5]

No smoke or steam were observed at either the Hydrogen Fluoride Production building or the Yellowcake Intake and Processing Building in January and March 2017.



Fig 4. Satellite image, vehicles at auxiliary building (14 March 2017)[5]

#### 3-2 DPRK's Uranium Mine

Pyongsan Uranium Mine is a mining complex in Pyongsan City, North Hwanghae Province comprising of a 10-hectare mine, a mill complex on the river that processes the uranium ore into “yellowcake” uranium, and a waste tailings pond that receives the by-product of the processed ore.

The open-pit mine is situated amongst several valleys north of the mill complex. A processing facility at the mine receives the ore, then crushes and grinds the ore before sluicing it through a pipeline to the uranium mill complex. Once at the mill, the ore is sent through a leaching, thickening, and extraction process to further separate uranium from the by-product. During each step

in the process, by-product is sent via pipeline to a waste tailings pond. Once the uranium is extracted from the by-product, it is filtered, dried, and packaged for shipment via rail in canisters to the Fuel Fabrication Plant at the Yongbyon Nuclear Complex.

Analysis of historical archive imagery in Fig 5 and 6 confirms the mining operations have expanded through the fluvial valleys in the hills northeast of the mill, and improvements to the mine and tailings pond have been made since the beginning of this decade.



Fig 5. Satellite image (8 September 2015)[5]



Fig 6. Satellite image (7 March 2017)[5]

### 4. Conclusion

From the imagery analysis above, there are various activities observed in Uranium Enrichment Facility and Pyongsan Uranium Mine. The meanings of these visual signatures are not clear. But there is a possibility that these signatures could be related to Uranium Enrichment Programme of DPRK. Regarding to Pyongsan Uranium Mine's activities, analysis of rail carts' activities connected to Yongbyon Nuclear Complex helps to figure out the progress of DPRK's Uranium Enrichment Programme and approximate amount of uranium enriched or used.

### REFERENCES

- [1] CNBC, “Full Statement from North Korea on Nuclear Test”, 2016
- [2] 함형필, “북한의 고농축우라늄 핵개발 상황과 우리의 대응방향”, 국방정책연구 2007년 겨울호(2007)
- [3] Dr. Hecker's Presentation, 2011.
- [4] KINAC 정책연구개발실, “북한 및 이란 핵문제 현안 분석 총서”, 2016
- [5] IHS Markit, “Yongbyon Nuclear Research Centre Imagery Update: January-May 2017”, 2017