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Self-declaration of the recovery of freedom from Highly Pathogenic Avian Influenza in poultry by Republic of Korea

Self-declaration submitted to the OIE on 16 May 2018 by Dr Oh Soon-min, Chief Veterinary Officer, OIE Delegate for Republic of Korea, Ministry of Agriculture, Food and Rural Affairs

I. HPAI Outbreak Situations

There have been four epidemics of the Highly Pathogenic Avian Influenza (HPAI) H5N1, three epidemics of the HPAI H5N8 and one of the HPAI H5N6 in the Republic of Korea (Korea) from 2003 to June 2017. The Korean Government successfully implemented quarantine measures on these epidemics and regained its HPAI freedom following its report to the OIE in accordance with the *Terrestrial Animal Health Code* (the *Terrestrial Code*) of the World Organization for Animal Health (OIE).

Following the successful containment of 343 outbreaks of HPAI H5N6 from 16 November 2016 to 3 March 2017 and 76 outbreaks of HPAI H5N8 between 6 February 2017 and 19 June 2017, Korea reported its HPAI-free status to the OIE as of 13 October 2017. One month later on 17 November 2017, HPAI H5N6 was again detected in a broiler duck farm in Gochang-gun, Jeollabuk-do. The virus was identified in 22 outbreaks in total until the last outbreak in an egg-layer farm in Asan-si, Chungcheongnam-do on 17 March 2018, and no further outbreaks have been identified.

When looking at the 22 outbreaks in which the animals tested positive for HPAI by the poultry types, they consist of 8 outbreaks in chickens (1 parent stock, 7 egg-layers) and 14 outbreaks in ducks (5 parent stock, 9 broiler ducks). Since the first outbreak identified in November 2017, when examining the monthly outbreak trend, the disease occurred mostly in December 2017 and January 2018 with 7 and 8 outbreaks respectively and by March, it occurred sporadically. Monthly outbreaks of HPAI are shown in **figure 1**. (See the Annex 1).

From the 22 outbreaks that tested positive to HPAI virus, 6,990,554 animals from 173 farms (22 in outbreak zone and 151 outside the affected areas) were culled and 32,802,805 eggs were destroyed (Tables 1.1. and 1.2.) (Annex 2.). In relation to this, a total of 271,185 personnel were mobilized; 6,211 of them were involved in culling and other biosecurity measures and 264,974 in the operation of quarantine facilities such as movement control posts. A total of 466 machineries (i.e. excavators and dumper trucks) were mobilized. (Table 2) (please see the Annex 2.)

II. Epidemiological investigations

It is presumed that infected migratory birds are mostly likely the reason for the occurrence of HPAI H5N6 in Korea in the years 2017/2018. Epidemiological investigations were conducted by visiting the affected farms, animal facilities that were epidemiologically related such as poultry farms, hatcheries, feed factories, live bird markets and resting places for migratory birds. Possibility of entrance into the farm via wild birds and mechanical factors such as the movement of people and vehicles were investigated. The analysis of possible origin and the transmission route were supported by the results of the gene analysis (See Annex 3).

II. Surveillance

Korea designated HPAI as notifiable infectious animal disease as of 1 April 1982 and has contained the disease accordingly. As HPAI occurred in the winter of 2003 and 2006, Korea has worked to intensify and expand the scope of surveillance especially in the winter season. When HPAI was identified in the spring of 2008, Korea eradicated the disease and AI surveillance scheme was then revised into a year-round constant surveillance.

The major monitoring tests carried out all year round in the surveillance program are as follows:

- 1) Inspections will be conducted more than once before release, and for carcass more than once a quarter on meat ducks. For small farms with difficulties in conducting such inspections, 4 times a year.
- 2) Monthly antigen test and semi-annual antibody test (2 times / year) on breeder ducks
- 3) Semi-annual test on the poultry other than chicken and ducks
- 4) Annual antibody test on chickens
- 5) Semi-annual test on poultry and mammals distributed in live bird markets
- 6) Semi-annual test on vehicles that deliver poultry to the store, dealers' holdings, and the poultry farms that supply poultry to the store at live bird markets
- 7) Quarterly test (4 times / year) on live bird market dealers' vehicles and holdings
- 8) Capture and tests on wild birds during migratory bird seasons. Testing on faeces and carcasses between January - December.
- 9) When necessary, targeted surveillance is conducted on poultry farms and habitats for migratory birds with high risk of AI infection.

Apart from such regular surveillance activities, there have been no H5N6 or H5N8 antigens and related antibodies detected through AI surveillance for a period of more than 3 months from 18 March 2018 when control measures including culling of poultry at the affected premises (egg layers) were completed to 10 July 2018. (please see the Annex 2.)

2.1. Early detection system

There is a year-round surveillance in place to ensure early detection of avian influenza (AI) virus in poultry farms and conduction of pre-emptive disease control measures by promptly detecting and issuing warning of AI virus in Korea. In addition, a year-round clinical laboratory tests for wild birds and poultry farms across the nation are performed as well as a year-round surveillance to prevent AI outbreaks including farm inspection, pre-slaughter inspection and environmental assessment on duck parent stocks, broiler ducks, chicken parent stocks, chicken broilers, egg layers, Korean traditional chickens and quails, turkeys and other poultry nationwide. The close examination of vehicles of livestock traders, holding facilities and poultry sale establishments has been performed.

2.2. Passive surveillance

2.2.1. Reporting HPAI Suspect Animals

Livestock owner (including manager) or veterinarian, animal feed and drug seller, etc. who find HPAI suspect animals with signs such as increase in death rate or decrease in spawning rate (drop in egg production), etc. among susceptible animals including chickens-ducks, etc. shall immediately report to organizations referred to in each of the following subparagraphs, taking into account the death rate, spawning rate and other clinical symptoms. (Article 11 of the Act on the Prevention of Contagious Animal Diseases). In particular, the livestock owner shall provide following information including livestock breeding business approval status, breeding

management records by animal facility, etc. to ensure that signs of disease occurrence are promptly recognized:

- (mortality rate) average mortality rate of animals/day at the same facility doubled compared to the previous week;
- (spawning rate) average spawning rate/day at the same facility decreased by more than 3% points compared to the previous week;
- (other clinical signs) chicken (drowsiness, cyanosis observed), ducks (green stool, neurological symptoms observed).

Organization that received a report on a suspect animal by a person working in the livestock industry such as animal owner (including manager) or veterinarian, etc. shall take the following actions on the animal owner and report to the governments of Do-City, Do-City animal disease control agencies and Animal Plant Quarantine Agency:

- direct the animal owners to stay within the farm and to remain available all time;
- impose movement restriction until the final result comes out as 'negative' from close examination of Animal and Plant Quarantine Agency (APQA) on livestock, faeces, equipment and devices of the farm concerned;
- restrict entry of all vehicles;
- ban all individuals at the farm concerned from leaving. (Please see Act on prevention of Contagious Diseases in annex 4).

2.2.2. Sampling, delivery and diagnosis

Diagnostic team, which is led by an AI expert, accompanied by at least one officer and be equipped with necessary tools including sampling devices, diagnostics kit and disinfection equipment, shall depart to the affected site without delay. Diagnostic team shall take appropriate actions of changing their attire including wearing protective equipment when entering the site in question.

Diagnosis of HPAI shall be carried out by pathology examination, virus isolation, type identification by serology and closer tissue examination at a laboratory of APQA (all examinations are conducted in a semi-or fully shielded facility) in accordance with testing procedures. However, a Do City agency designated as an AI precision diagnosis agency shall request the head of APQA for a closer examination after the subtype H5/H7 is determined.

If the test (antigen, antibody) result pursuant to AI Surveillance Test Plan is positive, the head of Do-City Animal Disease Control Agency shall take disease control measures equivalent to those taken on suspect animals with clinical signs of AI and request the head of APQA for a closer examination. Precision diagnosis for suspect livestock shall be conducted as follows:

AI antigen test

When inspecting carcasses, tissues are collected aseptically, and genetic test and gold standard test are conducted on tissue emulsion. For genetic testing, both real-time RT-PCR and AIV multi-tube RT-PCR kit are used to determine whether the virus is H5 or H7 type.

Genetic test is carried out if the result of a HA test is confirmed positive after a gold standard test.

AI antibody test

cELISA (for approved livestock types only) is conducted to screen isolated sera. If the sera are found positive by cELISA, a hemagglutinin inhibition (HI) test is carried out for H5/H7 antibody.

Due to the major control measures taken during the HPAI outbreaks (Annex 2, 5), HPAI antigens and related antibodies have not been detected in the AI surveillance tests for three months between 18 March 2018 (the last day when the quarantine measures were taken) and 17 June 2018 (Annex 6).

III. Prevention and contingency response

Korea maintains a non-vaccination policy on HPAI. All animals in the affected farms, in farms near the affected farms or in farms epidemiologically linked to the affected one having a susceptible population are selectively stamped out based on risk assessment results and go through quarantine measures. Contaminated items such as eggs and feeds are discarded (buried or burned). In addition, quarantine measures that are just as strong as for the HPAI outbreak are conducted when HPAI antibodies are detected, or antibodies and antigens of LPAI H5 or H7 serotypes that are highly likely to turn into the HPAI are found during the surveillance on those farms (including relevant facilities).

In complement to the early detection system, the AI control system in force in Korea is divided into four stages.

① Intensified border control measures to prevent the disease from entering the country; ② reinforced control system per farm/region, improved breeding environment in farms, and stepped up biosecurity measures upon the arrival of wild birds (migratory birds); ③ strengthened initial response system and making all-out efforts to enforce biosecurity measures upon the HPAI outbreak; ④ supplementing the compensation system for affected farms and prevention of reoccurrence of the AI.

IV. Control measures to maintain freedom

Government officials are designated for small-scale farms, farms that are vulnerable to infection, and all large-scale poultry farms, and the names of the officials who are in charge of AI control were publicly disclosed, allowing one-on-one management of farms. Control posts and disinfection facilities are in place on major roads and points across the country where vehicles carrying poultry, feed, or manure were required to stop by and go through cleaning and disinfection prior to arriving in their final destinations. Local governments are required to secure personnel to carry out stamping-out measures in case of emergency and provide disease control training and vaccines against AI to those people to allow immediate deployment upon the disease outbreak. For constant monitoring of the disease at slaughterhouses that are at high risk of outbreak as animals come from various areas, AI tests are conducted on 10% of chickens per farm (30% for ducks). Quarantine measures are strengthened not only for livestock related vehicles (carrying poultry, feed, veterinary medicines, etc.) that enter farms, but also for disinfection of vulnerable areas including slaughterhouses, live bird markets, garden restaurants, etc.

Constant disease control activities for areas vulnerable to the disease including small scale farms and live bird markets where middlemen run business were intensified such as by conducting disinfection on a weekly basis. Poultry farming was managed by requiring farms to report their restocking prior to beginning the process and only farms with proper quarantine facilities were permitted to restock animals. The movement of migratory birds was constantly monitored in the winter time and notified to the farms near the resting places of the migratory birds to promote the disinfection of nearby farms. Disease control measures including early reporting and disinfection upon AI outbreaks were promoted to farm owners and others who are important to control the disease by sending emergency alert texts, village broadcast, and distribution of promotional flyers.

V. Conclusion

Considering that:

- The Republic of Korea has maintained a no vaccination and a stamping-out policy since it designated HPAI as a type 1 notifiable animal disease starting from 1 April 1982. The same policy was imposed in the latest epidemics of HPAI H5N6.
- After the H5N1 HPAI broke out in Korea on 1 April 2008, the country regained the AI-free country status on 15 August 2008. Since then, the government has been exercising active HPAI surveillance program on potential routes for the entry of AI into the country annually to investigate the cause of the HPAI and LPAI (H5 and H7) viruses.
- The country recovered its AI-free country status as of 13 October 2017, 3 months after rigorous control measures were taken against HPAI H5N6 and H5N8 outbreaks that lasted from 16 November 2016 to 19 June 2017 in Korea. HPAI H5N6 (22 outbreaks) was detected again. Accordingly, a total of 6,990,554 poultry were culled at 173 locations including domestic poultry farms and a total of 32,802,805 eggs were

destroyed. Movement control posts and base disinfection facilities were operated and stringent control measures including stamping-out were conducted on susceptible livestock at farms epidemiologically related to and nearby the affected farm. 271,185 personnel and 466 equipment were mobilized to contain the disease.

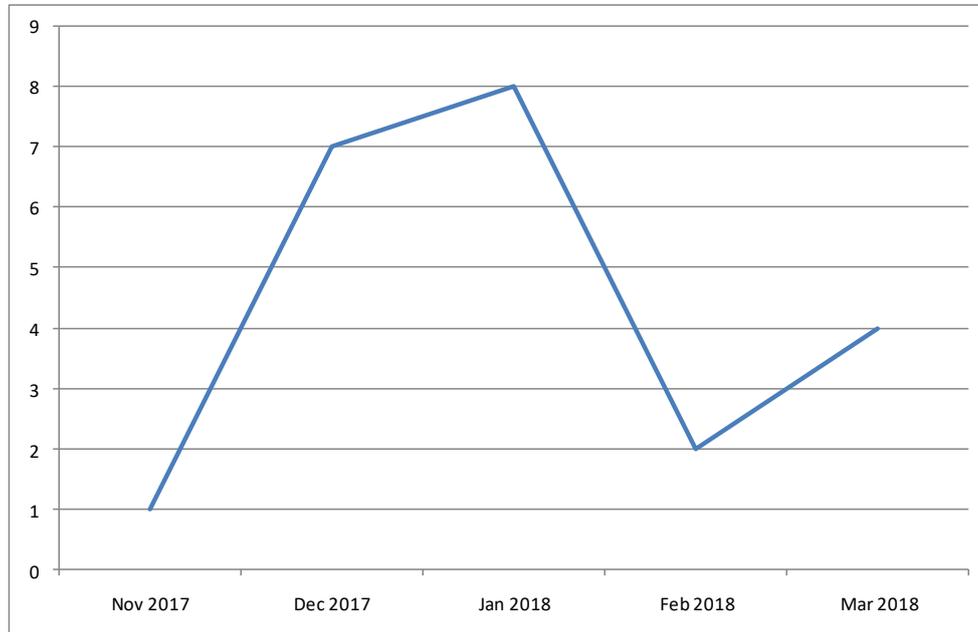
- According to an epidemiological investigation and genetic analysis conducted along with biosecurity measures, the sequence of H5N6 HPAI detected from 17 November 2017 to 17 March 2018 and the viruses detected from wild birds and poultry farms in Japan, Taiwan and the Netherlands during the same period showed a homology of 99% or higher. It is presumed therefore that the virus originated from a third country and was carried by migratory wild birds to enter Japan, the Netherlands and Korea respectively. It is assumed that the virus was transmitted via sources of contamination into farms by the movement of vehicles, humans and wild birds and occurred in sporadic and isolated outbreaks.
- There has been no additional outbreak since 18 March 2018, when all the biosecurity measures including stamping-out and burial, disinfection on affected farms were completed. The surveillance result (monitoring) on a total of 680,745 samples from 10,074 locations including poultry farms (9,355 farms, 654,342 samples) poultry distributed in live bird markets / supply farms (719 locations, 26,403 samples) detected no HPAI antigen or antibody.

The OIE Delegate of the Republic of Korea declares that the country complies with the requirements for a country free from HPAI as of 12 July 2018 in accordance with Chapter 1.6 and Article 10.4.4. of the OIE *Terrestrial Code*, and in compliance with the information provided in WAHIS.

VI. Annexes

Annex 1.

Figure 1. HPAI monthly outbreak trend



Annex 2.

Table 1. Details of disease control measures (culling and destruction, etc.)

(unit: no. of farms / animals)

Period	Category	Poultry				Eggs	
		Chickens	Ducks	Others*	Total		
November 17, 2017~March 17, 2018	Farms, etc.	Gyeonggi-do	53	-	7	60	
		Gangwon-do	7			7	
		Chungcheongbuk-do		1	1	2	
		Chungcheongnam-do	40		2	42	
		Jeollabuk-do	1	2	3	6	
		Jeollanam-do	4	48	2	54	
		Gyeongsangbuk-do	1		1	2	
		Total	106	51	16	173	

depopulation/ disposal	Gyeonggi-do	3,107,310	-	-	3,107,310	14,154,897
	Gangwon-do	113,156	-	-	113,156	347,700
	Chungcheongbuk-do	-	9,640	32,000	41,640	15,000
	Chungcheongnam-do	2,235,506		104,900	2,340,406	10,579,742
	Jeollabuk-do	220,000	41,300		261,300	2,023,827
	Jeollanam-do	160,240	804,588		964,828	4,717,018
	Gyeongsangbuk-do	77,614		84,300	161,914	964,621
	Total	5,913,826	855,528	221,200	6,990,554	32,802,805

* Others: quails, hatchery, table egg collection/sales business

Table 1-1. Details of disease control measures (outbreak farms)
(unit: no. of farms / animals)

Period	Category	Poultry				Eggs	
		Chickens	Ducks	Others*	Total		
November 17, 2017~March 17, 2018	Gyeonggi-do	Farms, etc.	5	-	-	5	
		depopulation/ disposal	1,000,757	-	-	1,000,757	2,043,625
	Gangwon-do	Farms, etc.	-	-	-	-	-
		depopulation/ disposal	-	-	-	-	-
	Chungcheongbuk- do	Farms, etc.		1	-	1	
		depopulation/ disposal	-	10,000	-	10,000	-
	Chungcheongnam- do	Farms, etc.	3	-	-	3	-
		depopulation/ disposal	76,000	-	-	76,000	369,840
	Jeollabuk-do	Farms, etc.	-	2	-	2	-
		depopulation/ disposal	-	41,300	-	41,300	-
	Jeollanam-do	Farms, etc.	-	11	-	11	-

		depopulation/ disposal	-	195,500	-	195,500	555,865
	Gyeongsangbuk- do	Farms, etc.	-	-	-	-	-
		depopulation/ disposal	-	-	-	-	-
Total		Farms, etc.	8	14	-	22	
		depopulation/ disposal	1,076,757	236,800	-	1,313,557	2,969,330

* Others: quails, hatchery, table egg collection/sales business

Table 1-2. Details of disease control measures (except outbreak farms)
(unit: no. of farms / animals)

Period	Category		Poultry				Eggs
			Chickens	Ducks	Others*	Total	
November 17, 2017~March 17, 2018	Gyeonggi-do	Farms, etc.	48	-	7	55	
		depopulation/ disposal	2,106,553	-	-	2,106,553	12,111,272
	Gangwon-do	Farms, etc.	7			7	
		depopulation/ disposal	113,156	-	-	113,156	347,700
	Chungcheongbuk- do	Farms, etc.		-	1	1	
		depopulation/ disposal	-	-	32,000	32,000	15,000
	Chungcheongnam- do	Farms, etc.	37		2	39	
		depopulation/ disposal	2,159,506		104,900	2,264,406	10,209,902
	Jeollabuk-do	Farms, etc.	1	-	3	4	
		depopulation/ disposal	220,000	-		220,000	2,023,827
	Jeollanam-do	Farms, etc.	4	37	2	43	
		depopulation/ disposal	160,240	609,088		769,328	4,161,153
	Gyeongsangbuk-	Farms, etc.	1		1	2	

	do	depopulation/ disposal	77,614		84,300	161,914	964,621
	Total	Farms, etc.	98	37	16	151	
		depopulation/ disposal	4,837,069	618,728	221,200	5,676,997	29,833,475

Table 2. Status on personnel/equipment mobilized in quarantine measures
(unit : No. of people/machines)

period	manpower			machines (total)
	follow-up measure	operation of quarantine facilities	total	
From 17 November 2017 to 17 March 2018	6,211	264,974	271,185	466

Annex 3.

Gene analysis and epidemiological surveillance

H5N6 virus isolated from wild birds and poultry between November 2017 and March 2018 was found to be included in the clade 2.3.4.4(B) virus. The analysis, performed in the **APQA (Animal & Plant Quarantine Agency)**, shows that it is a new type of H5N6 virus as a result of the recombination of the H5N8 virus (7 types of genes) that spread in Europe between 2016 and 2017, and LPAI HxN6 (1 type of gene) originated from wild birds. It is presumed to be newly introduced by winter migratory birds in the second half of 2017.

Based on closer analysis of genetic composition of the H5N6 virus for epidemiological purpose, the virus was discretionarily classified into 3 different types (Gochang type, Yeongam type and Dangjin type) according to homological differences or the recombination of internal genes. Especially, the Dangjin type virus newly appeared as a result of the recombination of 5 internal genes of the Yeongam type (PB1, HA, NA, MP, NS) and 3 internal genes (PB2, PA, NP) of the LPAI virus originated from wild birds. Out of the total 22 outbreaks in poultry, 7 outbreaks were found to be Gochang type, 13 outbreaks to be Yeongam type and 2 outbreaks to be Dangjin type. Of viruses isolated from wild birds (12 outbreaks), 3 outbreaks were Gochang type, 8 outbreaks were Yeongam type and 1 outbreak was Dangjin type.

It is presumed that infected migratory birds mostly likely the reason for the occurrence of HPAI H5N6 in Korea in the years 2017/2018 based on the below reasons.

- First, the HPAI H5N6 virus that occurred between November 17, 2017 and March 17, 2018 in Korea had never been found for 8 months since March 2017. Second, following the detection of H5N6 antigen in wild bird faeces (migratory birds) in Korea on 13 November 2017, the first occurrence was reported from a poultry farm on 17 November. On 17 October, it was first confirmed that wild birds (migratory birds) carrying the tracking device headed south. When the HPAI H5N6 was detected on 17 November, the virus was also found in wild birds (migratory birds) in Japan on 5 November. Third, genetic analysis on the H5N6 virus detected in wild birds such as migratory birds and poultry farms shows a high degree of homology (over 99%) with the HPAI H5N6 virus detected in Japan, Taiwan and the Netherlands during similar times.¹

¹ Characterization of a novel reassortant H5N6 highly pathogenic avian influenza virus clade 2.3.4.4 in Korea, 2017. *Emerg. Microbes. Infect.* 2018. 13:7(1), 103.

Detection of reassortment H5N6 clade 2.3.4.4 highly pathogenic avian influenza virus in a black-faced spoonbill (*Platalea minor*) found

- The virus was detected after 8 months since the last detection of the HPAI H5N6 virus in wild bird faeces and poultry farms in March 2017. Neither H5N6 antigens nor antibodies had not been detected during surveillance.
- HPAI epidemics in 2017 and 2018 were concentrated in the west regions of Korea where migratory birds spend the winter months.
- Of the last HPAI epidemics in Korea, H5N1 occurred four times, H5N8 three times and H5N6 once. The H5N6 virus was detected between November 2016 and March 2017 and showed, by genetic analysis, high level of homology with the H5N8 virus (7 genes) prevalent in Europe during the years of 2016/2017 and highest level of homology with the N6 gene of H5N6 originated from wild birds. (Table 3) (please see the Annex 5.)
- By factoring into overseas outbreak patterns, genetic analysis and the travelling route of migratory birds as regards the HPAI H5N6 epidemics in poultry farms during 2017/2018, it is presumed that the reasons that the virus first came into Korea are attributed to some of migratory birds that were infected with the virus in Siberia (breeding places for winter migrants) or Europe (the Netherlands, Greece, etc.).² It is also assumed that the epidemics occurred due to the introduction of contaminated sources into farms, not by direct / indirect epidemiological links between the affected farms, but by the movement of vehicles, people and wild birds and mammals, resulting in sporadic or isolated occurrences.
- The surrounding areas of the farms could have been contaminated by faeces of wild birds or contaminated sources entering mechanically into farms via vehicles, people or wild birds and mammals.

Other characteristics of the HPAI outbreak in Korea from 2017 to 2018 were as follows:

- 1) the HPAI occurred in isolated outbreaks among farms while showing a sporadic pattern between regions. As for the west coast where migratory birds' pathways are concentrated, the HPAI sporadically broke out with time intervals. As for areas with high density of poultry, mechanical factors of transmission played a role.
- 2) there was no case that tested positive for the virus at farms where pre-emptive stamping-out measure was taken (118 farms, 5,214 heads). It was thought that thorough surveillance and effective initial response contributed to containing the spread of the virus.
- 3) the possibility was raised that wild birds and mammals (mice) could transmit the virus into farms. The movement of mice was captured in the surveillance camera inside the poultry houses (windowless poultry house) of egg layer farms (2 farms).
- 4) the HPAI H5N6 was confirmed to hold 3 genotypes. Although H5N6 type detected in Korea was found to be the same serotype, it was categorized into 3 types according to homological differences or gene recombination.

Annex 4.

Act on the Prevention of Contagious Animal Diseases: Article 11 (reporting of dead or sick livestock)

① (1) Where an owner, etc. of livestock falling under any of the following (hereinafter referred to as "livestock subject to reporting"), a veterinarian who has conducted diagnosis or postmortem inspection on livestock subject to reporting, or an animal drug or feed seller who has visited a farm of the owner, etc. of livestock subject to reporting discovers livestock subject to reporting, he/she shall, without delay, report the discovery of livestock subject to reporting to the head of the National Animal Disease Control Agency, the head of a City/Gun/Gu having jurisdiction over the location of livestock subject to reporting, or the head of a City/Do animal disease control agency (hereinafter referred to as "head of a City/Do animal disease control agency"), as prescribed by

dead, Taiwan, 2017, *Infection, Genetics and Evolution* 62(2018) 275-278

² Evolution, global spread, and pathogenicity of highly pathogenic avian influenza H5Nx clade 2.3.4.4. *J. Vet. Sci.*, 2017. 18(S1), 269-280. Characterization of a novel reassortant H5N6 highly pathogenic avian influenza virus clade 2.3.4.4 in Korea, 2017. *Emerg. Microbes. Infect.*, 2018. 13:7(1), 103.

Ordinance of the Ministry of Agriculture, Food and Rural Affairs.

1-1. Livestock that have died from an unidentified disease;

1-2. Livestock that have been infected, or are believed to have been infected, with a contagious animal disease based on the results of an epidemiological investigation or close examination or clinical symptoms.

⑤ Where a disease is a zoonosis falling under the subparagraphs of Article 14(1) of the Infectious Disease Control and Prevention Act, the head of an administrative agency who has been reported pursuant to paragraph (1)2 shall, without delay, notify the Director of the Korea Centers for Disease Control and Prevention.

Annex 5.

Table 3. HPAI H5N6 epidemics in wild birds from Sep 2017 to Mar 2018

No	Si/Do	Si/Gun	Species	Sampling Date	Date of Final Confirmation	Test results	Testing agency
1	Jeollanam-do	Sooncheon	wild bird faeces	'17.11.13	'17.11.20	H5N6	NIER*
2	Jeju-si	Jeju-si	wild bird faeces	'17.11.21	'17.11.27	H5N6	NIER
3	Jeju-si	Jeju-si	wild bird faeces	'17.11.27	'17.12.02	H5N6	APQA*
4	Gyeonggi-do	Yongin-si	wild bird faeces	'17.12.13	'17.12.20	H5N6	NIER
5	Chungcheongnam-do	Cheonan-si	wild bird faeces	'17.12.19	'17.12.23	H5N6	APQA
6	Chungcheongnam-do	Cheonan-si	wild bird faeces	'17.12.20	'17.12.25	H5N6	APQA
7	Gyeonggi-do	Anseong-si	wild bird faeces	'17.12.22	'17.12.31	H5N6	NIER
8	Chungcheongnam-do	Cheonan-si	wild bird faeces	'17.12.23	'17.12.31	H5N6	NIER
9	Chungcheongnam-do	Cheonan-si	wild bird faeces	'17.12.28	'17.1.2.	H5N6	APQA
10	Chungcheongnam-do	Cheonan-si	wild bird faeces	'18.1.18	'17.1.24	H5N6	NIER
11	Jeju-si	Seogwipo	wild bird carcass	'18.1.30	'17.2.5	H5N6	NIER
12	Chungcheongnam-do	Asan-si	Captured wild bird	'18.2.1	'17.2.6	H5N6	APQA

* National Institute of Environmental Research (NIER), Animal and Plant Quarantine Agency (APQA)

Annex 6. Major quarantine measures taken during the HPAI outbreaks, Korea (Rep. of), 2017-2018

- ① In order to understand the HPAI situation accurately and exercise due command and control, the central government agencies (Ministry of Agriculture, Food and Rural Affairs and the Animal and Plant Quarantine Agency) and local governments (si/do and si/gun/gu) ran AI situation rooms. (October 2017 ~ May 2018)
- ② 18 times of standstill orders were issued on poultry, restricting the movement of poultry and people/vehicles in specific areas or across the nation and enforcing extensive disinfection.
- ③ Government officials were designated for small-scale farms, farms that are vulnerable to infection, and all large-scale poultry farms, and the names of the officials who are in charge of AI control were publicly

disclosed, allowing 1-on-1 management of farms.

- ④ Control posts and disinfection facilities were in place on major roads and points across the country where vehicles carrying poultry, feed, or manure were required to stop by and go through cleaning and disinfection prior to arriving in their final destinations.
- ⑤ “Day for temporary shutdown and disinfection” was operated on a weekly basis, requiring poultry stores in traditional markets and holdings of poultry dealers that are vulnerable to disease to clean and disinfect their facilities after removing all animals.
- ⑥ AI special quarantine teams were dispatched to major areas, including affected and adjacent si/guns to carry out tasks by providing support for disinfection and other quarantine techniques and disease control monitoring.
- ⑦ Local governments were required to secure personnel to carry out stamping-out measures in case of emergency and provide disease control training and vaccines against AI to those people to allow immediate deployment upon the disease outbreak.
- ⑧ For constant monitoring of the disease at slaughterhouses that are at high risk of outbreak as animals come from various areas, AI tests were conducted on 10% of chickens per farm (30% for ducks).
- ⑨ Farms were prohibited from raising ducks, AI high risk animals, for 5 months from November 2017 to March 2018, containing the AI outbreaks and spread.
- ⑩ The number of farms that vehicles carrying feeds or table eggs were allowed to visit was limited to one farm per day so as to prevent AI occurrence in advance that might be caused by frequent entry / exit of poultry related vehicles into farms.
- ⑪ 7-day stand still order and AI tests were conducted in all poultry farms of the affected areas (si,gun) if suspected animals were found. The distribution of live birds was also prohibited in traditional markets of such areas until the establishment of AI control zones was lifted in the concerned area.
- ⑫ Intensive quarantine inspections were conducted in facilities that are vulnerable to the disease infection, including rice husk suppliers, poultry manure processing facilities and table eggs collection/sale businesses.
- ⑬ Preventive stamping-out measure was enforced on animals of farms within the 3 km radius of the affected farm to prevent the spread of the disease
- ⑭ Control posts were established on the access roads to major poultry farms in the affected si/do in order to control people and vehicles entry to/exit from the farms. The access roads were disinfected every day.
- ⑮ Quarantine measures were conducted for area with densely populated egg layer farms including the establishment of control posts, the limit of egg release to one time per week and the operation of egg storage facilities. Egg layers went through tests once a week by using portable diagnostic kit to monitor AI occurrence.
- ⑯ Vaccine teams were required to report to the government prior to their visit to poultry farms, and they were allowed to enter the farms only after being confirmed that the personnel and vehicles were disinfected and in compliance with quarantine requirements, and that no issues were found.
- ⑰ Quarantine measures were strengthened not only for livestock related vehicles (carrying poultry, feed, veterinary medicines, etc.) that enter farms, but also for disinfection of vulnerable areas including slaughterhouses, live bird markets, garden restaurants, etc.
- ⑱ Vehicles were designated and operated for the purpose of carrying poultry and eggs, and a nation-wide control was enforced on the movement of faeces from poultry such as chickens and ducks.
- ⑲ Constant disease control activities for areas vulnerable to the disease including small scale farms and live bird markets where middlemen run business were intensified such as by conducting disinfection on a weekly basis.
- ⑳ Surveillance and testing was intensified for poultry by significantly increasing the quantities of items subject to constant surveillance and their frequency.
- ㉑ Nationwide tests were conducted on ducks (including parent stock) and special poultry (quails, pheasants, turkeys, goose and wild goose) to confirm whether AI antigens and antibodies existed.
- ㉒ Quarantine measures were strengthened for farms that are concerned to be affected by the disease through carrying out epidemiological investigation along with other related analysis on farms where animals were tested positive for HPAI antigens and H5 antibodies.

- ②③ Movement restrictions were imposed on habitats for migratory birds to limit the entry / exit of people and vehicles, and the entry roads to the habitats were disinfected everyday lowering the risk of disease occurrence from migratory birds.
- ②④ The restocking process requirements for poultry were strengthened to prevent recurrence in previously affected farms.
- ②⑤ Poultry farming was managed by requiring farms to report their restocking prior to beginning the process and only farms with proper quarantine facilities were permitted to restock animals.
- ②⑥ Intensified biosecurity measures against AI were enforced on si/gun/gu that are likely to be affected based on the risk analysis on AI transmission using 'Big Data.
- ②⑦ The movement of migratory birds was constantly monitored in the winter time and notified to the farms near the resting places of the migratory birds to promote the disinfection of nearby farms.
- ②⑧ AI infected animals were completely banned from moving into and out of the affected premises by enforcing a certification system across the nation. Only animals that are tested negative on AI tests and gain a certificate of movement issued by the livestock quarantine official were allowed to be transported in cases where they were released through slaughterhouses or poultry dealers or transported between farms.
- ②⑨ Complete inspection on AI disinfectants distributed in the market was conducted to verify their effectiveness.
- ③⑩ Live ducks, goose and wild goose and day-old chickens and pullet chickens were prohibited in garden restaurants and traditional live bird markets in order to prevent the spread of AI virus through small scale transactions of poultry.
- ③⑪ Poultry grazing was limited to prevent transmission to small farms raising under 100 birds. The government pre-emptively purchased and culled chickens.
- ③⑫ Disease control measures were strengthened on integrated poultry companies, including complete inspection on livestock facilities under the company, nationwide AI testing on all contracted farms of the company, doubled AI tests on slaughter houses and the issuance of stand-still orders within the integrated poultry company.
- ③⑬ Disease control measures including early reporting and disinfection upon AI outbreaks were promoted to farm owners and others who are important to control the disease by sending emergency alert texts, village broadcast, and distribution of promotional flyers.

Annex 7.

Table 4. HPAI Test Results in 18 Mar 2018-10 July 2018 (records)

Category	Tested subject	Total		Result	Note
		No. of place	No. of samples		
ducks	breeders	antigen	358	45,323	negative
		antibody	103	11,886	negative
	meat ducks	antigen	3,875	444,817	negative
		antibody	277	1,294	negative

chickens	grand parent	antigen	-	-	-	
		antibody	4	415	negative	
	parent	antigen	140	8,437	negative	
		antibody	148	16,664	negative	
	layers	antigen	854	34,499	negative	
		antibody	524	19,896	negative	
	Korean native chickens	antigen	63	4,217	negative	
		antibody	205	4,390	negative	
	Meat chickens	antigen	163	13,825	negative	
		antibody	1	80	negative	
other birds	Other birds*	antigen	1,833	43,516	negative	
		antibody	807	5,083	negative	
	poultry distributed in live bird markets / supply farms	antigen	719	26,403	negative	
Total			10,074	680,745	negative	

* other birds: quails, pheasants, turkeys, ostriches, goose, wild goose