



This document provides a brief overview of the *ND Etiology and Ecology Standard Operating Procedure (SOP)*. It is intended to be an easy to use reference for responders at all levels and provide a common basis for understanding ND. Please see the SOP or the *ND Response Plan: The Red Book* for further details.

ND is an infectious viral disease that affects at least 250 species of birds in 27 orders. Newcastle disease virus (NDV) is commonly classified according to disease severity with strains being defined as virulent (vNDV) or of low virulence (loNDV).

Etiology

The virus responsible for causing ND is a member of the family Paramyxoviridae in the genus *Avulavirus*. NDV is also known as avian paramyxovirus, of serotype 1 (APMV-1). Only infections with the virulent APMV-1 (or vNDV) are responsible for ND. Strains of NDV that are of loNDV are often used to formulate vaccines to prevent disease and death from ND.

There are three major pathotypes based on virulence: lentogenic (categorized as low virulence viruses), mesogenic, and velogenic (both virulent viruses). The virulent viruses are further classified as either neurotropic or viscerotropic. Even under controlled laboratory conditions, these pathotype groupings may not be obvious; low virulence and virulent, based on diagnostics, is a more appropriate way to classify NDV. For the U.S. definition of ND, please see 9 Code of Federal Regulations 82.1.

Subtypes are classified into strains, which are described by a number of characteristics, including type, host, place of first isolation, strain number, year of isolation, and antigenic subtype.

Ecology

Evidence suggests all avian species are susceptible to NDV infection, including chickens, turkeys, cormorants, migratory waterfowl, parrots, pigeons, and a wide variety of other birds, including shorebirds and penguins. ND is particularly threatening to domestic poultry. Under non-experimental conditions, there is no evidence to suggest ND affects mammalian hosts, with humans being the sole exception.

Endemic vNDV is present in much of the world, including Asia, Africa, Central and South America, and regions of Mexico. An outbreak of vNDV in the United States has not occurred since 2003.

The following are examples of how ND can be transmitted:

- ◆ *Animal to animal contact*: ND is usually transmitted via direct exposure to ND-infected birds, feces, feathers, eggshells, or secretions from infected birds.
- ◆ *Fomites*: ND is easily transmitted by objects and may persist on an item for an extended period of time. For example people, contaminated clothing, equipment, and vehicles can easily carry the virus.
- ◆ *Wildlife*: Contact with infected wild birds or their secretions, particularly wild birds or wild waterfowl, is the most likely mode of introduction of ND into a poultry population.
- ◆ *Airborne*: Airborne transmission of ND is not likely a primary mode of transmission, although it may occur over short distances as an aerosol via contaminated dust.

Incubation periods for ND are variable depending on the host species. The World Organization for Animal Health (OIE) recognizes the incubation period as 21 days. ND incubation periods vary depending on the strain of the virus; age, health, and species of infected birds; and other environmental factors. Most commonly, the incubation period can be from 2 to 15 days with an average of 5 to 6 days.

It is possible for a bird to shed the virus before and after the appearance of clinical signs. Depending on the species of bird, virus shedding can last anywhere from 1 week to a year.

Morbidity and Mortality in Birds

ND often causes morbidity and mortality rates in domestic poultry approaching 100 percent in unvaccinated flocks. However, wild waterfowl infected with ND may not show clinical signs.

Clinical signs in poultry commonly include:

- ◆ *General*: apathy, depression, lack of movement and appetite, reduced egg production, green or watery stool, respiratory difficulty, and conjunctivitis.
- ◆ *Viscerotropic*: internal and external hemorrhages and swelling of the head and neck.
- ◆ *Neurotropic*: partial wing paralysis, involuntary muscle tremors, and stiff or twisted head or neck.

Zoonotic Potential

ND is a zoonotic disease, although it does not pose a significant threat to public health. Human infection via exposure to infected birds can cause mild and self-limiting conjunctivitis and influenza-like symptoms. There is no evidence to indicate that the virus is contagious from one human to another; however, responders, flock personnel, and vaccination crews should comply with the appropriate biosecurity and safety measures, including the use of personal protective equipment.

Environmental Persistence

Persistence

ND can survive for several weeks in a warm and humid environment and indefinitely in frozen material.

Action	Resistance
Temperature	ND is inactivated by being heated at 56°C (132.8°F) for 3 hours, or 60°C (140°F) for 30 minutes.
pH	Inactivated by pH ≤2.0.
Chemicals/ Disinfectants	Ether sensitive; inactivated by formalin, phenolics and oxidising agents (e.g., Virkon®); chlorhexidine, sodium hypochlorite (6%).
Survival	Survives for long periods at ambient temperature, especially in feces.

Source: OIE Technical Disease Card for ND, 2013.

Virus Inactivation

The OIE recommends the following items and temperature for the inactivation of ND virus in egg, egg products, and meat. The tables below list the time and temperatures recommended for virus inactivation.

Inactivation of ND in Eggs and Egg Products		
	Temperature (°C)	Time
Whole egg	55.0	2,521 seconds
	57.0	1,596 seconds
	59.0	674 seconds
Liquid egg white	55.0	2,278 seconds
	57.0	986 seconds
	59.0	301 seconds
10% salted yolk	55.0	176 seconds
Dried egg white	57.0	50.4 hours

Inactivation of ND in Meat		
	Temperature (°C)	Time
Poultry meat	65.0	39.8 seconds
	70.0	3.6 seconds
	74.0	0.5 seconds
	80.0	0.03 seconds

Source: OIE Terrestrial Animal Health Code, 2016.

ND viruses can survive in bird carcasses for several days at ambient temperatures and a few weeks at refrigeration temperatures. Titters in carcasses will vary depending on the strain of the virus, species of bird, and time of death in relation to clinical stage of infection. Burying, incineration, and composting are alternatives for disposal.

Further Information



For more details please see the *ND SOP: Overview of Etiology and Ecology* and the *ND Response Plan: The Red Book*, available at <http://www.aphis.usda.gov/fadprep>.