Guidance for managing SARS-CoV-2 infections in farmed mink in Canada

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1. Background

- COVID-19 is a human disease caused by Severe Acute Respiratory Syndrome-Coronavirus-2 virus (SARS-CoV-2), which most likely emerged from an animal source. It has become a global pandemic which is being sustained through widespread human-to-human transmission.
- Human-to-animal transmission of SARS-CoV-2 has been reported in some animal species such as cat, dog and farmed mink. There have been several infected mink farms reported in various countries including Canada, Denmark, the Netherlands, Spain, Sweden, and the United States of America (OIE reports for SARS-CoV-2 events in animals). The full impact of virus spillover from humans into domestic and potentially wild animal populations is not known yet.
- Virus transmission from farmed mink to humans has also been reported in the Netherlands (Oude Munnink et al., 2020) and Denmark (OIE reports for SARS-CoV-2 events in animals). Based on current available information, humans, not animals, are the driver of this pandemic. Data on SARS-CoV-2 infections in animals is limited and as more information become available, the role of animals in this pandemic can be better assessed.
- Beyond the risk to farmed mink production and public health, there is concern that SARS-CoV-2 could spread from farmed mink into the surrounding wild animal populations and establish a reservoir for the virus if it infected a susceptible host. There is one report of detection of SARS-CoV-2 in a free-ranging, wild mink from the USA. The virus was indistinguishable from the virus characterized on the nearby affected commercial mink farm (December 11, 2020, USA report to the OIE on SARS-CoV-2 events in animals)). There is more to be learned about the origin of the virus and potential intermediate and reservoir hosts. The full scope of wild species susceptibility has not been characterized. If the virus is provided opportunity to persist in farmed animal populations, it is hypothesized that it may put additional evolutionary pressure on the virus, with many unknowns around the potential impacts on virulence, transmissibility or susceptible species range.

- Canada has established a COVID-19 One Health Working Group to share information, evaluate risk, and develop guidance for SARS-CoV-2 at the human-animal interface. This group consists of Canadian public health and animal health experts, with representation from federal and provincial/territorial governments, the Canadian Veterinary Medical Association, and academia.
- Recognizing shared responsibilities for animal health in Canada, the Canadian Food Inspection Agency (CFIA) is providing a coordination role for the development of a national guidance for managing SARS-CoV-2 infections in farmed mink. This guidance provides direction for provinces/territories in the proactive management of mink farms to prevent SARS-CoV-2 infection and respond should any mink farms in Canada report infections with this virus. It can be adapted as per local situations.
- The scope of this guidance document is not to describe all the operational elements of carrying out an outbreak response. It focuses primarily on establishing linkages and coordinating response with One Health partners and providing a selection of response options. It is meant to leverage and be complementary to the procedures and protocols already in place in the provinces/territories for other diseases which can be used/adapted for SARS-CoV-2 response.

2. Susceptibility of mink and other mustelids to SARS-CoV-2 infection

- Mink belong to the family *Mustelidae* (e.g. ferrets, otters, fishers, martens and wolverines). In experimental studies, ferrets have been found to be very susceptible to infection with SARS-CoV-2. Outbreaks in farmed mink after exposure to COVID-19 positive workers have demonstrated that mink are also very susceptible to infection with this virus.
- There are no treatments or vaccines for SARS-CoV-2 infection in mink. However, research is ongoing to develop a vaccine for farmed mink.
- **Appendix A** provides further information on SARS-CoV-2 infections in mink and other mustelids.

3. Canadian farmed mink industry

- In December, 2020, SARS-CoV-2 outbreaks were confirmed at two mink farms in British Columbia, Canada. For further information on these outbreaks, consult 'OIE reports for SARS-CoV-2 events in animals'.
- Mink farming in Canada is a provincial or territorial jurisdiction. As of January, 2021, there are approximately 64 active mink farms in 7 provinces with a total of approximately 194,000 breeding animals post-pelting. In Canada, mink farms are generally in rural locations, employ a small number of staff, and follow the National Farm-Level Mink Biosecurity Standard.
- Please see **Appendix B** for further information on Canadian farmed mink industry.

4. National risk assessment for SARS-CoV-2 in mink farms and wildlife near mink farms

- A group of Canadian experts in public, animal and ecosystem health have been assessing the risk associated with farmed mink and SARS-CoV-2. This assessment looked at the risk from the national perspective in farmed mink (*Neovison vison*).
- The assessment addressed four specific risk questions. Summary of conclusions is included in **Appendix C**.

  Note: This risk assessment follows an iterative process and can be updated as more relevant information becomes available. As a result, the conclusions included in this guidance document will be updated as needed to reflect the most recent iteration of the risk assessment.

5. Approaches taken by other countries and guidance from the World Organization for Animal Health (OIE)

- The OIE SARS-CoV-2 related information and the summary of key policy approaches taken by the European countries and the USA are included in **Appendix D**.

6. Guidance for managing SARS-CoV-2 infection in mink

- Managing animal health is a shared responsibility of animal owners, industry sectors, federal and provincial/territorial governments. All parties should work collaboratively to manage SARS-CoV-2 infections.
- The provinces/territories will lead the management of SARS-CoV-2 infections in farmed mink in their jurisdictions. They should assess their existing legal frameworks in advance to determine what authorities exist to apply various measures for managing this disease.
- The federal and provincial/territorial animal health authorities should reach out to all the stakeholders (producers, private veterinarians, laboratories) to educate them on the importance of early disease detection and implementing control measures. Mink farmers, veterinarians and laboratories are encouraged to report any suspicion of SARS-CoV-2 in farmed mink to the Chief Veterinary Office of the concerned province/territory.
- As a zoonotic disease, coordination and collaboration across various sectors using a One-Health approach is recommended to mitigate risks at the human-animal-environment interface. This involves public health, agriculture and wildlife services and farmed mink industry.
- The status and effects of the COVID-19 pandemic vary over time and between and within provinces and territories. Public health response measures are therefore tailored to the local situation by the local and provincial authorities. These differences can be taken into consideration when managing SARS-CoV-2 infections in farmed mink. However, some of the elements (for example, prevention of disease introduction to farms) should be applied consistently across Canada.
- A suite of measures applied across the human, animal and environment sectors proportionate to the risks should be used to achieve the desired level of control. As human interactions and behaviours continue to drive the transmission of SARS-CoV-2 in people, the potential impact (or lack thereof) of management of the virus in farmed mink on overall human health risks must be considered relative to the effort and resources required, impact on animal health and welfare, and potential risk to wildlife. Decisions over the management of the disease in farmed mink should therefore include

consideration of the scope, compliance and corrective actions taken with respect to public health, animal health and environment policies to achieve an acceptable outcome.

6.1 Preventing SARS-CoV-2 infections in farmed mink

- Maximum effort should be applied to preventing the introduction of SARS-CoV-2 in farmed mink for the following reasons:
    - ✓ Mink are highly susceptible to SARS-CoV-2 infection and some farms from other countries have experienced significant mortality and production losses.
    - ✓ Large numbers of animals infected and shedding virus in a confined area pose an occupational health risk.
    - ✓ It reduces the risk of the virus mutation/evolution via passage through large numbers of animals on farm.
    - ✓ It reduces the risk of virus spillover from farmed mink to surrounding wild animal populations, and the potential subsequent risk of creating a sylvatic reservoir.
- The most likely source of virus introduction to farmed mink is people who have contracted COVID-19 (e.g. workers, service providers) coming into close on-farm contact with mink. Producers should be educated and advised to follow strict biosecurity protocols.
    - ✓ General biosecurity recommendations are included in the National Farm-Level Mink Biosecurity Standard and the National Farm – Level Mink Biosecurity Standard – Producers' Guide.
    - ✓ Producers are strongly encouraged to not introduce any live mink in their existing herd from sources outside of their farm, domestic or international. If it is essential, it should be done only under full veterinary supervision to ensure that new animals are free from SARS-CoV-2. This can include testing of mink prior to and post-entry to your farm.
    - ✓ Restrict access to the premises and mink – only essential staff should be allowed on farm and in animal housing and feed storage areas.
    - ✓ Post accessible signage on the farm to inform individuals about SARS-CoV-2 biosecurity requirements.

- ✓ Maintain a daily log of all the individuals coming to the farm for tracing purposes, including date, nature of visit and contact information.
- ✓ Maintain a log of movements of animals, carcasses, manure and equipment for tracing purposes.
- ✓ Educate all employees on signs of COVID-19.
- ✓ Train all employees on the proper use of personal protective equipment (PPE) and ensure PPE are adequately fitted.
    - https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-masks-face-coverings.html
    - https://www.canada.ca/en/public-health/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/part-d.html#D.X

- ✓ Screen all employees and other individuals coming on the farm for symptoms and risk factors (e.g. recent travel, exposure to someone who may have or who are presumptive COVID-19) for COVID-19. A screening tool is included here https://ca.thrive.health/covid19/en, however local/provincial public and animal health can work with mink producers to develop other protocols for this screening or adapt existing screening tools used by other businesses.
    - Individuals who are ill or identified as high risk for being infected based on a screening should not be allowed on the premises. Request testing (if available) and require that employees stay at home until criteria to discontinue isolation have been met, in consultation with the local public health authority or healthcare provider.
    - Immediately notify the provincial animal health authority when any individual known to be exposed or infected with SARS-CoV-2 has come to the farm.
- ✓ Develop the business contingency plan, in advance, for situations if workers get sick or need to self-isolate.

- ✓ All individuals who interact with mink should use the same precautions as they would when interacting with other people.
- ✓ Minimize close contact with animals for all staff. Maintain physical distancing of 2 meters from people and animals, whenever possible, recognizing that it may not be possible for certain farm activities.
- ✓ All individuals on the farm should wear a medical mask when working around the animals, in the mink shed or preparing feed. If medical masks are not readily available, use non-medical masks. This recommendation is for routine farm tasks during production stages in which there is no close human-animal contact and the number of workers on farm is minimal.
    - During certain stages of production cycle (such as pelting, breeding, vaccination) in which there is close human-animal contact and likely increased number of workers on the farm, enhanced personal protective measures can be required for additional risk mitigation. For example, biosecurity advisory specific for pelting was sent to mink producers (**Appendix E**).
- ✓ Promote and facilitate personal preventive practices (e.g., frequent hand hygiene, avoid touching the face, respiratory etiquette, clean and disinfect frequently touched surfaces and equipment with approved products).
- ✓ Require the use of dedicated outer clothing (e.g. coveralls) and footwear when working on the farm.
    - Clean and disinfect footwear using approved products, before and after entering mink sheds.
    - Launder farm clothing daily. If outerwear cannot be laundered onsite, it should be placed in a closed bag or container for transport and handled as potentially contaminated material. Items should be routinely laundered and hot-air dried. Public laundry facilities should not be used. If access to laundry equipment is not possible, contact local public health authorities for additional guidance.
- ✓ Sharing of equipment, tools, supplies and workers between farms should be discouraged.

- ✓ Further biosecurity recommendations that should be considered by provinces and industry are included in **Appendix E.**
- ✓ As the regulation of mink farming is a provincial/territorial responsibility, there may be additional/specific biosecurity requirements.

6.2 Detecting SARS-CoV-2 infections in farmed mink

6.2.1 Case definitions for SARS-CoV-2 infection in farmed mink

- The case definitions included in this document were developed by the Veterinary Surveillance and Epidemiology Network (VSEN) under CCVO. See **Appendix F** for case definitions.

6.2.2 Surveillance of mink for SARS-CoV-2 infection

Note: A separate guidance on surveillance of SARS-CoV-2 in farmed mink is available: *"Surveillance Guidelines For SARS-CoV-2 In Farmed Mink In Canada"*. If any inconsistency is identified between these two documents on surveillance aspects, information included in "*Surveillance Guidelines For SARS-CoV-2 In Farmed Mink In Canada*" should be followed.

- Surveillance should ideally be conducted to detect infections as early as possible in order to minimize further spread to other animals and people. Early detection allows for additional protective measures to be put in place.
  - ✓ Settings with large numbers of infected mink pose a risk of getting exposed to the virus for workers and farm families.
  - ✓ There have been some reports of clustering of infected farms that are epidemiologically linked, possibly through people or other contacts between farms.
  - ✓ There is potential risk of spillover to other animals including farm animals, pets, and surrounding wildlife.

6.2.2.1 Clinical surveillance

- At a minimum, all producers should monitor mink daily for clinical signs of SARS-CoV-2 infections. All farm staff should be educated on recognizing clinical signs of infection in animals, which could include any of the following:

- ✓ Respiratory signs (e.g. difficulty breathing, sneezing, coughing)
- ✓ Discharge from nose and eyes
- ✓ Sudden drop in feed consumption
- ✓ Diarrhea
- ✓ Vomiting
- ✓ Lethargy
- ✓ Increased mortality

- It is also important to note that mink can be subclinically infected without showing any signs of illness and with no notable increase in farm mortality.
- Once the virus is introduced on a farm, it can spread rapidly among mink. If SARS-CoV-2 is suspected, producers should immediately contact their veterinarian for a disease investigation. The veterinarian should then notify the Office of the Chief Veterinary Officer (CVO) for their province or territory. The contact list is included at the end of the CCVO position statement on testing of animals for SARS-CoV2. Producers should immediately implement self-quarantine, as per public health guidelines, and movement restrictions on and off the farm.
- Additional triggers to potentially initiate a disease investigation and enhanced surveillance and testing on a mink farm include:
  - ✓ Known exposure of mink to a person with suspected or confirmed COVID-19. Public health investigators should collect information related to contact with animals and farmed mink for all suspected and confirmed cases of COVID-19 in people in order to identify any such links as early as possible.
  - ✓ Epidemiological link to another mink farm that has been confirmed or suspected to have SARSCoV-2 infection. This could include movement of individuals (e.g. staff, veterinarians, service providers), animals, products or items.
- If the decision is made to test farmed mink for SARS-CoV-2, provincial/territorial authorities will provide sampling and testing guidance specific to the case.

6.2.2.2 Active surveillance

- Given that internationally a number of infected mink farms did not report observable clinical disease, or found that the virus was likely circulating for weeks before observable

morbidity and mortality, active surveillance approaches should be considered for early identification of infected farms.

- A higher incidence of COVID-19 in humans and unidentified sources of community transmission where farm staff reside can increase the likelihood of infection in farm staff. However, other factors may also increase this risk (e.g. travel, communal or crowded living conditions).
- Active surveillance approaches based on the local epidemiology of the disease are recommended. Sampling and testing should be considered in situations where the results will inform animal or human case management.
- The producers who send mink carcasses for pelting to the USA should find out if there are any surveillance/testing requirements from the pelting factory in the receiving state. The US national guidance has recommended measures for pelting of animals. If there are any requirements, the producers should discuss with the provincial authorities to address those.
- The decision to conduct active surveillance should be made in collaboration with the local public health and provincial/territorial animal health authorities.

6.2.3 Confirmatory testing by the CFIA and notification to the OIE

- SARS-CoV-2 infection in animals is categorized as an 'emerging disease' by the OIE. Therefore, any case of infection of animals with SARS-CoV-2 will be reported to the OIE in accordance with the OIE Terrestrial Animal Health Code and include information about the species, diagnostic tests, and relevant epidemiological information. The OIE is an international standard setting body for promoting animal health and welfare. Member countries are required to notify the OIE for cases of diseases under its scope.
- The CFIA is the competent authority in Canada responsible for OIE disease notifications. The CFIA will do the confirmatory testing so that OIE notifications can be made.
  - ✓ All non-negative cases of SARS-CoV-2 from a laboratory must be confirmed in CFIA National Centre for Foreign Animal Disease (NCFAD) laboratory in Winnipeg. When there is a suspect detection of SARS-CoV-2 in mink samples by a provincial network laboratory, the network laboratory can contact the local CFIA Animal Health District Office staff who will pick and submit suspect samples to NCFAD for

confirmatory testing. If operational demands are such that local CFIA staff are not able to respond in a timely manner, the option to utilise provincial laboratory to NCFAD laboratory submission transfer could be discussed between the NCFAD coordinator and the submitting laboratory.

- ✓ The following guidance further describes the procedures to be followed for sample submission to NCFAD: Interim Guidance for Laboratories Testing Animals for SARS-CoV-2.

6.3 Outbreak response following detection of SARS-CoV2 in a Canadian mink farm

6.3.1 Establish a One Health disease response team

- Local/provincial public health, agriculture and wildlife/environment authorities should establish a collaborative One Health team in order to share information, harmonize communications and develop and implement risk mitigation measures in the event that SARS-CoV-2 is detected on a mink farm. This group should be established in advance so that all partners understand their roles and responsibilities for the investigation ahead of time.

6.3.2 Conduct local/regional risk assessment around the infected farm

- Although a national-level risk assessment has been developed for SARS-CoV-2 infection in mink (**Section 4**, **Appendix C**), this assessment recognizes a significant amount of variability due to the variety of situations associated with individual farms, their animals, their staff and their immediate environment, as well as the ever-changing SARS-CoV-2 disease dynamics in a given area. As a result, risk will also need to be assessed on a case-by-case basis.
- Following detection of SARS-CoV-2 infection on a mink farm, the local/provincial public health, agriculture and wildlife/environment authorities should conduct a collaborative risk assessment to identify risks and determine the goals for public, animal and wildlife health. Guidance is provided in **Appendix G** that may be used for this risk assessment.
- Conduct One Health investigation to gather epidemiological information that will be useful in completing the risk assessment and selecting the most appropriate response

option. To facilitate these initial investigations, epidemiological investigation resources are provided in **Appendix H** and **Appendix I.** The information collected via this resource will help identify epidemiological contacts with humans, other mink farms, pet animals and wildlife.

6.3.3 Outbreak management options

- Based on the risk determination and risk tolerance, several response options that can be considered for different situations are included in Table 1. The end goal of all the options is to eventually eliminate SARS-CoV-2 virus from the farm, but the risk assessment will help determine if this must be done immediately (through depopulation) or if disease can be managed on farm for some period of time, depending on other goals.

Table 1: SARS-CoV-2 disease management options for mink farms

Management Options	Should be considered when	Pros	Cons
Manage the disease in the herd on an ongoing basis without depopulating animals. Allow routine pelting of animals and retention/preservation of breeding animals. The intent is to contain disease on the farm, and limit financial losses by allowing pelting and marketing of animals through the normal cycle. Frequent cleaning and disinfection whenever possible (and particularly after pelting) as well as excellent biosecurity and compliance with infection control measures and use of PPE are required. Must be able to perform testing of animals to eventually demonstrate freedom from disease.	• the disease in mink is mild and does not pose significant ongoing animal welfare concerns. • Animals are close to pelting season and will be depopulated through that process. • the premises is isolated (physically/epidemiologicall y) from other mink premises and human populations. • appropriate containment biosecurity is present including a perimeter biosecurity fence or fully enclosed shed to minimize the risk of escapes, and pest and wildlife control is in place. • there is a small cohort of workers who do not work at or visit any other mink facilities. • there is good compliance with use of PPE and other measures to prevent transmission of the virus to	• allows producers, industry and province to manage disease onsite. • reduces economic impact to producers from destruction of animals, business interruption and costs for repopulating the premises. • preserves breeding stock which may have valuable genetic traits (pelt quality, resistance to disease, temperament, etc.). • if active infection in mink clears, antibodies may provide mink immunity from re-infection – however the ability to clear infection and the development of protective antibodies is not yet known (research opportunity). • does not preclude the use of depopulation if the disease or biosecurity situation changes if the animals had cleared	• high degree of uncertainty whether the disease will resolve with mink clearing active infection or become enzootic on the farm. • potential prolonged risk of infection to people, animals and wildlife.

Management Options	Should be considered when	Pros	Cons
	staff and further spread off site. • the herd has favourable genetics that require preservation of breeding animals on the farm. • there is regulatory oversight capability to help ensure compliance and prevent disease spread.	infection by end of production cycle, there will be reduced exposure to virus for individuals who otherwise would have been exposed to virus while depopulating and disposing infected animals.	
Immediate partial depopulation of infected animals +/- those at highest risk of infection, and allowing remaining animals to continue production cycle. The intent is to contain disease on the farm, and limit financial losses by allowing pelting and marketing of animals through the normal cycle. Frequent cleaning and disinfection whenever possible and is particularly important after pelting. Requires excellent biosecurity and compliance with infection control measures and use of	• all considerations above for managing the disease on farm on an ongoing basis, as well as situations in which: • infection is severe yet can be contained to a subset of animals on the farm. • there are adequate resources and means to test all animals and provide ongoing enhanced surveillance of the remaining animals.	• all pros above (to some degree) for managing the disease on farm on an ongoing basis, as well as: • may help to slow down further spread of disease on farm by decreasing stocking density and removal of infected animals. • more likely to eliminate the disease from the farm in a shorter time frame compared to ongoing management with no culling of animals.	• all cons above (to a lesser degree) for managing the disease on farm on an ongoing basis, as well as: • increased risk of virus exposure to people involved in depopulation of infected animals. • producer may or may not be financially compensated for losses if ordered under provincial regulatory authority, depending on jurisdictions and level of regulatory response.

Management Options	Should be considered when	Pros	Cons
PPE is required. Must have the ability to perform repeated follow up testing to eventually demonstrate freedom from disease. The goal of partial depopulation in such a case is to decrease the infection pressure and the population density so that infection control measures are more likely to effective, and to decrease animal suffering as a result of severe illness.			
Immediate depopulation of all mink followed by cleaning and disinfection of the farm. The intent is to remove all sources of infection and transmission beyond the farm as soon as possible. A recovery plan regarding when and how the farm can be restocked is required to ensure the virus does not infect new animals.	• farms for which implementation of biosecurity measures will not sufficiently mitigate risk of virus spread to other farms, public and animals/wildlife. • proximity to large human populations and significant populations of susceptible wildlife (including potential species at risk). • potential for the development of a significant pathogen load based on the number of mink on the premises and current management practices. • significant number of temporary contract/off farm workers.	• eliminates source of virus transmission to people, domestic animals and wildlife.	• potential risk of virus exposure to people involved in depopulation of infected animals. • marked negative economic impact to producer and animals on the farm, including loss of breeding stock. • producer may or may not be financially compensated for losses if ordered under provincial regulatory authority, depending on jurisdictions and level of regulatory response.

Management Options	Should be considered when	Pros	Cons
	• mink are close to whelping (which greatly increases population density and requires significant handling of animals over several weeks) or mink are already close to pelting (at which point a large proportion of the farm is depopulated regardless).		

6.3.3.1 Actions that should be considered in all cases

- Apply regulatory movement controls on the farm to prevent disease spread, as per provincial/territorial authorities.
- Review biosecurity measures and make improvements, when possible. These may include, but are not limited to:
  - ✓ Fencing/containment and preventing escapees.
  - ✓ Cleaning and disinfection protocols, using approved products.
  - ✓ Manure and mortality management to prevent inadvertent exposure to other animals (feral, wild, domestic).
  - ✓ Pest control and preventing exposure to other animals on the premises (e.g. cats, dogs).
- Ensure adequately fitted PPE for all persons working around the animals. Those at higher risk for severe COVID-19 illness should not work around infected animals. The number of people interacting with these animals should be kept to a minimum. Staff that must have contact with these animals should wear gloves, eye protection (e.g. googles, face shield) and respiratory protection (e.g. N95 respirator or equivalent) instead of a facemask. When respirators are used to protect users from hazardous exposures such as the virus that causes COVID-19 a respiratory protection program which includes components such as medical screening, fit-testing and training and education should be developed. The Canadian Standards Association has developed CAN/CSA Z94.4-18 on selection, use and care of respirators. Appendix E contains some resources on respiratory protection program.
- Train personnel on the proper use of PPE.
- Review COVID-19 screening protocols for personnel.
- Producers must continue to monitor all animals daily for clinical signs of disease and provide regular updates to their veterinarian and provincial animal health authorities regarding any change in health status of animals.
- **Appendix E** contains other mitigation measures that can be considered depending on the case situation.

7. Communications

- Follow a collaborative and coordinated approach among local, provincial/territorial and federal animal and public health authorities and industry stakeholders.
    - ✓ Key messaging should be developed collaboratively and adapted for local/provincial situation, if needed.
    - ✓ Local/provincial authorities should lead communications for issues within their jurisdiction.
    - ✓ National and international communication on disease reporting (OIE) and trade will be led by the CVO/OIE delegate and CFIA.

Appendix A: SARS-CoV-2 in Mustelids

Farmed mink in the Netherlands (See the OIE website for up-to-date information.)

- SARS-CoV-2 has been detected in mink on several farms in the Netherlands (Bruschke, 2020; Ministry of Agriculture Nature and Food Quality (the Netherlands), 2020a; b; Oreshkova et al., 2020). For up-to-date information on the number of outbreaks, see the OIE COVID-19 Portal "Events in animals". After the initial detection of infection on four farms at the end of April and early May, widespread surveillance through new reporting requirements and weekly testing of mortalities was initiated.
- The source of infection on some farms is considered to be infected employees based on sequence analysis, though for other farms the source is unknown. No clear mechanism of transmission between the various farms has been identified (Ministry of Agriculture Nature and Food Quality (the Netherlands), 2020b).
- Respiratory signs in the mink primarily consisted of watery nasal discharge, but some animals showed severe respiratory distress (Oreshkova et al., 2020). In severely affected animals, clinical signs were typically seen for 2-3 days prior to death (Molenaar et al., 2020). Gastrointestinal signs were also observed (Ministry of Agriculture Nature and Food Quality (the Netherlands), 2020a). Affected animals were spread throughout the farms (Oreshkova et al., 2020). On the first four farms, the duration of clinical disease on each farm was approximately four weeks (Molenaar et al., 2020).
- The most severely affected animals on the first farms were those at the end stage of gestation (Bruschke, 2020).
- Serological results reveal that mink can also be infected sub-clinically (ProMED-Mail, 2020g), and a number of the positive farms have been identified via an early warning system, rather than the owners noticing clinical signs (Ministry of Agriculture Nature and Food Quality (the Netherlands), 2020b).
- Initial mortality rates on the first two farms were estimated to be 1.2% and 2.4% in a period of approximately 10 days, where 0.6% was expected due to routine mortality in the same time period (Oreshkova et al., 2020). The total mortality rates on the first four farms, over the course of clinical illness, were 3.8%, 3.1%, 9.8% and 2.4% (Molenaar et al., 2020).

- Pathological analysis of animals that died on the affected farms revealed evidence of interstitial pneumonia. No macroscopic abnormalities were observed in any other organs. Viral RNA was primarily detected in conchae, lungs, throat swabs and rectal swabs, but also in the liver and intestines of some. Throat swabs had higher viral loads than rectal swabs (Oreshkova et al., 2020).
- Samples of dust from the air in the mink sheds at Farms 1 and 2 tested positive for viral RNA (Oreshkova et al., 2020), but viral loads were low and samples from outside the sheds were negative (Bruschke, 2020).
- Mink (at least in Farms 1 and 2) are caged separately with solid partitions between cages, precluding direct contact (Oreshkova et al., 2020).
- Mortalities were observed in kits belonging to severely affected dams, but the kits did not show clinical signs prior to death and it is not known if they died due to SARS-CoV-2 infection or lack of maternal care. Viral antigen was detected in one of five kit lungs tested (Molenaar et al., 2020).
- Antibodies were detected in 7/24 feral cats on Farm 1. Viral RNA was also demonstrated by PCR in one of the seven cats, but only a small amount was detected, which did not allow for sequencing (ProMED-Mail, 2020e; f).
- Viral sequencing and positioning of viral isolates on a phylogenetic tree suggests that it is plausible that employees on two farms have been infected by the mink. This occurred prior to the issuance of advice to employees regarding the use of PPE (e.g., masks) (ProMED-Mail, 2020e; g).

Farmed mink in other countries

- Farmed mink have also tested positive for SARS-CoV-2 in several other countries, including: Canada, Denmark, Spain, Sweden, and the USA (Utah). See the OIE website for up-to-date information.
- On one of the positive farms in Denmark, more than 50% of the herd was shown to be infected (ProMED-Mail, 2020b).
- On the positive mink farm in Spain, 7/14 employees had tested positive for COVID-19. The initial source of the infection was thought to be the wife of one of the employees, who had travelled, followed by person-to-person spread (Axón Comunicación, 2020). Sampling of

the mink revealed infection at a within-herd prevalence of 80%, though no clinical signs were observed (ProMED-Mail, 2020a).

- The positive mink farms in the USA were confirmed to have positive cases of SARS-CoV-2 in humans that had been in contact with the mink. These farms were detected through investigation of increased mortality rates (United States Department of Agriculture, 2020). In the USA, some of the affected farms have experienced relatively higher mink mortality than what has been reported from European farms.

Other Mustelids

- The family *Mustelidae* contains many well-known species, including: badgers, wolverines, martens, fishers, polecats, weasels, otters, ermine, mink, and ferrets. Skunks and raccoons are in different families, but within the same superfamily *Musteloidea*. There have been decades of debate about the genus classification of American mink (the type of mink used for the fur trade), which have been designated either *Neovison vison* or *Mustela vison*. Recent genetic analysis suggests that there is a distinct New World lineage (including American mink and various weasels) that is separate from the Old World lineage (including European mink, ermine, polecats, weasels, and domestic ferrets) (Harding & Smith, 2009).
- Various experimental studies with SARS-CoV-2 have been conducted on domestic ferrets, demonstrating susceptibility to infection and transmission to in-contact ferrets (CSIRO, 2020; Kim et al., 2020; Richard et al., 2020; Schlottau et al., 2020; Shi et al., 2020). Viral RNA and infectious virus was detected in nasal washes, saliva, urine and feces, and seroconversion was detected. Viral yields were highest in the respiratory tract. Some infected ferrets developed mild, transient clinical signs, such as: fever, lethargy and loss of appetite.
- Kim et al. (2020) found that transmission was less efficient when ferrets were separated by a permeable partition (low levels of viral RNA detected in 2/6 indirect contact ferrets, no clinical signs, and only one animal seroconverted), while Richard et al. (2020) found that the virus was transmitted efficiently to 3 out of 4 ferrets separated similarly (including the isolation of infectious virus and seroconversion). In both studies, the ferrets were in separate cages within 1 metre of each other, but precluding direct contact.

- For more detailed information on findings related to SARS-CoV-2 in domestic ferrets, as well as cats, see the previous assessment conducted by the Expert Appraisal Group: “Rapid Qualitative Risk Assessment: SARS Coronavirus 2 (SARS-CoV-2) in Companion Animals”.

Related viruses

- Evidence related to SARS-CoV showed that ferrets were capable of infection under experimental conditions, and transmitting infection to contact animals. Some clinical signs were seen in the ferrets (Martina et al., 2003).
- Although not related to SARS-CoV-2, Aleutian mink disease virus (AMDV) has been studied in wild and farmed populations of mink and other mustelids, and this provides some clues on routes of disease transmission between these species (Kidd et al., 2009; Nituch et al., 2011; Nituch et al., 2012). Bowman et al. (2014) found results supporting the hypothesis that the major point of spillover of AMDV between mink farms and wildlife is manure and composting carcasses on mink farms. It is important to remember, however, that AMDV and SARS-CoV-2 viruses differ significantly in their ability to survive in the environment.

Further information on coronaviruses in animals can be found in the document “Infosheet: Coronaviruses at the Human-Animal Interface” at https://www.cahss.ca/groups/CEZD/ (12 February 2020).

Appendix B. The mink industry in Canada

Note: Most of the following information was directly taken from Rapid Qualitative Risk Assessment: SARS-CoV-2 in Farmed Mink.

Number of Farms and Industry Value

As of January 2021, there are approximately 64 active mink farms in 7 provinces. Farms tend to be in rural environments.

Number of active farms that have mink as of November 2020 (as per CMBA)

Newfoundland and Labrador	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	British Columbia
5	21	3	2	20	3	10

Number of total licensed mink farms by province. Of these farms, only farms included in above table currently have mink.

Newfoundland and Labrador	Nova Scotia	New Brunswick	Prince Edward Island	Quebec	Ontario	Manitoba	British Columbia
5	61	4	4	3	28	4	19

Farm Size (number of animals) in Canada

Farm size is attributed to the number of breeding females on a farm. Currently in Canada, average farm size is approximately 3,000 (range 1,000 to 25,000) breeding females; the number of animals will increase 5-6 fold after kits are born. There are also a number of farms maintaining small populations of breeding stock (200-500) to restock their farm/industry should demand for pelts increase.

Products Produced

The mink industry produces multiple products:

- pelts are of greatest value and are produced for garments;

- mink oil contains palmitoleic acid that makes it valuable as a component of medical and cosmetic products; to treat, condition, and preserve leather, also used as biodiesel;
- carcasses are used as bait for fishing, composted or rendered into a variety of products (carcasses from mortalities are stored frozen prior to their use/composting);
- manure is used as crop fertilizer, and may be stored for up to 1 year prior to use on crops.

Number of Employees

The number of employees on a farm changes seasonally. Many farms are family run and employ both full and part time staff in small numbers. A single person can care for 1000 mink and stable staff levels range from 1-25 depending on farm size. This can double in busy periods after kits are born, when vaccinating animals, and during pelting. Veterinarians are the only other individuals that will have direct contact with the animals. Other staff, contractors and delivery drivers will generally not enter the barns.

Physical Infrastructure

Mink are primarily housed in open sided sheds that are unheated; mink are exposed to natural daylight and environmental conditions while protected from rain, snow and direct sunlight. Barns can have two rows or multiple rows of cages; distance across the aisles is sufficient for a feed cart to drive through daily for feeding, but still narrow enough for a person to touch the cages on both sides with their arms outstretched.

Cages are primarily constructed of metal (wire mesh); wood and/or plastic may also be used in the construction of side panels between cages to separate mink. Nest boxes are often constructed of wood. Mink in adjacent cages are unable to contact one another directly, the distance between cages is a couple of centimetres allowing indirect contact between animals. There may or may not be the ability for mink to see each other.

The majority of farms have very good fencing that protects the farms from access by people and animals from outside the farm environment. Fencing is also critical to keep escaped mink within the farm boundaries; should an animal escape its cage. Farmers may also use live traps and dogs to keep the animals within the farm.

Mink Production Cycle (focus on direct contact between mink and people)

Information on care and handling of mink can be found in the Code of Practice for the Care and Handling of Farmed Mink (National Farmed Animal Care Council and the Mink Breeders Association, 2013). Lifecycle information is described on the Truth about Fur website (Truth About Fur, 2020).

1. **Whelping and Weaning (April to June)**
    - Kits can be handled up to 4 times during this time, they will be counted and may be weighed. Females are only handled if sick. Weaning (mid June) is the most intense time for animal handling.
    - Kits are vaccinated twice after weaning at the end of June. Each breeding female will be vaccinated once each year after weaning.
    - Barren females will be injected with melatonin to stimulate pelt production, and they will be pelted in August. This practice may not occur on all farms.

2. **Growth and Pelting (July to December)**
    - Handling is minimal during growing time (July to October) until pelting occurs. Some vaccination may take place during this period. Generally animals are observed daily, and feeding occurs via driving through the barns using a feeding cart to deposit feed on the top of each cage. Only common contact with animals is through shared air.
    - During growth season, animals are primarily handled if they are off feed or appear sick.
    - In Fall mink will be handled for grading and may be weighing. During harvest (August for barren females if implanted, November-December for this year's crop), animals are handled for humane euthanasia using carbon monoxide at the cage side. Sick animals will be harvested first. Extra staff must be on site during harvest time.
    - Pelts are processed on farm in British Columbia and Manitoba. In Ontario some pelts can be sent to a pelting plant in the United States. In Nova Scotia there are two pelting plants, whereas in Newfoundland a single pelting plant handles all of the animals.
    - Cages are cleaned after harvest, but generally not at other times.

3. **Conditioning and Breeding (December to March)**
    - Contact is minimal during conditioning. Only sick animals would be handled.
    - During breeding, females will be taken to the male's cage. A female may be bred with multiple males. The females are induced ovulators with delayed implantation leading to some uncertainty in the exact timing of whelping.

Major inputs and outputs on a mink farm

Biosecurity measures and operational management of mink farms are described in the National Farm-Level Mink Biosecurity Standard (Government of Canada, 2013).

	Input	**Control Measure**	**Outputs**
Animals	Replacement breeding animals	New animals – buy clean Animal Movements Mortality Management Manure Management	Pelts Oil Mortalities Carcasses from pelting Manure
Water	Municipal or well water	Water Management	
Feed	Primarily fed waste products from slaughter industry: raw meat, offal, etc. Will include waste products from bakeries, egg processing, cheese manufacturing, fish offal etc.	Feed Management	Nil
Fomites	Premises Equipment Vehicles	Premises, Building, Equipment and Vehicle Sanitation	Equipment Vehicles
Vectors	Feral cats Farm cats and dogs Raccoons Flies Staff/Visitors	Pests and Pet Control Entry, Movement and Exit Protocols	Feral cats Raccoons Flies

Mink farming in Canada is a provincial or territorial jurisdiction. Although the federal government produces guidelines for biosecurity, these are implemented through provincial or territorial policies or regulations to different degrees. Biosecurity regulations apply to (1) the

requirement for licensing and inspection of mink farms; (2) fencing standards; (3) disease surveillance; and (4) carcass and waste disposal. In each of these categories, there is a diversity of approaches. For example, some provinces require licensing and inspection of mink farms, whereas others do not. Only some provinces have minimum standards for fencing. Different approaches are taken by jurisdictions to disease surveillance and waste disposal. The biosecurity risks posed by and to a given mink farm are therefore affected by the provincial or territorial regulatory frameworks, in addition to overall compliance with those regulations.

Appendix C: Conclusions of Rapid Qualitative Risk Assessment on SARS-CoV-2 infections in Canadian farmed mink.

https://www.cahss.ca/media/uploads/CEZD/documents/20-09-29_22-51/Farmed_mink_RQRA_summary_-_Iteration_2.pdf

This assessment considered the following four questions:

Question 1

What is the probability of exposure of Canadian farmed mink to SARS-CoV-2, and subsequent infection, through direct or indirect contact with persons who have contracted COVID-19 (i.e., human to mink transmission), and what are the resulting health impacts on the mink and mink industry?

The probability of the exposure and infection of Canadian farmed mink to SARS-CoV-2 from infected humans is most likely low, but ranging from negligible to high due to variability. The outbreaks currently occurring in the Netherlands reveal that mink are clearly susceptible to infection. In Canada, the probability of exposure for mink farms is more limited, since they are in rural locations and they employ a small number of staff. Biosecurity in the mink industry is guided by the National Farm-Level Mink Biosecurity Standard. Generally, biosecurity measures targeting the exclusion of visitors and preventing access to mink are good. The uncertainty is moderate.

If infection does occur, the magnitude of the effects on affected mink producers and the mink industry would most likely be significant. This would not necessarily be due to the disease itself, which seems to have relatively low morbidity and mortality in mink, but rather due to control measures taken to prevent further spread, labour issues, and the results of public perception. **The overall national-scale impact on farmed mink and the mink industry of this scenario is therefore considered to be moderate to high**.

The large amount of variability in the probability estimate is dependent on the geographical and temporal distribution of human cases in Canada, and this should be assessed regionally. Other risk factors causing variability include: seasonality (with a greater amount of human-mink contact from April to June), and the biosecurity practices employed by the farm. Key uncertainties include: regional prevalence of symptomatic and asymptomatic human cases, the

amount of shedding by asymptomatic people, virus survival in the environment, and infectious dose.

Question 2

What is the probability of exposure of humans to SARS-CoV-2 in Canada through direct or indirect contact with live farmed mink or mink carcasses (i.e., human-mink-human transmission), and what is the resulting human health impact at the national level?

SARS-CoV-2 is primarily a human pathogen. The probability of human exposure to SARS-CoV-2 from infected farmed mink in Canada is first dependent on the mink becoming infected from exposure to a person who has contracted COVID-19, as in question 1. The mink must then shed sufficient virus (or have virus present in exposed tissues), and sufficiently expose a susceptible human, to transmit the infection. The probability can be considered in terms of the overall pathway (i.e., human-mink-human transmission), or just the probability of mink-human transmission in cases where the mink have been infected (i.e., assuming the first part of the pathway has already occurred).

For employees and contractors involved in pelting:

- **The probability of human-mink-human transmission is most likely low**, but ranging from negligible to high due to variability. This is primarily a result of the probability of human-mink transmission, as in question 1.
- **Where mink have been infected, the probability of mink-human transmission is most likely moderate**, but ranging from very low to high due to variability. Before being cleaned, the pelts of infected animals would probably be contaminated with feces, respiratory droplets and saliva, and employees/contractors often have close contact with the fur soon after euthanasia.
- The uncertainty is moderate.

For employees and veterinarians working with live mink on the farm:

- **The probability of human-mink-human transmission is most likely low,** but ranging from negligible to high due to variability. This is primarily a result of the probability of human-mink transmission, as in question 1.

- **Where mink have been infected, the probability of mink-human transmission is most likely moderate**, but ranging from very low to high due to variability. Information from the Netherlands suggests that this transmission is plausible, and dust particles in the air within the sheds have been shown to be positive by PCR. Other routes of exposure include contaminated cages, door handles, feed carts, and floor dust.
- The uncertainty is moderate.

For the general public:

- **The probability of human-mink-human transmission is most likely negligible**, but ranging from negligible to low due to variability. Biosecurity measures are in place to separate the public from farmed mink. Information from the Netherlands suggests that virus was not present in dust samples outside the mink sheds, and mink farms are typically located in sparsely-populated areas. Although manure-spreading is a potential pathway of transmission, manure is generally held on the farm before partially composted manure is spread on fields once a year. It is unlikely that the general public would contact a sufficient dose of virus via this route. **This probability does not change in cases where mink have been infected.**
- The uncertainty is moderate.

Given the current context of a global pandemic, with a vast number of cases resulting from exposure to sources other than farmed mink, **the overall national-scale impact on human health associated with this hazard is considered to be negligible to low**. The impact could be higher in cases involving highly susceptible individuals, though, on average, these individuals are unlikely to have contact with farmed mink.

In addition to the risk factors mentioned in question 1, other sources of variability in the probability estimates include: increased human-mink contact from August to November for pelting, whether mink are pelted on-site versus at a pelting plant, stage of illness in the animals and therefore the amount of shedding, husbandry practices, manure management, and environmental factors. The probability of a person contracting COVID-19 from another person is notably higher than any probability of contracting the virus via farmed mink.

Key uncertainties include: extent of pelt contamination in symptomatic and asymptomatic animals, virus survival throughout the pelt-cleaning process and potential cross-contamination of

pelts, within-herd prevalence, virus survival in manure and compost piles, and lack of transmission and pathology information from experimental studies in mink.

Question 3

What is the probability of exposure of wildlife to SARS-CoV-2 in Canada, and subsequent infection, through direct or indirect contact with live farmed mink or mink carcasses (i.e., human-mink-wildlife transmission), and what are the resulting impacts (including potential development of a virus wildlife reservoir)?

The probability of the exposure and infection of a wild animal in Canada to SARS-CoV-2 from farmed mink is most likely low, but ranging from negligible to high due to variability. Wild mustelids and felids are most likely to be susceptible. Mink farms generally have a perimeter fence and traps within compounds, which are meant to keep wildlife out and prevent mink from escaping; however, these measures are not necessarily consistent across the country. Housed in raised pens, contact with some pests and wildlife is mitigated and pest management practices are used to manage insects, rodents and where necessary wildlife. Mink are solitary and territorial. Direct contact between them and other animals is likely infrequent, except for escaped and wild mink (especially during interbreeding or at bait stations). This would require, though, that mink escape while infectious, which would be less likely once an outbreak is identified on a farm. Transmission via indirect contact would be more likely on the farm, due to wildlife contact with improperly managed manure/compost piles, since virus survival is likely longest under these conditions. Manure is generally composted in a fenced area, and carcasses are buried or transported to a landfill to minimize exposure to a variety of pathogenic organisms. The uncertainty is moderate to high.

If infection does occur in a wild animal, the spread of infection would most likely be limited and transient, though the exact extent of spread would depend on the species exposed. Wild mustelids are most likely to be exposed and susceptible, but their solitary and territorial nature makes widespread transmission amongst them unlikely. In addition to host considerations, the virus must be well-adapted to spread efficiently in a reservoir species. SARS-CoV-2 appears well-adapted to humans, and infections in animals have so far resulted in virus shedding of short duration, if at all. In addition, the virus is adapted to transmit best in areas of high density. **The**

probability that an ongoing virus reservoir develops within a wild animal population in Canada is considered to be low, but with a high level of uncertainty.

Despite this low probability, the effects of such a scenario were explored. These effects could be significant, depending on the species affected, the morbidity and mortality experienced, and the extent of contact that species has with humans and other animals. Effects could include conservation concerns (if a rare wildlife species is affected), ongoing challenges for mink farmers, or an ongoing zoonotic risk (if a species with frequent human contact is affected). However, human to human transmission is likely to remain the most important route of transmission for the foreseeable future. The existence of a reservoir would also create opportunity for the virus to mutate into something more pathogenic for humans or animals. Other effects could include a fear of wildlife by humans, with potential consequences to wildlife due to human interference.

In addition to the risk factors mentioned in question 1, other sources of variability in the probability estimate includes: type of housing, stage of illness in the animals and therefore the amount of viral shedding, husbandry practices, environmental factors, and wild animal species susceptibility. Key uncertainties include: virus survival in manure and compost piles, infectious dose, and the susceptibility of wild animal species in North America, such as bats, raccoons, skunks, and squirrels.

Question 4

What is the probability of exposure of farm or feral cats to SARS-CoV-2 in Canada through indirect contact with farmed mink, and subsequent exposure (with or without infection) of humans and animals (i.e., human-mink-cat-human/other transmission)? Impacts are assumed to be the same as in questions 1 to 3.

The probability of the exposure of humans (without infection) and animals (with infection) in Canada to SARS-CoV-2 from farm or feral cats on mink farms is:

- **Most likely very low for employees and veterinarians on the farm**, but ranging from negligible to moderate due to variability. Although it is fairly likely that cats on affected farms would be exposed and infected, as has been observed in the Netherlands, it is unclear if cats would be able to contaminate the environment with a sufficient amount of virus to result in effective transmission. There has currently been no evidence of cat-

human transmission of this virus, but it has been demonstrated that cats can transmit it to other cats. Direct contact between humans and these cats is often minimal, especially for feral cats. The uncertainty is moderate.

- **Most likely very low for the general public**, but ranging from negligible to low due to variability. In addition to the above considerations regarding transmission by cats, farms are in very rural areas and cats are unlikely to range far from the farms. Farm cats are exposed to few people, and feral cats tend to keep their distance from people. The uncertainty is moderate.
- **Most likely very low for wildlife**, but ranging from negligible to moderate due to variability. In addition to the above considerations regarding transmission by cats, the nature of interaction between cats and susceptible wildlife is an important consideration. Cats appear to excrete virus for a short period of time, and it is unlikely that a wild animal would contact the same environment that a cat passed through for long enough to contact an infectious dose.. The exception is transmission between feral cats and other feral cats. Transmission among feral cat populations is also more likely to be prolonged, since they live in social groups. The uncertainty is moderate to high.
- **Most likely very low to low for farmed mink**, but ranging from negligible to high due to variability. In addition to the above considerations regarding transmission by cats, direct or indirect contact between cats and mink (including contact with cat feces) is unlikely unless the cats were to access mink feed on the cages. The uncertainty is moderate.

In addition to the risk factors mentioned in question 1, other sources of variability in the estimates include: type of cat (farm versus feral), type of housing, stage of illness in the animals and therefore the amount of shedding, husbandry practices, environmental factors, and wild animal species susceptibility. It should be noted that farm/feral cats may be exposed and infected from sources other than infected mink. Key uncertainties include: virus survival in manure and compost piles, extent of shedding by cats, infectious dose, and the susceptibility of wild animal species in North America.

Appendix D: Summary of key policy approaches taken by other countries for managing SARS-CoV-2 in farmed mink

SARS-CoV-2 cases in farmed mink have been reported in several countries (such as Canada, Denmark, the Netherlands, Spain and the USA). Consult the OIE 'Events in Animals' web page for further information on disease investigations in all affected countries. The following is a summary of how some of these countries have approached some key policy issues related to managing these infections.

One Health approach

- All countries are using One Health approach that ensures collaboration and coordination among public health, animal health and wildlife authorities and the industry.

Prevention of infection in farmed mink

- Prevention is the most important element of disease management. All countries are strongly recommending biosecurity measures for the mink industry to prevent introduction of virus to farms.

Surveillance

- All countries are recommending producers to closely monitor their animals for signs of SARS-CoV-2 infection and notify the authorities at the earliest.
- Denmark, France, Sweden, the Netherlands and the USA have recommended/implemented serological and/or RT-PCR based testing of mink for early detection of infected farms. Greece has implemented weekly testing of mink producers and workers and follow-up testing of mink farms with confirmed human cases.

Control measures

The following measures have been implemented by all these countries on the affected mink farms to prevent disease spread:

- Official movement controls and strengthened biosecurity measures to prevent disease spread to individuals, other farms, pets and wildlife.

- Enhanced public health protection measures for farm staff and families, service providers and visitors (e.g. PPE, education, personal hygiene).
- One Health investigation to identify source and likely spread of infection in animals and humans.
- Enhanced surveillance to support outbreak investigation, based on epidemiological information.
- Cleaning and disinfection of farms.

Depopulation of infected mink farms

- The US national guidance (https://www.aphis.usda.gov/publications/animal_health/sars-cov-2-mink-guidance.pdf) leaves to the individual states to decide on specific control measures such as depopulation of farms. As of December 2020, none of the four states (Michigan, Oregon, Utah, Wisconsin) pursued immediate depopulation of infected mink farms.
- As precautionary measure, Denmark depopulated the first three infected farms. This approach was discontinued for some subsequent farms which were managed by implementing disease control measures while allowing farms to complete production. Several more infected mink farms were detected in next few months and Denmark decided to depopulate all mink farms.
- The Netherlands is doing depopulation of infected farms. It should be noted that even prior to emergence of SARS-CoV-2, the Netherlands had already decided to terminate farmed mink industry by 2024. They have decided to terminate the mink industry by March 2021 after pelting rather than wait until 2024.
- France and Spain depopulated mink on their first infected farms. As there have been only one infected farm so far in these countries, it is not known if the same approach will be continued or not for subsequent farms.
- As of December 2020, Greece and Sweden did not peruse immediate depopulation of infected mink farms.

Other resources:

USA interim SARS-CoV-2 guidance and recommendations for farmed mink and other mustelids

USA Response and contaminant Guidelines: Interim Guidance for Animal Health and Public Health Officials Managing Farmed Mink and other Farmed Mustelids with SARS-CoV-2: https://www.aphis.usda.gov/publications/animal_health/sars-cov-2-mink-guidance.pdf

Information from the OIE

OIE Technical Factsheet on Infection with SARSCoV-2 in animals

Questions and Answers on COVID19

Considerations for sampling, testing, and reporting of SARS-CoV-2 in animals

Appendix E: Risk mitigation measures for SARS-CoV-2 infections in farmed mink

Some of the information in this appendix has been adapted from the USA interim SARS-CoV-2 guidance and recommendations for farmed mink and other mustelids.

- Workplaces should identify possible COVID-19 exposure risks in their operation and consider the feasibility of steps to mitigate these risks. This risk assessment involves evaluating the workplace for areas where people have frequent contact with animals, with each other and share spaces, surfaces and objects.
- Mitigation measures include restricted access to buildings where animals are kept, keeping sick/exposed individuals at home, physical distancing, engineering controls (e.g. creating physical barriers between people when distancing is not possible; increasing ventilation), administrative controls (e.g. redistributing responsibilities to reduce contact between individuals, using technology to facilitate communication) and personal protective equipment and non-medical masks. For more information see PHAC Risk Mitigation tool for workplaces/businesses operating during the COVID-19 pandemic and Community-based measures to mitigate the spread of coronavirus disease (COVID-19) in Canada.

Some resources on respiratory protection program

Designing an effective PPE program
https://www.ccohs.ca/oshanswers/prevention/ppe/designin.html
Respirator selection
https://www.ccohs.ca/oshanswers/prevention/ppe/respslct.html
Respirator care
https://www.ccohs.ca/oshanswers/prevention/ppe/respcare.html
Respiratory protection against airborne infectious agents for health care workers
https://www.ccohs.ca/oshanswers/prevention/respiratory_protection.html

Precautions when dealing with healthy mink

- Additional measures are needed when physical distancing is not possible in the workplace. This may include:
  - ✓ Create physical barriers between employees/clients
  - ✓ Increase ventilation
  - ✓ Mitigate risks from exposure to high-touch surfaces (i.e., frequently touched by others).
  - ✓ Mitigate risk for people at higher risk of severe illness
- Modify practices to reduce how long employees/clients are in contact with each other and animals and how many employees/clients come into contact with each other.

Precautions at SARS-CoV-2 positive farm

- Do not use compressed air and/or water under pressure for cleaning, or any other methods that might aerosolize (spray into the air) infectious material. PPE should be used when cleaning or disinfecting a potentially SARS-CoV-2 contaminated area; follow the cleaning or disinfectant product manufacturer's instructions for use.
- Always immediately wash your hands with soap and water for at least 20 seconds after:
  - ✓ You have direct contact with animals, their food, or supplies, waste/feces.
  - ✓ Cleaning up after animals, including any body fluids or waste.
  - ✓ Leaving areas where animals are housed, even if you did not touch an animal.
  - ✓ Removing PPE or face covering.
- Follow recommendations for safe practices for how to put on (don) and take off (doff) PPE.
- If there is a breach in PPE or other accidental direct contact with a sick animal or its urine, feces, blood, saliva, or vomit on exposed skin, a supervisor should be immediately notified, and the exposed area should be immediately washed with soap and warm water for at least 20 seconds. If soap and water are not immediately available, use an alcohol-based hand sanitizer (at least 60% alcohol content) on skin. If hands are visibly dirty, always wash hands with soap and water before using alcohol-based hand sanitizer. If an employee has an exposure to their mucous membranes (e.g. eyes, inside of nose, or mouth), the area that was exposed should be flushed with only water. Do not use soap or hand sanitizer to wash the eyes, inside of nose, or mouth.

- If a farm worker receives a bite, scratch or, abrasion from an animal, animal product, or an object contaminated by an animal: wash the exposed area of skin immediately with soap and warm water for at least 20 seconds, immediately alert the supervisor, and contact a health care provider.
- If there are people exposed to sick animals or sick people, they should follow current public health guidance.

Precautions during pelting of animals at SARS-CoV-2 positive farm

- When possible, pelting on the infected farm should be delayed until animals have cleared the infection to minimize risk of virus spread and transmission. The Health Authorities should consider testing of animals to determine SARS-CoV-2 status of farm.
- Follow all the precautions that are included for handling sick animals.
- During pelting, blood and other bodily fluids form carcasses should be prevented from contaminating the environment. Pelting activities should be performed in buildings or locations with hard, impervious surfaces or on soil that has sufficient absorbent material to prevent fluids/leachate from contaminating the area. Shavings, sawdust, straw can be used as an absorbent material which can then be added to manure and carcasses to be disposed of.

Biosecurity advisory to the Canada Mink Breeders Association, Canadian mink producers, and mink farm workers (December 4, 2020)

Background

There has been a recent surge of SARS-CoV-2 cases, the virus that causes COVID-19, in humans in many provinces and communities in Canada.

There have been many outbreaks on mink farms reported from several countries. Infected farm workers were the primary source of introduction of the virus onto the farms. There are reports of transmission of virus from infected farmed mink back to humans, posing a risk to the workers, which has led to further community spread in some countries. There has also been evidence of

mutations in the virus on some farms, but the implications of such mutations on transmission, or effect on vaccine or treatment efficacy in humans is under investigation.

The Canadian Food Inspection Agency and the Public Health Agency of Canada are working closely with federal and provincial partners to respond to this emerging issue. This includes the development of national guidance on infection prevention, monitoring, testing, and response for mink farms and employees.

Additional concerns during the pelting season

With the additional workers on mink farms to assist with selecting and pelting mink, there is an increased opportunity for contact between workers and mink and amongst workers. As well, mink processing procedures may increase the risk of spread of SARS-CoV-2 or other zoonotic diseases.

While no cases of SARS-CoV-2 have been reported in farmed mink in Canada to date, infection in mink may not always result in obvious clinical signs or significantly increased mortality on a farm. Several infected farms in other countries were identified only through testing of the mink. In the absence of knowing the precise health status of workers and mink, an abundance of caution is urged to protect mink and human health. Maximum effort should be applied to prevent the introduction of SARS-CoV-2 in farmed mink.

As recommended in the '*Guidance for managing SARS-CoV-2 infections in farmed mink in Canada*', the following measures should be implemented to reduce both animal and public health risks by:

- Restricting access to the premises and mink to only essential staff on the farm, in animal housing and feed storage areas.
    - Farmers should maintain a daily log of all the individuals coming to the farm for contact tracing purposes.
- Conducting screening of employees and other individuals coming on the farm for symptoms and risk factors for COVID-19 (e.g. recent travel, exposure to someone who may have or who is presumptive COVID-19).
    - Farm employees should notify their employer if they are diagnosed with COVID-19 and were on the farm during the period of acquisition or transmission.

    - Farm employees who are self-isolating or who are ill, especially with symptoms of COVID-19, should be excluded from the farm.
    - Follow local public health guidance for COVID-19.
- Minimizing close contact and practicing physical distancing of two metres from people and animals, whenever possible.
- Promoting and facilitating personal preventative practices through:
    - Use of dedicated outer clothing and footwear when working on the farm.
        - Clean and disinfect footwear using approved products, before and after entering mink sheds and pelting areas.
        - Launder farm clothing daily. If outerwear cannot be laundered onsite, it should be placed in a closed bag or container for transport and handled as potentially contaminated material. Items should be routinely laundered and hot-air dried. Public laundry facilities should not be used.
    - Frequent hand washing and disinfecting frequently touched surfaces and equipment in accordance with public health guidance.
    - Preventing access of wildlife and pet animals to sheds, and preventing mink from escaping.

Additionally, **during the pelting season**, the following measures are strongly recommended:

- Limit contact to breeder mink that will remain after pelting to protect their health. Where feasible, designate a farm worker that has limited contact with temporary workers to feed and care for breeder mink.
- Where possible, test all workers for COVID-19 before pelting begins and on a weekly basis until pelting concludes. Testing can further reduce the risk of introduction of SARS-CoV-2 by infected people who are not showing symptoms.
    - Producers who wish to pursue testing for workers are encouraged to discuss this with their local public health authority to see if testing can be arranged.
    - Any worker with a positive COVID-19 test result should be excluded from the farm.
    - Immediately notify the provincial animal health authority if an individual known to be infected with SARS-CoV-2 has been on the farm.

    - Immediately notify your local public health authority if a worker tests positive for COVID-19 or has clinical signs compatible with COVID-19.
- To prevent transmission of virus, the following Personal Protective Equipment are recommended for all people working on the mink farm, even with no known exposure to COVID-19 or any symptoms:
    - Gloves
    - Eye protection (goggles, face shield)
    - Mask:
        - If available, adequately fitted respiratory* protection (N95 respirator or equivalent).
        - If a respirator is not available, a medical mask should be worn.
        - If that is not available, a 3-layer non-medical mask should be worn. People who are at high risk of more severe illness should not work on the farms.

        ** When respirators are used to protect users from hazardous exposures such as the virus that causes COVID-19, a respiratory protection program, which includes components such as medical screening, fit-testing and training and education should be developed. The Canadian Standards Association has developed CAN/CSA 94.4-18 on selection, use and care of respirators.*

As the regulation of mink farming is a provincial responsibility, there may be additional/specific biosecurity requirements within your province.

Further information on PPE and a respiratory protection program can be accessed at:

- https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-masks-face-coverings.html
- https://www.canada.ca/en/public-health/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/part-d.html#D.X
- **Designing an effective PPE program**
    - https://www.ccohs.ca/oshanswers/prevention/ppe/designin.html
- **Respirator selection**
    - https://www.ccohs.ca/oshanswers/prevention/ppe/respslct.html
- **Respirator care**

- https://www.ccohs.ca/oshanswers/prevention/ppe/respcare.html
- **Respiratory protection against airborne infectious agents for health care workers**
  - https://www.ccohs.ca/oshanswers/prevention/respiratory_protection.html

Further information on Provincial worker safety guidance can be accessed at:

- BC - WorkSafe BC
- MB - Safe Work Manitoba
- NB – WorkSafe NB
- NL – Workplace NL
- NS - Nova Scotia Occupational Health and Safety Division
- ON - Ontario Workplace Health and Safety
- PEI – Workers Compensation Board
- QC - CNESST

Manure and carcass management at SARS-CoV-2 positive farm

- Manure and carcass disposal methods should comply with provincial and local regulatory requirements.
- Manure and carcasses from infected premises should be managed to reduce the risk of spread/transmission of live virus on and from the premises. This should include measures to:
  - ✓ Inactivate the virus in carcasses and manure prior to disposal, OR
  - ✓ Dispose of carcasses and manure in a manner that prevents exposure and transmission of live virus
- When possible, dispose of carcasses and manure onsite to reduce the risk of contamination and transmission of the virus to additional sites.
- When disposal onsite is not an option:
  - ✓ inactivate virus in carcasses and manure prior to moving offsite OR
  - ✓ contain carcasses and manure in a manner that prevents transmission of the virus to an offsite location for inactivation and disposal of these materials
- The persistence of SARS-CoV-2 in manure and carcasses of animals under varying conditions is not yet fully established. While there are a number of methods that can be used to inactivate the virus, current research and information has primarily been

conducted under controlled laboratory conditions in various matrixes, as such, care should be taken when interpreting and applying methods to the management of carcasses and manure.

- Persistence of viruses in the environment depend on inherent characteristics of the virus with the presence of a lipid envelope often reducing survivability. Survival of other corona viruses in animal carcasses and manure can inform decision making, however, there can be variation even within strains of a virus.
- The SARS-CoV-2 virus behaves similar to other enveloped viruses with temperature, relative humidity, pH, surface substrate/matrix and initial viral load impacting survival. In general, virus persistence is decreased:
    - ✓ at higher temperatures
    - ✓ when relative humidity is either very low or very high
    - ✓ when pH levels are more acidic or more basic
    - ✓ when initial pathogen loads are reduced
- While survival and infectivity of SARS-CoV-2 on various materials and matrixes appears to range from hours to days in summer, survival in a farm environment under heavier organic burden and higher pathogen loads is less well established. Porcine Epidemic Diarrhea Virus, a corona virus, has been found to survive 9 months in open earthen manure storages (lagoons) (Tun et al., 2016). Transmissible gastroenteritis virus, a swine pathogen and mouse hepatitis virus remain infectious in water and sewage from several days to weeks. At 4°C, both viruses can survive up to 4 weeks in water and sewage (Casanova et al., 2010).
- Methods to inactivate the virus generally involve the application of heat, however, chemical inactivation has proven effective against other corona viruses.
- Suitable methods for inactivation of virus in carcasses include but are not limited to:
    - ✓ Burning
    - ✓ Rendering
    - ✓ Composting
    - ✓ Burial
- Suitable methods for inactivation of virus in manure/shavings include but are not limited to:

- ✓ Burning
- ✓ Composting
- ✓ Burial
- ✓ Alkaline stabilization using lime

- Inactivation of the virus and disposal of manure and carcasses during winter will be difficult to accomplish. Composting in an enclosed/heated structure and/or storage until spring when adequate ambient temperatures support sufficient composting temperatures may be required.
- While many viruses undergo a gradual decrease in activity over time due to changes in temperature, pH, humidity, exposure to sunlight, and other environmental conditions, at lower temperatures (below 4°C) and in water, corona viruses can persist longer.
- Following composting or alkaline stabilization, materials can be applied to land in adherence with provincial environmental/farming regulations and following generally accepted farming practices.

Survival/inactivation of SARS-CoV-2 virus

Method		**Matrix**	**Inactivation**
Heat	At 4°C for 14 days (Chin et al., 2020)	Infected cell culture supernatant	Approximately 0·7 log_{10} reduction of virus titre
	22 °C for 14 days (Chin et al., 2020)	Infected cell culture supernatant	>5 log_{10} reduction of virus titre
	56 °C for 30 minutes (Chin et al., 2020 & Pastorino et al., 2020)	Cell culture supernatant Spiked blood sera Spiked nasopharyngeal sample	>5 log_{10} reduction of virus titre
	37 °C for 2 days[3] (Chin et al., 2020)	Infected cell culture supernatant	>5 log_{10} reduction of virus titre
	70 °C for 5 minutes[3](Chin et al., 2020) 70 °C for 26 hours[4] 70 °C for 176 minutes[4]	Infected cell culture supernatant Virus deposited on fabric mask Virus deposited on steel disc	>5 log_{10} reduction of virus titre 6 log_{10} reduction of virus 6 log_{10} reduction of virus
Heat	30 min at 75°C 60 min at 67°C	106 TCID50 in 100 µl culture medium in well plates	Undetectable cytopathogenic effect

	90 min at 56°C		

Appendix F: Case definitions for SARS-CoV-2 infections in animals

Note: This information was taken as such from VSEN document and may need to be updated if any changes are made by VSEN in the original document.

SARS-CoV-2 case definition for animals

2020-12-14

Veterinary Surveillance and Epidemiology Network (VSEN)

SARS-CoV-2 CASE DEFINITION FOR ANIMALS

CONTEXT:

In the following case definitions:

- The term "animal" refers to an individual animal (companion or wild animals) or a group of animals (farm animals).
- The animals known to be not susceptible are excluded. A list of susceptible and not susceptible animals to SARS-CoV-2 infection is available on the Government of Canada website: https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/animals-covid-19.html
- Asymptomatic animals are excluded, unless required for public health intervention (e.g., surveillance, research, disease control, rehoming of companion animals).
- All samples tested must be collected directly from the animal.
- Screening and confirmatory test for SARS-CoV-2 are used to detect an active infection. Other tests for SARS-CoV-2 (e.g., serology, virus neutralization) could be used in the overall diagnostic approach but are excluded from these case definitions.

SUSPECT CASE:

An animal presenting with clinical signs or pathological lesions compatible with a SARS-CoV-2 infection (respiratory disease and / or gastrointestinal disease) with at least one of the following:

- The animal has a known exposure to a confirmed or presumptive positive case of SARS-CoV-2 in a human or an animal.

AND / OR

- Diagnostic procedures were performed and clinical signs could not be explained by other aetiologies.

For farmed mink, asymptomatic animals with a known exposure to a confirmed or presumptive positive case of SARS-CoV-2 in a human or an animal are considered a suspect case.

PRESUMPTIVE POSITIVE CASE:
An animal classified as a suspect case of SARS-CoV-2 that has a non-negative result on a screening test for SARS-CoV-2.

- Screening tests are subject to change. At the time of the creation of this case definition, RT-PCR specific for SARS-CoV-2 is the only available screening test to detect active infection.

CONFIRMED POSITIVE CASE:
An animal classified as a presumptive positive case of SARS-CoV-2 that is confirmed as infected with SARS-CoV-2 by the National Centre for Foreign Animal Disease (NCFAD) by one of the following tests:

- Isolation and identification of SARS-CoV-2.

  AND / OR

- Confirmation of the presence of nucleic acid specific to SARS-CoV-2 by:
  - Targeting at least two specific genomic regions.
    OR
  - Targeting a single genomic region followed by sequencing of a secondary target.

CONFIRMED NEGATIVE CASE:
An animal classified as a suspect case of SARS-CoV-2 that has a negative result on a screening test for SARS-CoV-2.
AND / OR

An animal classified as a presumptive positive case of SARS-CoV-2 that has a negative result on a confirmatory test for SARS-CoV-2.

POST-POSITIVE CASE CONFIRMED NEGATIVE CASE:

An animal that had previously been a confirmed positive case of SARS-CoV-2 that no longer has clinical signs of SARS-CoV-2 infection and that has had two negative results in two samples collected at least 24 hours apart by one of the following tests:

- A screening test for SARS-CoV-2.

  AND / OR

- A nucleic acid test specific for SARS-CoV-2.

Appendix G: Guidance for regional-level rapid qualitative risk assessment on farmed mink and SARS-CoV-2

National-level rapid qualitative risk assessments (RQRA) have been conducted on farmed mink and SARS-CoV-2 by an Emergency Collective Expert Appraisal Group, consisting of volunteers from federal, provincial and territorial departments of public health, animal health, wildlife and the environment, veterinary associations, private veterinarians and academia. These assessments are iterative, recognizing that there is still a lot of uncertainty and rapidly changing information related to infection in animals other than humans. The assessments also recognize a significant amount of variability, due to the variety of situations associated with agent, host and environment across Canada in space and time. As a result, it is acknowledged that the risk will also need to be assessed regionally, and on a case-by-case basis.

Some key best practices related to RQRA include:

- Consider a One Health perspective, and that exposure pathways involving humans and animals can have potential impacts on public health, animal health, and ecosystem health.
- Determine the specific risk questions that need to be answered to inform risk management measures, including:
    - ✓ Hazard of interest, geospatial and temporal scope, transmitting populations, populations at risk (e.g., human/livestock/wildlife, occupational groups, vulnerable populations), risk components of interest (e.g., probability of exposure, probability of infection, most likely spread scenario, magnitude of the effects, overall impact).
- Determine and clearly state assumptions, including context.
- Determine and clearly state uncertainty.
- Communicate the outputs of the risk assessment in keeping with the precision of inputs (e.g., F).
- Regularly monitor for updated information that would affect the risk.

Risk Factors related to Farmed Mink and SARS-CoV-2

A number of factors were identified in the national-level RQRA on farmed mink as affecting the variability of the risk associated with SARS-CoV-2 (to public health, animal health, or wildlife

health), and these can therefore be considered risk factors. These risk factors are described in detail below.

- Factors affecting likelihood of transmission from infected humans to farmed mink
    - ✓ Prevalence of human cases in the community in proximity to mink farms
        - Although there is minimal contact between the general public and mink farms, prevalence of community cases in the region may indicate the likelihood of infected farm staff.
        - Work exclusion measures in place and PPE.
    - ✓ Individual risk factors of employees - age, travel history, congregate living etc.
    - ✓ Number of staff employed
        - Farms employing more staff, especially if they are migrant workers or have unknown exposure history, have a higher likelihood of having infected people on site than those employing only a few staff (such as family-run businesses).
    - ✓ Stage of production cycle
        - The extent of contact between farm staff and the mink varies considerably throughout the annual production cycle, with the highest amount of contact during breeding, birthing, weaning, counting, and vaccination (especially April-June).
    - ✓ Standard biosecurity protocols
        - Protocols such as the use of non-medical masks, dedicated clothing, and leather gloves, as well as regular cleaning of objects used to handle mink (e.g., transfer crates, separation boards), will reduce the likelihood of transmission from infected humans to mink via droplets or fomites.
- Factors affecting the magnitude of the effects of an outbreak on mink producers and the mink industry
    - ✓ Stage of production cycle and morbidity and mortality
        - The impacts will depend on the morbidity and mortality on affected mink farms which is variable based on outbreak data from other countries. Impacts will depend on: age of animals (end stage gestation animals and adults seem to be severely affected), and number of animals present on a

farm (e.g., pre- and post-birthing). Other factors such as nutritional status, genetics, virus strain and comorbidities may also affect the magnitude of impacts.

- ✓ Extent of control measures required
  - The highest impact on an affected mink farm is likely to be due to the costs associated with control measures, which may be required to address risks to other sectors (e.g., public health, wildlife health).
- ✓ Public perception
  - Regardless of actual risk, the public perception of risk (especially with inadequate risk communication) could affect the mink industry via effects on the market or the activities of animal rights groups.

- Factors affecting the likelihood of transmission from infected mink to employees, veterinarians, or contractors on the farm or during pelting
  - ✓ Stage of infection and prevalence in the animals
    - Research studies on infection in animals suggest that shedding of live viable virus, where it occurs, is of short duration.
    - Symptomatic animals would likely have more virus on the fur/pelt.
  - ✓ Stage of production cycle
    - In addition to the activities mentioned above (i.e., breeding, birthing, weaning, counting, and vaccination) that bring employees/veterinarians into close contact with the mink, close contact during the euthanasia process also results in a higher likelihood of mink-to-human transmission.
  - ✓ Husbandry practices and environmental conditions
    - Good ventilation in the mink sheds and carcass/pelt processing areas would decrease likelihood of transmission.
    - Length of virus survival in the environment is affected by temperature, humidity, UV light, and air circulation, as well as cleaning and disinfection procedures.
    - There is a higher likelihood of human exposure to contaminated dust particles in the air inside the mink sheds, compared to outside.

        - The style of mink housing, types of surfaces, and manure handling and storage will affect the likelihood of human exposure to contaminated surfaces.
    - ✓ Biosecurity protocols
        - The use of enhanced PPE (e.g., N95 masks to prevent exposure to contaminated dust particles) would reduce the likelihood of exposure.
    - ✓ Pelting procedures
        - Live viable virus would more likely be present on carcasses during pelting when the pelting occurs on-site immediately after euthanasia versus after transportation to a pelting plant.
- Factors affecting the likelihood of transmission from infected mink to the general public
    - ✓ More likely through transmission by infected farm workers and other individuals on the farm.
    - ✓ Proper implementation of biosecurity measures and PPE use at farm.
    - ✓ Strictly follow public health guidelines for managing exposed/infected individuals on the farm. This may include not allowing those individuals to come of farm and require self-isolation.
        - Manure management practices.
        - Based on available evidence and risk assessment, contamination levels outside the farm environment would likely be insufficient to result in effective exposure of humans.
        - This likelihood was assessed as negligible to low in the national-level RQRA.
        - Within this range, the likelihood could be affected by manure management practices (e.g., timing of manure spreading in relation to infection).
- Factors affecting the magnitude of the effects of human cases associated with a mink farm
    - ✓ Vulnerable populations
        - The majority of human infections do not result in serious illness, but the presence of vulnerable people (e.g., immunocompromised, elderly) on a mink farm could increase the magnitude of effects.

- ✓ Local context
    - On a global or national level, the addition of a few human cases resulting from mink exposure would be indiscernible amongst the current pandemic; however, in an area experiencing very few cases, these exposures could have a relatively greater impact.
    - Virus mutation rates - unknown consequence.

- Factors affecting the likelihood of transmission from infected mink to wildlife (including feral cats):
    - ✓ Wild species prevalent in the area
        - Mustelids (e.g., weasel, mink, ermine, marten, fisher, wolverine, otter, badger) and felids (e.g., bobcat, lynx, cougar, feral cats) are the wild species most likely to be susceptible.
        - There is a lot of uncertainty regarding susceptibility of species such as skunks, raccoons, squirrels, and North American bat species.
        - The highest likelihood of direct exposure of a wild animal is between escaped mink and wild mustelids (e.g., wild mink during breeding season or at bait stations).
        - Some mink farms are co-located near commercial fishing operations to take advantage of waste fish as a food source, and wild mink tend to be abundant in these coastal areas.
    - ✓ Stage of infection and prevalence in the animals
        - The quantity of infectious virus would be highest on heavily affected farms, though enhanced biosecurity measures are likely to be implemented at that time.
    - ✓ Husbandry practices and environmental conditions
        - The highest likelihood of indirect exposure of a wild animal is in manure/compost piles on the farm; therefore a crucial factor is management of wildlife contact with these piles.
    - ✓ Biosecurity protocols
        - Mink farms generally have a perimeter fence and traps within compounds, which are meant to keep wildlife out and escaped mink from getting

released into the wild; however, these measures are not necessarily consistent across the country, and there is evidence that escaped farmed mink comprise a detectable proportion of the free-ranging mink populations in parts of Canada.

- Factors affecting the magnitude of the effects of wildlife cases associated with a mink farm
    - ✓ Wild species prevalent in the area
        - Different species have different levels of susceptibility to infection.
        - Spread between individuals would be more likely in social or colonial species, such as bats and feral cats.
        - Transmission back to humans would be more likely in peri-urban species.
    - ✓ Vulnerable populations
        - Infection of a susceptible and rare wildlife species could present a conservation concern (e.g., some pine marten populations).
    - ✓ Public perception
        - Regardless of actual risk, the public perception of risk (especially with inadequate risk communication) could result in a fear of wildlife by humans, with potential consequences to wildlife due to human interference.

Appendix H. Epidemiological Investigation Resource

(Adapted from draft FAO document)

Epidemiological Investigation Resource Although, the primary focus is on farmed mink, epidemiological links with other animals near farm (feral, wild) and in homes of affected individuals (pets, backyard farming) should also be considered. The epidemiological links can be human-to-human of staff, visitors and service providers at farm, in family and community. Also, the epidemiological links between animals and humans at farm and in homes.	
Section 1 **Information on the affected mink farm**	
Government authority conducting investigation: Name of individual: Designation: Department/agency/unit: Contact information:	
1. Farm identification (premises ID) GPS Coordinates	
2. Describe proximity to nearest human population	
3. Contact information for the farm	Name: Relationship to farm: (Owner, operator, farm worker etc.) Tel: Email: Fax:
4. Describe layout of the farm (attach maps, pictures etc.)	
5. Describe all biosecurity practices currently followed at the farm.	
6. Describe ventilation in mink sheds?	
7. Number of mink on the farm. Are there separate multiple production units on the farm? If yes, are they epidemiologically-linked, i.e. share ownership, staff, equipment, feed, service providers etc.?	
8. Describe age and stage of production cycle of animals. *(The extent of contact between farm staff and the mink varies considerably throughout the annual production cycle, with the highest amount of contact during*	

breeding, birthing, weaning, counting, and vaccination, especially April-June)	
9. What is the historical normal/baseline mortality on the farm?	
10. Describe vaccine status of animals.	
11. Are animals showing any clinical signs compatible with SARS-CoV-2 infection? If yes, describe clinical signs? When were clinical signs first observed? Proportion of moribund animals? Are animals fully recovered, still showing clinical signs? What is the mortality data? Any co-morbidities suspected?	
12. Has any veterinary investigation been done on the animals? When was it done? Describe the findings?	
13. Is testing of mink for SARS-CoV2 required? *Note: This decision must be taken in consultation with Provincial/Territorial CVO.*	
14. Testing of animals for SARS-CoV-2. When were samples taken? What samples were tested and which tests were used? Which laboratory did the testing? What are the test results?	
Comments/Notes:	
Information on pet animals on the mink farm	
15. Do any pet animals have access to mink farm? **16.** Which species? **17.** Describe interaction/contact of pet animals on the farm in context of SARS-CoV-2 transmission?	
Information on wild animals near affected mink farm	
18. Are any wild animal species near farm? **19.** Which species? **20.** Can they access the farm? Describe interaction/contact of wild animals with the farm in context of SARS-CoV-2 transmission?	
Information on feral animals near affected mink farm	
21. Are any feral animal species near farm?	

22. Which species? **23.** Can they access the farm? Describe interaction/contact of feral animals with the farm in context of SARS-CoV-2 transmission?	
Regulatory actions on the farm	
24. Is there a need to immediately implement government regulatory controls on the farm? **25.** Describe your rationale.	
26. What regulatory control measures have been implemented? **27.** Date of implementation of controls?	
Movement tracing of animals, products, feed, equipment, manure on affected mink farm during the critical period.	
28. Any introduction of new animals? **29.** If yes, specify the last date and source of these animals? Since arrival of new animals, describe the type of their interactions with existing animals .i.e. are they epidemiologically mixed with or separate from existing animals?	
30. Have any live animals moved out of the farm during critical period? If yes, specify the last date, destination and end use of these animals?	
31. Have any animal products moved in or out of the farm during critical period? If yes, specify the date, source/destination, amount, kind of product and end use?	
32. Describe feed type for animals (raw/fresh, semi cooked, fully cooked, dried etc.)? **33.** Source of feed/feed ingredients? Is feed prepared on site or commercially made?	
34. Does this farm share any equipment with other facilities that rear and handles SARS-CoV-2 susceptible animals? **35.** If yes, identify the equipment, date and sharing facility? Describe any cleaning and disinfection done on equipment before sharing?	
36. Describe manure handling practices at the farm? **37.** Biosecurity to prevent access to feral/wild animals to manure **38.** When was manure last moved out of the farm?	

39. How (i.e spray on agriculture fields, land fill etc.) and where was manure disposed? **40.** Identify if any SARS-CoV-2 contaminated material could have been added to manure that has been disposed during critical period? If yes, assess likelihood of survival of virus in the manure?	
Comments/Notes:	
Information on individuals (staff, service providers, visitors, others) associated with the mink farm (all individuals of interest based on likelihood of exposure and infection with virus; i.e. it is not restricted to only clinical COVID-19 cases)	
41. Identify all individuals that have come to the farm during the critical period **42.** Include their contact information **43.** Identify date of contact/visit on the farm **44.** Describe the nature of interaction/contact with other individuals on the farm. **45.** Describe the nature of interaction/contact with animals on the farm **46.** What precautions/PPE were used by these individuals when on farm? **47.** Do any of these individuals have clinical signs compatible with COVID19? **48.** Have any of these individuals been tested for COVID19? If yes, when and what are results? **49.** Do any of these individuals know if they have been recently (14 days) in close contact with someone who is COVID19 positive or is self-isolating due to COVID19? **50.** Do they have any history of international travel in past 14 days? If yes, specify the preventive measures (quarantine, self-isolation, other) taken upon their return. **51.** Do any of these individuals come in contact with animals on other farms, have pets or backyard animals? If yes, describe their contacts with other animals? Based on this information, identify any other farms or individual animals that will require follow-up investigation.	**Farm workers:** **1.** **2.** **3.** **4.** **5.** **Service providers:** **1.** **2.** **3.** **4.** **5.** **Visitors:** **1.** **2.** **3.** **4.** **5.** **Others (specify):** **1.** **2.**

52. Based on the information from the previous questions, identify individuals that may require further public health investigation.	Name: Contact information: Follow-up investigation required with this contact individual (explain rationale):
Comments/Notes:	
Section 2 **Information on the individuals (family members, community) who are epidemiologically-linked with the individuals (staff, visitors and service providers) associated with affected mink farm (identified based on information in Section 1).** **Note: The Public Health Authority is likely to have its own epidemiological investigation procedures/forms that can be used. The following animal related questions can be added to the public health investigation.**	
1. Any contact of person with SARS-CoV-2 susceptible animals (has pets, backyard animals, work on farm)	Wildlife: Pet: Farmed:
2. Location of potential exposure of individual to animals (if applicable)	Animal store: House: Farm: Wild: Other (specify):
3. Describe type of interaction/contact with animals	
4. Dates of first and last exposure to the animals on the location specified in question 2.	First exposure: Last Exposure:
5. Any contact with other individuals who keep/work with SARS-CoV-2 susceptible animals. If yes, include details.	Name: Contact information: Follow-up investigation required with this contact individual (explain rationale):
6. Prevalence of human cases in the community in proximity to mink farm (Local/provincial public health information)	
Comments/notes:	

Section 3 **Information on pet animals (identified in section 2) that have epidemiological link with COVID-19 individuals (all individuals of interest based on likelihood of exposure and infection with virus; i.e. it is not restricted to only clinical COVID-19 cases)**	
1. Species present	
2. Number of animals	
3. Age, breed, sex of animals	
4. Physiological status of females (pregnant, lactating, NA)	
5. Where are animals kept (home, on farm, other)	
6. Describe relationship of individual with the pet who potentially exposed this animal to the virus. (owner, caretaker etc.)	
7. Dates of first and last exposure to the animals	
8. Describe type of interaction/contact with animals (assess likelihood of exposure to virus)	**Animal-owner interactions** Licking □ Sniffing □ Pawing □ Other …….. **Owner-animal interactions** Kissing □ Sharing bed/sofa □ Sharing food □ Sharing kitchen or other utensils □ Other ……..
9. Medications or vaccines currently or recently used (over the past 4 weeks)	
10. Any underlying health issues	
11. Animal health status 14 days prior to exposure from COVID-19 human	
12. Animal health status after exposure to COVID-19 human	□ Asymptomatic □ Symptomatic (describe signs)
13. Date of onset of clinical signs in animals, if applicable.	
14. How many animals (by species) are affected, if applicable?	

15. Are animals fully recovered, still showing clinical signs or died?	
16. Have animals been seen by a veterinarian? **17.** Date of last examination by a veterinarian? **18.** What was the veterinary assessment?	
19. Describe any testing done on animals? Any testing for SARS-CoV-2? Date of testing? How many animals were tested? What are the test results?	
20. Any other relevant information	
21. What is your final assessment on SARS-CoV-2 status of the animals? A veterinarian should make this assessment.	
22. Do these animals require SARS-CoV-2 testing under oversight of authorities? This decision must be taken in consultation with Provincial/Territorial CVO.	
23. Describe, if any, public and animal health recommendations made by authorities to the individual in contact with these animals?	
If your assessment has identified that these animals pose risk of SARS-CoV-2, these additional questions should be asked to identify any further contacts with these animals.	
24. Have these animals come in contact with other animals and humans, during critical period? When did the contact happen? Describe the type of contact? Based on this information, is there a need to follow-up with these identified contacts?	
Comments/Notes:	

Appendix I : Enhanced Public Health Investigation of SARS-CoV-2 on a Mink Farm

Public Health Agency of Canada | Agence de la santé publique du Canada

Enhanced Public Health Investigation of SARS-CoV-2 on a Mink Farm

National ID, if applicable :	NCFAD ID, if applicable :	Provincial ID :	Local Health Unit ID :

Questionnaire Background for Interviewer (information on source(s) not to be shared with interviewee)

There is evidence of SARS-CoV-2 on a mink farm in your jurisdiction, which has been detected in mink and/or in people directly linked to the farm (i.e. farmers, workers). The purpose of this form is to support an enhanced public health investigation of the farm, including collecting information about cases, contacts, exposures, risk factors, and public health measures implemented. This form can be adapted and modified to suit the needs of the affected jurisdiction. Information collected in this public health investigation can be used to support a larger One Health investigation in collaboration with other sectors such as agriculture, environmental health, and occupational health. The lead sector(s) of the One Health investigation will be determined by the provincial/territorial jurisdiction. This form is intended to be used ***in addition to*** routine individual COVID-19 case report forms already used for public health follow-up. However, a case report template is also included in **Appendix I (1)**, which can be used to collect additional data about the case in the context of the mink farm setting. A case line list template has also been included as an example in **Appendix I (2)**.

Items to collect and share with the One Health mink farm investigation team:

- ☐ Map of farm and any onsite housing/accommodation **(Appendix I (3**)
- ☐ List of employees and visitors to farm (up to 14 days prior to the first case [human or animal] being identified on the farm to current date)

Section 1. Farm Information and Description:

This is an:
- ☐ Initial notification report — Date: dd_____ / mm_____ / yyyy_____
- ☐ Updated notification report — Date: dd_____ / mm_____ / yyyy_____
- ☐ Final summary report — Date: dd_____ / mm_____ / yyyy_____

Name of farm:

Name of farm owner(s):

Number of household contacts of owner(s): _____

Phone number:

Province /Territory: ☐ NL ☐ NB ☐ MB ☐ BC ☐ YT ☐ PE ☐ QC ☐ SK ☐ NT ☐ NS ☐ ON ☐ AB ☐ NU

Farm address/coordinates:

Date first case identified: dd_____ / mm_____ / yyyy_____

Date type:
- ☐ Symptom onset date
- ☐ Specimen collection date
- ☐ Lab report date

First case detected in:
- ☐ Human
- ☐ Mink
- ☐ Other animal, specify: _____

Approximate annual mink production (number of pelts): _____

Approximate number of mink during each season:

Months	Season	Approximate #
Dec – Mar	Conditioning & Breeding	
Apr – Jun	Whelping & Weaning	
Jul – Oct	Growth & Furring	
Nov – Dec	Grading & Harvesting	

What other types of domestic and/or farm animals are present?

☐ Cattle ☐ Pigs
☐ Horses ☐ Dogs
☐ Sheep ☐ Cats
☐ Goats ☐ Poultry or domesticated waterfowl
☐ Other, specify: _____

What types of wildlife are present within the perimeter of the farm (within perimeter fence, if one is present)?

☐ Bats ☐ Seagulls

Number of sheds: _____
Number of pens: _____

Describe the shed design (enclosed, open, etc.):

_____
_____
_____

☐ Rodents ☐ Other wild birds
☐ Rabbits ☐ Skunks
☐ Raccoons ☐ Feral mink
☐ Other, specify: _____

Section 2. Biosecurity and Screening:

Is there a residential house with a family living in it on the property? ☐ Yes ☐ No ☐ Unknown
Is there a common entrance to the farm and residence? ☐ Yes ☐ No ☐ Unknown ☐ N/A
Is the farm area fenced in? ☐ Yes ☐ No ☐ Unknown
Is there a designated parking area for workers and visitors away from the sheds? ☐ Yes ☐ No ☐ Unknown
What toileting facilities are provided for workers and visitors?
☐ Flush toilets ☐ Portable toilets ☐ Other, specify: _____
Are there hand hygiene stations nearby toileting facilities? ☐ Yes ☐ No ☐ Unknown
Hand sanitizer ☐ Yes ☐ No ☐ Unknown
Hand washing facilities ☐ Yes ☐ No ☐ Unknown
Are there hand hygiene stations elsewhere on the farm? ☐ Yes ☐ No ☐ Unknown
Hand sanitizer ☐ Yes ☐ No ☐ Unknown
Hand washing facilities ☐ Yes ☐ No ☐ Unknown
Is there a changing area for workers? ☐ Yes ☐ No ☐ Unknown
Are dedicated laundered coveralls worn by workers? ☐ Yes ☐ No ☐ Unknown
If yes:
Do workers don dedicated coveralls before entering sheds? ☐ Yes ☐ No ☐ Unknown
Do workers doff dedicated coveralls after exiting sheds? ☐ Yes ☐ No ☐ Unknown
Where do workers doff dedicated coveralls?
☐ Changing area ☐ Outside shed ☐ Other, specify: _____
Do workers wear rubber boots or boot covers inside sheds? ☐ Yes ☐ No ☐ Unknown
Do workers wear masks inside sheds? ☐ Yes ☐ No ☐ Unknown
If yes, specify:
☐ Non-medical masks (e.g. homemade)
☐ Medical (surgical or procedure) masks
☐ Fit tested respirator such as N95 or equivalent
Do workers use any other personal protective equipment? ☐ Yes ☐ No ☐ Unknown
If yes, specify:
☐ Gloves
☐ Eye protection (face shield, goggles)
☐ Other, specify: _____
Is there an entry area in the sheds before entering the mink area? ☐ Yes ☐ No ☐ Unknown
Are employees screened for symptoms and risk factors of COVID-19? ☐ Yes ☐ No ☐ Unknown
If yes, are employees screened: ☐ Daily ☐ Weekly ☐ Other, specify: _____
Are visitors screened for symptoms and risk factors of COVID-19? ☐ Yes ☐ No ☐ Unknown
If yes, are visitors screened: ☐ Daily ☐ Weekly ☐ Other, specify: _____
Append or describe the symptom/risk factor screening policy:

_____
_____
_____

Section 3. Farm Workers:

Current total number of persons working on the farm: _____
Number of workers living on the farm premises who are:
a. Family: _____
b. Nonfamily: _____
Workers are assigned to:
☐ Entire farm
☐ Specific sheds/areas
Do the workers have a common break area? ☐ Yes ☐ No ☐ Unknown

Do the workers have a common meal area? ☐ Yes ☐ No ☐ Unknown

Do any workers carpool to/from the farm? ☐ Yes ☐ No ☐ Unknown

Is there accommodation on the farm for migrant/seasonal workers? ☐ Yes ☐ No ☐ Unknown

If yes, please describe: _____

How often are training sessions held on biosecurity for workers? _____ times/year

(continues on next page)

List of farm workers (from 14 days of first case being detected until current date):

#	Name	Phone number	Role & Work Location(s)	Dates worked on farm	Works on other farm(s)?	If yes, where?
1					☐ Yes ☐ No ☐ Unk	
2					☐ Yes ☐ No ☐ Unk	
3					☐ Yes ☐ No ☐ Unk	
4					☐ Yes ☐ No ☐ Unk	
5					☐ Yes ☐ No ☐ Unk	
6					☐ Yes ☐ No ☐ Unk	
7					☐ Yes ☐ No ☐ Unk	
8					☐ Yes ☐ No ☐ Unk	
9					☐ Yes ☐ No ☐ Unk	
10					☐ Yes ☐ No ☐ Unk	

Section 4. Farm Visitors:

How many visitors do you have on a daily basis? _____ # visitors

Is there a visitor log to sign in? ☐ Yes ☐ No ☐ Unknown

If yes, obtain copy of visitor log for contact tracing purposes.

Is any outer clothing or other PPE provided to visitors entering the farm? ☐ Yes ☐ No ☐ Unknown

If yes, identify items provided and describe procedure for donning/doffing: _____

_____

Record the following information for all visitors who were on the farm up to 14 days prior to the first case (human or animal) being identified to current date:

#	Name	Phone Number	Date(s) (mm/dd)	Role (e.g. veterinarian, feed delivery, cleanout services, etc.)	Exposure* to mink
1					☐ Yes ☐ No ☐ Unk
2					☐ Yes ☐ No ☐ Unk
3					☐ Yes ☐ No ☐ Unk
4					☐ Yes ☐ No ☐ Unk
5					☐ Yes ☐ No ☐ Unk
6					☐ Yes ☐ No ☐ Unk
7					☐ Yes ☐ No ☐ Unk
8					☐ Yes ☐ No ☐ Unk
9					☐ Yes ☐ No ☐ Unk
10					☐ Yes ☐ No ☐ Unk
11					☐ Yes ☐ No ☐ Unk
12					☐ Yes ☐ No ☐ Unk
13					☐ Yes ☐ No ☐ Unk
14					☐ Yes ☐ No ☐ Unk
15					☐ Yes ☐ No ☐ Unk

*Exposure to mink would include direct or indirect contact with live or dead mink or their environments, such as contact in a barn/shed, or with feces, bedding, feed or water, or other surfaces that could potentially be contaminated, without appropriate use of recommended personal protective equipment.

Section 5. Surveillance and Testing:

Is there routine testing of mink for SARS-CoV-2 occurring on the farm? ..... ☐ Yes ☐ No ☐ Unknown

If yes, describe the number and frequency of testing: _____

Is there routine testing of people for SARS-CoV-2 on the farm? ..... ☐ Yes ☐ No ☐ Unknown

If yes, describe frequency of testing: _____

Are new mink routinely tested for SARS-CoV-2 prior to introduction into the herd? ..... ☐ Yes ☐ No ☐ Unknown ☐ N/A

Are new mink quarantined prior to introduction into the herd? ..... ☐ Yes ☐ No ☐ Unknown ☐ N/A

Have any new mink been introduced into the herd since 14 days of the first case (human or animal) being detected to the current date?

..... ☐ Yes ☐ No ☐ Unknown

If yes, provide name and contact information of supplier(s): _____

Date(s) mink introduced into herd: (1) dd_____ / mm_____ / yyyy_____ (2) dd_____ / mm_____ / yyyy_____

Are there genetic sequencing results (animal or human)? ..... ☐ Yes ☐ No ☐ Unknown ☐ Pending

If yes and applicable to public health investigation, obtain copy of results to assist with phylogenetic/cluster analysis.

Sections 6-9 are summary tools that can be used to collate and summarize information about groups of individuals: primary cases, secondary cases, and animal cases, as defined in the sections below.

Section 6. Primary Case Summary (people with direct exposure to farm):

	Workers/Staff	**Visitors**	**Other**	**Total Human**
# symptomatic				
# lab-confirmed cases				
# at risk (individuals with direct exposure to farm, i.e. workers/visitors)				
Attack rate *(# lab-confirmed cases / # at risk * 100)*				
# hospitalized cases				
# case fatalities related to outbreak				
case fatality rate *(# fatalities related to outbreak / # at risk * 100)*				
# recovered				

Section 7. Primary Case Symptoms *(can be used as a summary table derived from Appendix A, Case Report Template):*

Symptom	**# Yes**	**# No**	**# Unknown**
Cough			
Fever (≥38°C)			
Feverish/chills (temperature not taken)			
Loss of taste and/or smell			
Sore throat			
Runny rose			
Shortness of breath/difficulty breathing			
Nausea/vomiting			
Headache			
General weakness			
Pain (muscular, chest, abdominal, joint, etc.)			
Irritability/confusion			
Diarrhea			
Other			
Asymptomatic			

Section 8. Secondary Case Summary (people without direct exposure to farm):

Mode of secondary transmission documented for all secondary cases (*select all that apply)*

- ☐ Animal contact
- ☐ Person-to-person
- ☐ Environmental contamination
- ☐ Other, specify: _____
- ☐ Unknown

Number of secondary cases:	#
Lab-confirmed	
Probable (as defined within jurisdictional case definition)	
Total	
Secondary case outcomes:	#
Died	
Currently hospitalized	
Recovered	

Section 9. Animal Case Summary:

(Provide estimates if exact numbers are unknown)	**Mink**	**Other animal, specify:** _____	**Other animal, specify:** _____
# symptomatic			
# animals with positive laboratory test			
# at risk (number of mink/other animal on farm)			
Attack rate for symptomatic animals *(# symptomatic / # at risk * 100)*			
Attack rate for lab-confirmed animals *(# lab-confirmed / # at risk * 100)*			
# fatalities related to outbreak			
case fatality rate *(# fatalities related to outbreak / # at risk * 100)*			

Section 10. Public Health Measures:

(Select all that apply)

- ☐ Provided eduction and/or educational materials:
  - ☐ Cleaning and disinfection
  - ☐ Hygienic practices (hand hygiene, respiratory etiquette, etc.)
  - ☐ Disease (etiology, transmission, signs/symptoms)
- ☐ Exclusion of ill employees and visitors
- ☐ Disinfection of facility and high-touch surfaces/equipment
- ☐ Notified regulating agency
- ☐ Restriction of visitors
- ☐ CNPHI Public Health Alert
- ☐ Enhanced PPE provided, specify:_____
  _____
- ☐ Isolation/quarantine
- ☐ Facility voluntarily closed
- ☐ Outbreak notification posted/distributed
- ☐ Site visit
- ☐ Farm depopulated
- ☐ Active surveillance, specify: _____
  _____
- ☐ Other, specify: _____
  _____

Section 11. Event Description:

Section 12. Recommendations for Policy/Practice Changes:

Appendix I (1). Case Report Template for Enhanced Public Health Investigation of SARS-CoV-2 on a Mink Farm (can be used as a complement to routine case report form):

Client Details	
First name:	
Last name:	
Date of birth:	
Current address:	
Phone number:	
Alternate phone number:	

Work Details	
Case is:	☐ Farmer or farm worker ☐ Visitor ☐ Other, specify: _____
Last day worked before isolation:	dd_____ / mm_____ / yyyy_____ ☐ N/A
First day of return to work:	dd_____ / mm_____ / yyyy_____ ☐ N/A
Workplace(s):	
Role:	
Area(s) of farm where case spends majority of time:	

Clinical Information			
Symptoms	Yes	No	Unknown
Cough	☐	☐	☐
Fever (≥38°C)	☐	☐	☐
Feverish/chills (temperature not taken)	☐	☐	☐
Loss of taste and/or smell	☐	☐	☐
Sore throat	☐	☐	☐
Runny rose	☐	☐	☐
Shortness of breath/difficulty breathing	☐	☐	☐
Nausea/vomiting	☐	☐	☐
Headache	☐	☐	☐
General weakness	☐	☐	☐
Pain (muscular, chest, abdominal, joint, etc.)	☐	☐	☐
Irritability/confusion	☐	☐	☐
Diarrhea	☐	☐	☐
Other, specify : _____	☐	☐	☐
Asymptomatic	☐	☐	☐

Acquisition and communicable period calculation		
Acquisition period:	*14 days prior to symptom onset (or specimen collection if asymptomatic) to the date of symptom onset (or specimen collection if asymptomatic)*	dd_____ / mm_____ / yyyy_____ to dd_____ / mm_____ / yyyy_____
Communicable period:	*48 hours prior to symptom onset (or specimen collection date if asymptomatic) to full resolution of symptoms or 10 days after symptom onset date (or specimen collection date), whichever is longer*	dd_____ / mm_____ / yyyy_____ to dd_____ / mm_____ / yyyy_____

Exposures and Acquisitions

During the period of acquisition, identify:

Contact with any confirmed cases of COVID-19?

Name	**Phone Number**	**Relationship to case/location**	**Date(s) of contact**	**Notes**
		☐ Household		

		☐ Close contact		
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		

Contact with someone with similar illness (may not know if they have COVID-19)?				
Name	**Phone Number**	**Relationship to case**	**Date(s) of contact**	**Notes**
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		
		☐ Household ☐ Close contact		

Common areas on the farm (spent more than 15 minutes <2 metres apart, cumulative or at one time)?			
Area	**Date(s)**	**Location**	**Notes**
☐ Break area			
☐ Meal area			
☐ Shared transportation			
☐ Sheds			
☐ Other, specify: _____			
☐ N/A			

Transmission Details

During the period of communicability, identify:

Household contacts		
Name	**Phone Number**	**Notes**

Non-household close contacts				
Name	**Phone Number**	**Relationship to case**	**Date(s) of contact**	**Notes**

Common areas on the farm (spent more than 15 minutes <2 metres apart, cumulative or at one time)?			
Area	**Date(s)**	**Location**	**Notes**
☐ Break area			
☐ Meal area			
☐ Shared transportation			
☐ Sheds			
☐ Other, specify: _____			
☐ N/A			

Appendix I (2). Sample Case Line List:										
ID	**Name**	**Age**	**Sex**	**Role**	**Symptom onset date** *(dd/mm/yyyy)*	**Specimen date** *(dd/mm/yyyy)*	**Report date** *(dd/mm/yyyy)*	**Hospitalized** *(Y/N/Unk)*	**Died** *(Y/N/Unk)*	**Recovered** *(Y/N/Unk)*

Appendix I (3). Farm Diagram: ***Attach a satellite imagery map if possible. In addition, draw or obtain a schematic map of the farm site.***

Appendix J: References

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