64-509200-041-000-0010

Nuclear Power Demonstration Closure Project

CHIMNEY SWIFT STUDIES TECHNICAL SUPPORTING DOCUMENT

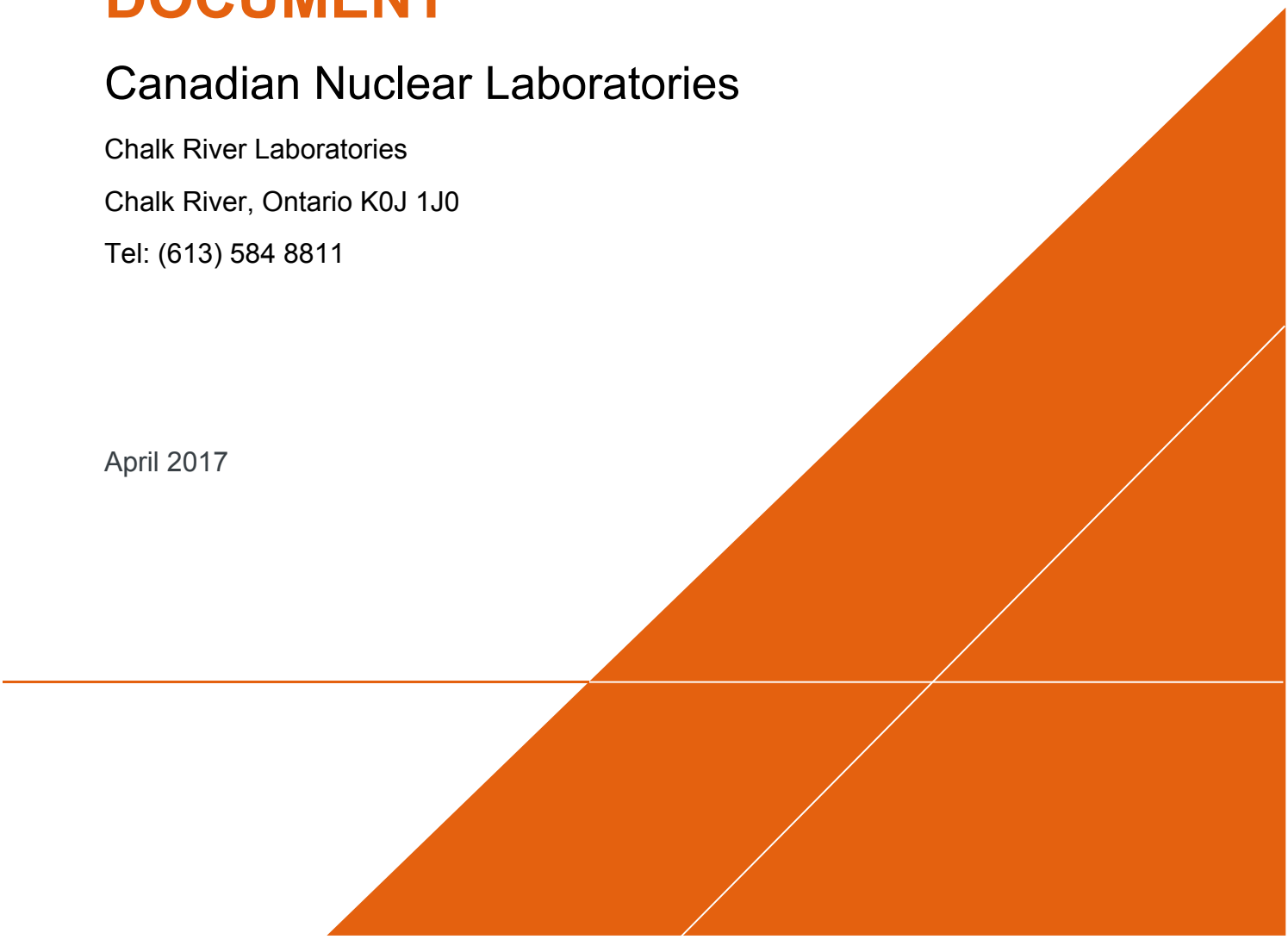
Canadian Nuclear Laboratories

Chalk River Laboratories

Chalk River, Ontario K0J 1J0

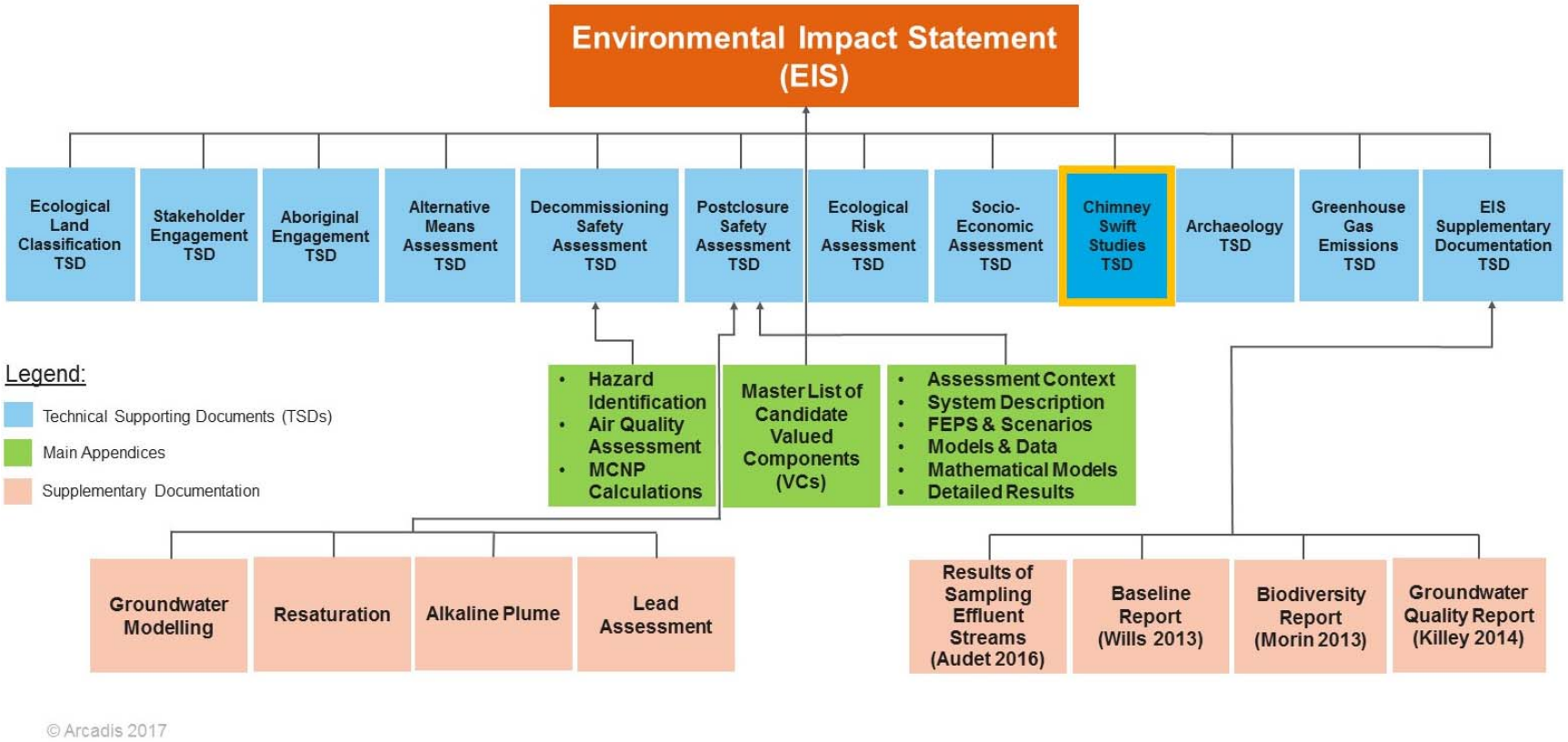
Tel: (613) 584 8811

April 2017



This Technical Supporting Document (TSD) has been prepared in support of the Nuclear Power Demonstration (NPD) Closure Project. The project qualifies as a Designated Project under the *Canadian Environmental Assessment Act (2012),* and therefore, an Environmental Impact Statement (EIS) is being prepared as part of the Environmental Assessment process. This TSD is comprised of three individual reports.

The findings of this TSD have been summarized in the NPD Closure Project EIS (CNL Doc #64-509200-ENA-004). The following figure shows the various documents associated with the EIS, and their relationships.



Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

NPD- IDENTIFICATION AND ASSESSMENT OF POTENTIAL EFFECTS TO CHIMNEY SWIFTS FROM PLANNED DECOMMISSIONING ACTIVITIES

NPD DECOMMISSIONING

64-509200-REPT-003

Revision 0

	CNL	LNC
☐ ACCEPTED AS NOTED	☒ ACCEPTED	☐ NOT ACCEPTED

Signature	Representing	Date
Meggan Vachon	gen	2016/12/13

"The use and meaning of "ACCEPTED" is governed by the terms and conditions of the P.O. CNL Ref. No **474880**
and in any event its use does not relieve the manufacturer of any of its obligations to CNL and/or to its Client"

OFFICIAL USE ONLY **À USAGE EXCLUSIF**

286 Plant Road
Chalk River, Ontario
Canada K0J 1J0

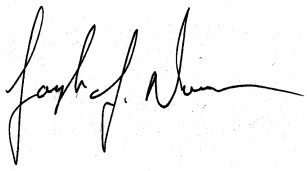
286, rue Plant
Chalk River (Ontario)
Canada K0J 1J0

Identification and assessment of potential effects to Chimney Swifts from planned decommissioning activities

Contribution #1 to a body of scientific advice to Canadian Nuclear Laboratories on potential impact on Chimney Swift during decommissioning activities and proposed mitigation measures and monitoring

A deliverable as per:
P.O. # 474880 and TSW # 64-508320-320-000

13 December 2016



Joseph J Nocera
Joe.nocera@unb.ca

Scientific Advice on the Potential Impact on Chimney Swift during Decommissioning Activities and Proposed Mitigation Measures and Monitoring

PO #: 474880

TSW #: 64-508320-320-000

A Report To: Identify and assess the potential effects to the Chimney Swifts as a result of the planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Executive Summary

A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF) at the Nuclear Power Demonstration Nuclear Generating Station (NPDNGS). The facility will be decommissioned in an *in situ* manner. The above ground structure will be removed, contaminated materials will be placed below grade, grouting will seal the below grade structure, reactor vessel and systems and components. The final activity will be to cap the structure within a concrete monolith. There is concern that the decommissioning activities may disturb a significant roost of Chimney Swifts, a federally *Threatened* species, that use the ventilation stack on site. To that end, this report suggests monitoring activities to determine the degree of disturbance to swifts by decommissioning activities. **Two contemporaneous approaches are recommended: 1) daily roost counts during the breeding season and 2) behavioral monitoring during inclement weather during the non-breeding (migratory) season.** Daily roost counts during the breeding season show that numbers steadily decrease until the last swifts are observed in the last week of August. It is the period between the third week of June and late July that daily roost counts would provide the most sensitive indicator of disturbance. **If a >50% decrease in the average of the counts from the previous 4 nights is observed, an examination of the associated decommissioning activities must ensue** to identify the likely source of disturbance, with mitigation measures taken. Monitoring outside the breeding period would be less sensitive as numbers can fluctuate widely, and decreases among days are to be expected. In this period, the only sensitive population-level indicator would be abandonment of the roost. In lieu of daily counts of swifts using the roost, the more useful indicator in the non-breeding periods (1 May – 21 June and 31 July – 1 September) would be monitoring the roost for swifts existing the stack in the daytime during inclement weather. In such cases, the same monitoring protocol that CNL uses to count swifts at sunset would be employed for one-hour time periods on poor weather days (while decommissioning activities are ongoing). **When >25 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, an examination of the associated decommissioning activities must ensue** to identify the likely source of disturbance, with mitigation measures taken (to be outlined in a future report). If swifts are seen exiting the roost on day 2 or more of inclement weather, a more reliable threshold of **>200 swifts being observed leaving the roost in the daytime during inclement weather, and not returning within the observation period,** should trigger an examination of the associated decommissioning activities.

Scientific Advice on the Potential Impact on Chimney Swift during Decommissioning Activities and Proposed Mitigation Measures and Monitoring

PO #: 474880

TSW #: 64-508320-320-000

A Report To: Identify and assess the potential effects to the Chimney Swifts as a result of the planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Decommissioning Activities. The Nuclear Power Demonstration Nuclear Generating Station (NPDNGS) is situated in a remote area on the south bank of the Ottawa River. The facility was operational from 1962 to 1987. A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF), which will be done in an *in situ* manner. The above ground structure will be removed and contaminated materials will be placed below grade. Grouting will be used to seal the below grade structure, reactor vessel and systems and components. The structure will be capped with concrete and a barrier, creating a concrete monolith.

The NPDWF site hosts a main building storing the reactor and associated systems, a diesel-generator, ventilation stack, and guardhouse. Thus, there is limited infrastructure onsite, and temporary addition of mobile offices, washrooms, increased electrical services, and a temporary concrete batch mixing plant will be required.

The grout batch mixing plant will require aggregate, sand, and cement to be shipped by truck and stockpiled. Further, a water tank, piping, power and settling ponds will be constructed. All below grade areas will be filled with grout. The Main Building, the above ground portion of the Pressure Relief Pit walls, and Guard House will be demolished and placed in the facility. A final reinforced concrete cap will be poured over the foot print of the *in situ* decommissioned reactor facility. An engineered barrier is anticipated to be installed over the concrete cap to reduce infiltration. The area will be graded and drainage ditching installed to manage precipitation run-off. After the final concrete has been poured, the temporary facilities including the concrete batch plant, construction trailers, temporary fencing and barriers will be removed. Clean building slabs, foundations and non-essential roadways will be rubblized *in situ* and the area restored with native vegetation. All buried utilities and systems will be capped or disconnected but remain in place to limit environmental disruption. The above grade electrical distribution systems will also be deactivated including removal of the backup power diesel generator from site.

The grouted area will be fenced and additional groundwater monitoring wells will be installed. The project will limit the amount of waste requiring off-site shipment by entombing wastes within the below grade structure. All construction debris from the above grade structures demolition will also be re-used as fill for below grade voids.

Environment and Wildlife. The decommissioning activities are predicted to have no adverse environmental effects. However, nine species-at-risk have been detected at the NPD site during targeted surveys: Bald Eagle, Chimney Swift, Common Nighthawk, Eastern Wood Pewee, Eastern Milksnake, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Monarch Butterfly.

The ventilation stack, a 45.7 m reinforced concrete structure, discharges airborne effluent from the Main Building. However, Chimney Swifts use the ventilation stack as a roost at night and during inclement weather.

Chimney Swifts. Chimney Swifts are aerial insectivores, a guild of birds that has been in dramatic population decline in North America. The species is listed as *Threatened* in Canada, and in the province of Ontario. Chimney Swifts spend most daylight hours in flight foraging for aerial insects, returning to roost and nest sites at dusk. During spring migration, Chimney Swifts arrive at Ontario nesting sites in late April to mid-May. During spring and fall migration, Chimney Swifts congregate at communal roosts (predominantly chimneys) at dusk. Chimney Swifts exhibit high site fidelity. Sites are used from year to year, as long as habitat remains suitable.

Large numbers of the birds can enter some roosting chimneys, and the ventilation stack at NPDNGS is a relatively large roost. Roost counts were initiated by CNL in 2010 and have been performed annually on a weekly basis. Chimney Swifts sheltering in the stack during spring migration can reach just over 2,500 individuals per night. During the summer months, swifts disperse from these roosts to find nesting sites. Non-breeding birds will continue to roost communally throughout the summer.

Potential Effects of Decommissioning on Chimney Swifts. CNL seeks to preserve the integrity of the ventilation stack during decommissioning, and minimize disturbance to roosting swifts during the process. Possible sources of disturbance from decommissioning include loud noise (acute and/or chronic), vibration (e.g., from demolition or machinery), and encroachment (i.e., activities being carried out too close to the stack, regardless of noise or vibration produced).

In all seasons, Chimney Swifts usually leave the roost at dawn and spend the day foraging until they return at sunset. Therefore, daytime decommissioning activities *should* have little direct effect on roosting swifts (unless those activities somehow physically alter the roost's habitat quality). Direct effects of decommissioning activities are most likely to occur when the activities overlap with swifts being present in the roost. Swifts roost only at night, or during the day when the weather is inclement. Therefore, the only decommissioning activities that pose a greater risk of directly disturbing roosting swifts are those that occur at night (which would only be during an abnormal situation) or on poor weather days.

Thus, a consistent and sensitive approach to monitoring is needed to detect disturbance.

Objective. The purpose of this document is to recommend a seasonally-appropriate and consistent approach to monitoring Chimney Swifts at the ventilation stack roost that will allow detection of a population-level response to decommissioning activities.

Suggested Monitoring Program. There are several responses that may be exhibited by roosting swifts to indicate the possibility of having been disturbed by contemporaneous decommissioning activities: 1) a population-level response, 2) behavioral response, and 3) physiological response. A feasible monitoring program can be developed to assess population and behavioral responses. Measuring physiological responses would provide detailed information on the degree of disturbance experienced by swifts, but does not present as part of a feasible monitoring program. For example, corticosterone is a stress hormone that can be measured in bird tissues to determine the degree of stress an individual has recently experienced. However, measuring corticosterone requires capturing the birds and taking a blood sample. Capture and blood sampling at a stack 45.7 m high would be costly in terms of finances and labor, and is likely to cause greater disturbance to roosting swifts than the decommissioning activities. Therefore, only passive monitoring is recommended that focuses on population and behavioral responses.

The greatest density of roosting swifts occurs during the migratory (non-breeding) periods in the spring (late April to early June) and fall (late July to September) (Figure 1). During migration, the number of swifts using the ventilation stack as a roost fluctuates greatly between nights. Chimney Swifts will either return to the roost early during inclement weather or remain in the roost all day. Chimney Swifts respond to disturbance (e.g., noise, vibration, encroachment) at roosts by temporarily leaving or abandoning the roost. It is this response that any monitoring protocol must be able to detect in regards to the decommissioning process.

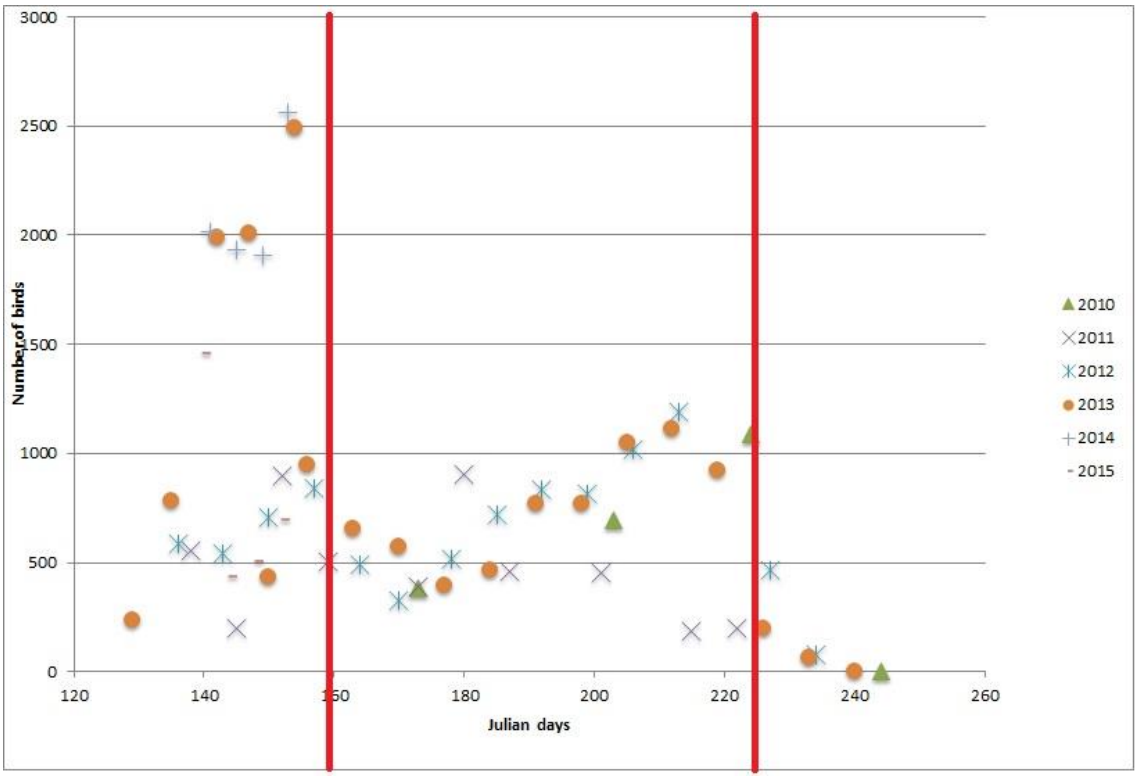


Figure 1. Counts of roosting Chimney Swifts at the Nuclear Power Demonstration Nuclear Generating Station from 2010-2015. Data and graphic courtesy of Annie Morin, CNL. Red lines indicate the transition from migratory period to breeding period (~day 160) and from breeding period to migratory period (~day 210).

CNL already has a protocol in place, adapted from the SwiftWatch protocol of Bird Studies Canada (see http://www.birdscanada.org/volunteer/ai/resources/Ontario_Swiftwatch_Protocol.pdf), for monitoring the abundance of swifts using the ventilation stack as a roost (these data are shown in Figure 1). Although this protocol is important in determining peak usage of the stack, the protocol could only be used as a disturbance measuring tool during the breeding period. This is because great variation in roost count numbers during migration is to be expected. Thus any decrease in roosting swifts that is seen between or among days during the non-breeding (migratory) period *may not be indicative* of disturbance. However, variation in numbers during the breeding season, when roosting populations remain relatively stable, *would be sensitive* to detecting a population level disturbance.

CNL roost site monitoring from 2010-2016 shows that swifts begin arriving at the ventilation stack as early as 4 May (as seen in 2016). The spring migratory period sees a predictable increase in roost size until the first week of June, followed by a decline in numbers as swifts disperse to their breeding sites (Figure 1). This dispersal period lasts approximately two weeks. By the third week of June, roost size numbers stabilize during the breeding period, and a slow steady increase is seen until a peak is reached in late July (Figure 1). From late July onward, the fall migration is protracted (relative to spring migration) and numbers steadily decrease until the last swifts are observed in the last week of August. **It is the period between the third week of June and late July that daily roost counts would provide the most sensitive indicator of disturbance.** During this period, we expect a slow steady increase in bird numbers. If a marked decrease is seen, this may indicate that the swifts have been disturbed by a contemporaneous activity in the decommissioning process (e.g., noise, vibration, encroachment). A marked decrease is here defined as **a >50% decrease in the average of the counts from the previous 4 nights** during which decommissioning activities have taken place during the day. When such a threshold of evacuation has been reached, an examination of the associated decommissioning activities must ensue to identify the likely source of disturbance, with mitigation measures taken (to be outlined in a future report).

Monitoring the abundance of roosting swifts during the non-breeding (migratory) period would not be a sensitive indicator of disturbance. This is because numbers can fluctuate widely during this period, and sizeable decreases among days are to be expected. In this period, the only feasible and sensitive population-level indicator that could be observed would be abandonment of the roost. In lieu of nightly counts of swifts using the roost, **the more useful indicator in the non-breeding periods (1 May – 21 June and 31 July – 1 September) would be through monitoring the roost for swifts exiting the stack in the daytime during inclement weather.** In such cases, the same monitoring protocol that CNL uses to count swifts at sunset would be employed for one-hour observation periods during poor weather (while decommissioning activities are ongoing). However, the observable instances are not the number of swifts entering the roost (as in counts at sunset), but the number of swifts leaving the roost. In inclement weather, swifts tend not to leave the roost unless they are disturbed. In some cases, swifts will leave the roost during inclement weather, but are known to return after a short period outside the roost. Thus, when **>25 swifts are observed leaving the roost in the daytime during inclement weather, and do not return within the observation period,** an examination of the associated decommissioning activities must ensue to identify the likely source of disturbance, with mitigation measures taken (to be outlined in a future report).

Inclement weather is herewith defined as a period with either or both of the following features:

- measurable precipitation lasting longer than 30 continuous minutes
- ambient temperatures dropping below 9°C for longer than 120 continuous minutes

Note: inclement weather in this protocol does not involve wind as a consideration. This is because previous research has shown that swifts may benefit from higher wind speeds. Swifts are known to leave the roost earlier and return later on days with high wind speeds, as insect prey becomes increasingly mobilized and available. Thus, monitoring for swifts exiting the roosts on high wind days will not provide an indication of disturbance.

When weather has been deemed inclement, a one-hour observation period should begin as soon as possible. If the inclement weather ends during the observation period, the observation period can be curtailed. If the inclement weather persists beyond the first one-hour observation period, then subsequent observation periods are to be initiated at times of the observer's choosing to a maximum of three observation periods per day.

If inclement weather persists into multiple days, observations as described above should still be performed. However, the criterion for what constitutes a disturbance must change. This is because as swifts are forced to sequester in a roost over multiple days, their motivation for leaving the roost to forage increases, regardless of the type of weather. Therefore, if swifts are seen exiting the roost on day 2 or more of inclement weather, a more reliable threshold of **>200 swifts being observed leaving the roost in the daytime during inclement weather, and not returning within the observation period,** should trigger an examination of the associated decommissioning activities to identify the likely source of disturbance, with mitigation measures taken (to be outlined in a future report).

End Statement. The two monitoring protocols outlines above will require an enhancement in the efforts currently employed by CNL to monitor swifts. Instead of weekly roost counts during the breeding period, the suggested protocol is to conduct them daily. Similarly, during the non-breeding period efforts must be put forth during the day, in one-hour blocks in inclement weather, to watch for exiting swifts.

These efforts suggested in this document are important means of detecting disturbance to swifts from decommissioning. The nature of these effects and potential mitigation of them will be the subject of two subsequent reports. Nonetheless, it is not too early to consider that certain activities that are prone to create noise or vibration are best to be restricted to fair-weather days and not to be conducted at night or on days with inclement weather.

It will also be important, as will be discussed in a subsequent report, to consider that alterations to the environment surrounding the roost may change site characteristics such as microclimate, which may have a significant influence on the suitability of the habitat. In this regard, efforts must be made to remain at some distance from the roost. As an example, the Ontario habitat regulations state that "During the season in which Chimney Swift are present in Ontario, the nest, human-made nesting / roosting feature and area within 5 m of it, and the natural nesting / roosting feature and the area within 35 m of it, are considered the least tolerant to disturbance." As such, if possible, no decommissioning activities should be conducted, and no infrastructure (such as the batch plant) should be placed within 5 m of the roost. Further, as a precaution, any reduction in decommissioning activity between 5-35 m of the roost would be beneficial.

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

PROPOSED MEASURES TO MITIGATE THE POTENTIAL IMPACT ON CHIMNEY SWIFTS FROM PLANNED DECOMMISSIONING ACTIVITIES AT NPD

NPD DECOMMISSIONING

64-509200-REPT-004

Revision 0

	CNL	LNC
☐ ACCEPTED AS NOTED	☒ ACCEPTED	☐ NOT ACCEPTED

Signature	Representing	Date
Meggan Vichorel	gen	2017/01/24

"The use and meaning of "ACCEPTED" is governed by the terms and conditions of the P.O. CNL Ref. No **474880**
and in any event its use does not relieve the manufacturer of any of its obligations to CNL and/or to its Client"

OFFICIAL USE ONLY **À USAGE EXCLUSIF**

286 Plant Road
Chalk River, Ontario
Canada K0J 1J0

286, rue Plant
Chalk River (Ontario)
Canada K0J 1J0

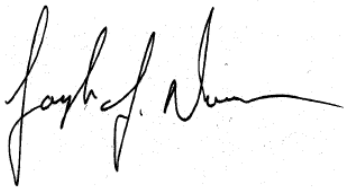
Proposed measures to mitigate the potential impact on Chimney Swifts from planned decommissioning activities

Contribution #2 to a body of scientific advice to Canadian Nuclear Laboratories on potential impact on Chimney Swift during decommissioning activities and proposed mitigation measures and monitoring

A deliverable as per:

P.O. # 474880 and TSW # 64-508320-320-000

January 18, 2017



Joseph J Nocera

Joe.nocera@unb.ca

Scientific Advice on the Potential Impact on Chimney Swift during Decommissioning Activities and Proposed Mitigation Measures and Monitoring

PO #: 474880

TSW #: 64-508320-320-000

A Report On: proposed measures to mitigate the potential impact on Chimney Swifts from planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Executive Summary

A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF) at the Nuclear Power Demonstration Nuclear Generating Station (NPDNGS). The facility will be decommissioned in an *in situ* manner. The above ground structure will be removed, demolition materials will be placed below grade, grouting will seal the below grade structure, reactor vessel and systems and components. The final activity will be to cap the structure within a concrete monolith. There is concern that the decommissioning activities may disturb a significant roost of Chimney Swifts, a federally *Threatened* species, that use the ventilation stack on site. To that end, a previous report suggested monitoring activities to determine the degree of disturbance to swifts by decommissioning activities, and that mitigation of decommissioning activities might be necessary if: 1) During daily roost counts during the breeding season, a >50% decrease in the average of the counts from the previous 4 nights is observed, or2) During behavioral monitoring during inclement weather during the non-breeding (migratory) season, and a) >25 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, or b) >200 swifts are observed leaving the roost in the daytime during subsequent days of inclement weather, and do not return within the observation period.

The predicted sources of disturbance to swifts from decommissioning activities are: 1) noise, 2) vibration, 3) dust, 4) encroachment, and 5) light. During daylight hours, when weather is fair, swifts are not expected to be in the stack. Therefore, **the primary means of mitigation to prevent disturbance to roosting swifts is to limit, as much as possible, decommissioning activities to daylight hours.** It is also recommended **to minimize decommissioning activities near the roost as much as possible**. Ideally, little infrastructure (such as the batch plant) should be placed within 5 m of the roost. Further, any reduction in decommissioning activity between 5-90 m of the roost would be beneficial. However, decommissioning activities may need to occur during inclement weather and/or outside daytime working hours. At such times, roosting swifts in the stack could experience moderate impacts. **The impacts from work during inclement weather or at night may be partly mitigated through using best practices and, where necessary, using 10 specific additional measures outlined herein.** Especial among these measures is the recommendation **for activities that will create substantial vibration or noise to employ a 'soft-start' approach.** This requires that each time the activity is initiated after a period of inactivity (>24 hours), the disturbance (noise or vibration) levels will be gradually increased over a 30 minute period to allow swifts an opportunity to acclimate.

The potential for significant adverse impacts is very low for all work conducted on fair-weather days during daylight hours. The suggested mitigation measures will help reduce impacts for work conducted during inclement weather and/or at night. With these measures instituted, the impacts from decommissioning should be minor. However, monitoring for mitigation effectiveness (as will be laid out in Contribution #3, March 2017) should still be ongoing during and after mitigation. If moderate or more significant impacts are found to occur during monitoring, consideration should be given to creating further and additional measures to mitigate these impacts.

Scientific Advice on the Potential Impact on Chimney Swift during Decommissioning Activities and Proposed Mitigation Measures and Monitoring

PO #: 474880

TSW #: 64-508320-320-000

A Report On: proposed measures to mitigate the potential impact on Chimney Swifts from planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Decommissioning Activities. The Nuclear Power Demonstration Nuclear Generating Station (NPDNGS) is situated in a remote area on the south bank of the Ottawa River. The facility was operational from 1962 to 1987. A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF), which will be done in an *in situ* manner. The above ground structure will be removed and demolition materials will be placed below grade. Grouting will be used to seal the below grade structure, reactor vessel and systems and components. The structure will be capped with concrete and a barrier, creating a concrete monolith.

The NPDWF site hosts a main building storing the reactor and associated systems, a diesel-generator, ventilation stack, and guardhouse. Thus, there is limited infrastructure onsite, and temporary addition of mobile offices, washrooms, increased electrical services, and a temporary concrete batch mixing plant will be required.

The grout batch mixing plant will require aggregate, sand, and cement to be shipped by truck and stockpiled. Further, a water tank, piping, power and settling ponds will be constructed. All below grade areas will be filled with grout. The Main Building, the above ground portion of the Pressure Relief Pit walls, and Guard House will be demolished and placed in the facility. A final reinforced concrete cap will be poured over the foot print of the *in situ* decommissioned reactor facility. An engineered barrier is anticipated to be installed over the concrete cap to reduce infiltration. The area will be graded and drainage ditching installed to manage precipitation run-off. After the final concrete has been poured, the temporary facilities including the concrete batch plant, construction trailers, temporary fencing and barriers will be removed. Clean building slabs, foundations and non-essential roadways will be rubblized *in situ* and the area restored with native vegetation. All buried utilities and systems will be capped or disconnected but remain in place to limit environmental disruption. The above grade electrical distribution systems will also be deactivated including removal of the backup power diesel generator from site.

The grouted area will be fenced and additional groundwater monitoring wells will be installed. The project will limit the amount of waste requiring off-site shipment by entombing wastes within the below grade structure. All construction debris from the above grade structures demolition will also be re-used as fill for below grade voids.

Environment and Wildlife. The decommissioning activities are predicted to have no adverse environmental effects. However, nine species-at-risk have been detected at the NPD site during targeted surveys: Bald Eagle, Chimney Swift, Common Nighthawk, Eastern Wood Pewee, Eastern Milksnake, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Monarch Butterfly.

The ventilation stack, a 45.7 m reinforced concrete structure, discharges airborne effluent from the Main Building. However, Chimney Swifts use the ventilation stack as a roost at night and during inclement weather (as defined in Contribution #1, November 2016).

Chimney Swifts. Chimney Swifts are aerial insectivores, a guild of birds that has been in dramatic population decline in North America. The species is listed as *Threatened* in Canada, and in the province of Ontario. Chimney Swifts spend most daylight hours in flight foraging for aerial insects, returning to roost and nest sites at dusk. During spring migration, Chimney Swifts arrive at Ontario nesting sites in late April to mid-May. During spring and fall migration, Chimney Swifts congregate at communal roosts (predominantly chimneys) at dusk. Chimney Swifts exhibit high site fidelity. Sites are used from year to year, as long as habitat remains suitable.

Large numbers of the birds can enter some roosting chimneys, and the ventilation stack at NPDWF is a relatively large roost. Roost counts were initiated by CNL in 2010 and have been performed annually on a weekly basis. Chimney Swifts sheltering in the stack during spring migration can reach just over 2,500 individuals per night. During the summer months, swifts disperse from these roosts to find nesting sites. Non-breeding birds will continue to roost communally throughout the summer.

Monitoring Potential Effects of Decommissioning on Chimney Swifts. CNL seeks to preserve the integrity of the ventilation stack during decommissioning, and minimize disturbance to roosting swifts during the process. Swifts are commonly found in urban environments and are exposed to *chronic* (prolonged) elevated noise levels. These chronic noise levels seem to pose little problem to swifts who show strong fidelity to roost and nest sites, as has been observed with swifts at the CNL site. This site fidelity suggests acclimatization to chronic noise. However, there have been no studies on how swifts respond to *acute* (short burst) elevated noise levels such as will be experienced with demolition activities at NPDWF.

In all seasons, Chimney Swifts usually leave the roost at dawn and spend the day foraging until they return at sunset. Therefore, daytime decommissioning activities *should* have little direct effect on roosting swifts (unless those activities somehow physically alter the roost's habitat quality). Direct effects of decommissioning activities are most likely to occur when the activities overlap with swifts being present in the roost. Swifts roost only at night, or during the day when the weather is inclement. Therefore, the only decommissioning activities that pose a greater risk of directly disturbing roosting swifts are those that occur at night (which would only be during an abnormal situation) or on poor weather days.

A seasonally-appropriate and consistent approach to monitoring Chimney Swifts at the ventilation stack roost has been previously outlined (Contribution #1, November 2016) that will allow detection of a population-level response to decommissioning activities.

During the third week of June and late July (breeding season), we expect a slow steady increase in bird numbers at the roost. If a marked decrease is seen, this may indicate that the swifts have been disturbed by a contemporaneous activity in the decommissioning process. A marked decrease is here defined as a >50% decrease in the average of the counts from the previous 4 nights during which

decommissioning activities have taken place during the day. When such a threshold of evacuation has been reached, an examination of the associated decommissioning activities must ensue to identify the likely source of disturbance, with mitigation measures taken (see below).

During the non-breeding periods (1 May – 21 June and 31 July – 1 September), roosting swifts should be monitored for exiting the stack in the daytime during inclement weather. When >25 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, or, if >200 swifts are seen exiting the roost on day 2 or more of inclement weather and do not return within the observation period, an examination of the associated decommissioning activities to identify the likely source of disturbance, with mitigation measures, should be taken (see below).

Possible Disturbance from Decommissioning to Chimney Swifts. There are five primary sources of disturbance to swifts that may be predicted from decommissioning activities: 1) noise, 2) vibration, 3) dust, 4) encroachment, and 5) light.

How birds respond to disturbance varies between species. What constitutes a disturbance for a given species may depend on the typical levels of the stressor (noise, vibration, dust, encroachment, and light) already at the site and whether they are increased by an activity. Species-specific thresholds of disturbance are likely to relate to differences in tolerance, spacing behaviour, and bioacoustic profiles. Activities which result in increases in stressors above ambient levels may disturb birds, although some birds may successfully habituate to new sources of stressors. However, birds are more affected by startle than long-term, elevated noise and vibration levels. Birds usually respond to such disturbance by moving away from the stressor source, which is the response that a previously suggested monitoring program was designed to detect (Contribution #1, November 2016).

Activities that can regularly create airborne particulates (e.g., extensive demolition) have been shown to reduce avian diversity as birds vacate the area. Further, particulates may introduce toxic material into the air which, in extreme cases, may cause reproductive failure or mortality. Birds would be expected to respond to such disturbance by moving away from the stressor source, which is the response that a previously suggested monitoring program was designed to detect (Contribution #1, November 2016).

Light pollution is a well-known population stressor for many bird species, especially in terms of mortality risk during migration due to collisions. However, the sub-lethal effects are less well known. Recent research has shown that chronic exposure to increased light levels (especially at night) have altered reproductive schedules, disrupted song patterns, and changed species interactions. Birds would be expected to respond to such disturbance by moving away from the stressor source, which is the response that a previously suggested monitoring program was designed to detect (Contribution #1, November 2016).

Suggested Mitigation Activities. During daylight hours, when weather is not inclement (as defined in Contribution #1, November 2016), swifts are not expected to be in the stack. On such days, they will be out foraging during daylight hours. If all decommissioning work could be accomplished during daylight hours during clement weather, the disturbance to swifts is predicted to be negligible.

The first and primary means of mitigation to prevent disturbance to roosting swifts is, therefore, to limit decommissioning activities to daylight hours as much as possible.

Further, it is important to consider that encroachment and alterations to the environment surrounding the roost may change site characteristics such as microclimate, which may have a significant influence on the suitability of the habitat. As far as is feasible, efforts should be made to remain at some distance from the roost. For example, the Ontario Ministry of Natural Resources and Forestry[1] states that "A human-made nesting/roosting feature, or a natural nesting/roosting tree cavity and the area within 90 m of the tree, are considered the least tolerant to alteration."

Another mitigation is to minimize decommissioning activities near the roost (within 5m) as much as possible. Placement of infrastructure (e.g., batch plant) should be avoided within 5 m of the roost. Further, any reduction in decommissioning activity between 5-90 m of the roost would be beneficial.

However, abnormal situations may require that decommissioning activities occur during inclement weather and/or outside daytime working hours. At such times, roosting swifts in the stack could experience moderate impacts. These impacts may be mitigated through using best practices throughout decommissioning work and, where necessary, using specific measures during disruptive activities.

The following ten specific measures to minimize disturbance during decommissioning should be considered:

1. Noise performance should be considered in the selection of mechanical equipment and vehicles.
2. Bearing in mind a minimum placement of 5m from the stack, mobile plants (e.g., compressors, generators) and other noisy apparatuses such as concrete batching should be located as far as possible from the roosting stack. These devices should be oriented to direct noise emissions away from the stack as far as possible, and onsite structures and terrain will be used to screen the stack and provide noise suppression wherever practicable.
3. Dramatic and sudden disturbances should only ever be undertaken during daylight hours.
4. The noise level of audible warning devices should be kept to the minimum necessary for employee health and safety.
5. Major demolition activities should be undertaken following a planned schedule.
6. Major demolition procedures should be developed to keep noise and vibration to a minimum without compromising demolition requirements.
7. If significant vibration impacts cannot be avoided, consider relocating sources so that there is no direct line of sight between the source and stack.
8. Orient all external lighting fixtures so that the top of the stack is not illuminated.
9. Insofar as is practical, keep dust from demolition to a minimum.
10. Activities that will create substantial vibration and noise should only be undertaken during daylight hours, and it is also recommended that a 'soft-start' approach be undertaken. This requires that each time the activity is initiated after a period of inactivity (>24 hours), the disturbance (noise and vibration) levels will be gradually increased over a 30 minute period to allow swifts at least an opportunity to acclimate.

The potential for significant adverse impacts is low for all work conducted on fair-weather days during daylight hours. The above suggested mitigation measures will help reduce impacts for work conducted during inclement weather and/or at night. With these measures instituted, the impacts from decommissioning should be of no more than minor significance. However, monitoring (to be described in Contribution #3, March 2017) should still be ongoing during and after mitigation to determine effectiveness. If moderate or more significant impacts are found during such follow-up monitoring, consideration should be given to creating further and additional measures to mitigate these impacts.

[1] OMNRF (Ontario Ministry of Natural Resources & Forestry). 2013 (revised 2016). General Habitat Description for the Chimney Swift (*Chaetura pelagica*). Queen's Printer for Ontario, Toronto, ON. 4 pp.

End Statement. The two monitoring protocols outlined in a previous report allow for the detection of disturbance to swifts from decommissioning activities. If such disturbance is detected, the mitigation measures proposed in this report offer a partial solution. Nonetheless, it is important to consider that two pre-emptive mitigation measures be instituted before any disturbance impacts are detected. Namely,

1. The first and primary means of mitigation to prevent disturbance to roosting swifts is, therefore, to limit decommissioning activities to daylight hours.
2. A secondary means of mitigation is to minimize decommissioning activities near the roost (within 5m) as much as possible. Placement of infrastructure (such as the batch plant) should be avoided within 5 m of the roost. Further, any reduction in decommissioning activity between 5-90 m of the roost would be beneficial.

Outside of instituting these two recommendations pre-emptively, if disturbance is detected, this report offers 10 options for further reduction of disturbance. Important among them is the recommendations to limit all sudden and large disturbances to daylight hours on fair-weather days, where less impactful decommissioning activities can proceed during inclement weather or at night, if necessary. Also important is the recommendation for a 'soft-start' to disruptive activities to allow swifts an opportunity to acclimate to the disturbance.

The effectiveness of these mitigation actions is likely to be variable based on the nature of the disturbance. As such, it will be important to monitor swifts roosting in the stack to determine whether the mitigation activities have been successful. This will require a modification to the monitoring protocol suggested in Contribution #1 (November 2016) and will be the subject of a subsequent report (Contribution #3, March 2017).

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

REPORT FOR MONITORING THE EFFECTIVENESS OF MITIGATION MEASURES ON CHIMNEY SWIFTS FROM PLANNED DECOMMISSIONING ACTIVITIES AT NPD

NPD DECOMMISSIONING

64-509200-REPT-006

Revision 1

	CNL	LNC
☐ ACCEPTED AS NOTED	☒ ACCEPTED	☐ NOT ACCEPTED

Signature	Representing	Date
Meggan Vichorel	gen	2017/05/16

"The use and meaning of "ACCEPTED" is governed by the terms and conditions of the P.O. CNL Ref. No **474880**
and in any event its use does not relieve the manufacturer of any of its obligations to CNL and/or to its Client"

OFFICIAL USE ONLY **À USAGE EXCLUSIF**

286 Plant Road
Chalk River, Ontario
Canada K0J 1J0

286, rue Plant
Chalk River (Ontario)
Canada K0J 1J0

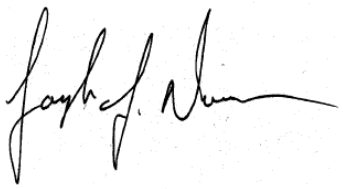
Monitoring the effectiveness of mitigation measures on Chimney Swifts from planned decommissioning activities

Contribution #3 to a body of scientific advice to Canadian Nuclear Laboratories on potential impact on Chimney Swift during decommissioning activities and proposed mitigation measures and monitoring

A deliverable as per:

P.O. # 474880 and TSW # 64-508320-320-000

April 2, 2017



Joseph J Nocera

Joe.nocera@unb.ca

Scientific Advice on Monitoring the Effectiveness of Mitigation Measures on Chimney Swifts from Planned Decommissioning Activities

PO #: 474880

TSW #: 64-508320-320-000

A Report On: Assessing the effectiveness of mitigation measures to reduce the potential impact on Chimney Swifts from planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Executive Summary

A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF) at the Nuclear Power Demonstration Nuclear Generating Station (NPDNGS). The facility will be decommissioned in an *in situ* manner. The above ground structure will be removed, demolition materials will be placed below grade, grouting will seal the below grade structure, reactor vessel and systems and components. The final activity will be to cap the structure within a concrete monolith. There is concern that the decommissioning activities may disturb a significant roost of Chimney Swifts, a federally *Threatened* species, that use the ventilation stack on site. To that end, a previous report suggested monitoring activities to determine the degree of disturbance to swifts by decommissioning activities, and that mitigation of decommissioning activities might be necessary if: 1) During daily roost counts during the breeding season, a >50% decrease in the average of the counts from the previous 4 nights is observed, or2) during behavioral monitoring during inclement weather during the non-breeding (migratory) season, and a) >25 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, or b) >200 swifts are observed leaving the roost in the daytime during subsequent days of inclement weather, and do not return within the observation period. A subsequent report then suggested that the primary means of mitigation to prevent disturbance to roosting swifts is to limit, as much as possible, decommissioning activities to daylight hours. It was further recommended to minimize decommissioning activities near the roost as much as possible. The impacts from work during inclement weather or at night may be partly mitigated through using best practices and, where necessary, using 10 specific additional measures outlined in the second report.

The potential for significant adverse impacts is very low for all work conducted on fair-weather days during daylight hours. The suggested mitigation measures will help reduce impacts for work conducted during inclement weather and/or at night. With these measures instituted, the impacts from decommissioning should be minor. However, monitoring for mitigation effectiveness should still be ongoing during and after mitigation. To that end, this report suggests monitoring activities to determine the degree of response by swifts to mitigation. The same monitoring protocols as used to detect disturbance are to be used in detecting response to the mitigation. However, although the methods do not change, the criteria for evaluation do. **If, during the breeding season, a >25% increase in the average of the counts from the previous 4 nights is observed, it may be assumed that mitigation measures have been successful.** However, as previously suggested, the monitoring methods during the non-breeding season differ**. During the non-breeding period, when <10 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, it may be assumed that mitigation measures have been successful.** The criteria change if inclement weather persists over several days. **If swifts are seen exiting the roost on day 2 or more of inclement weather, a more reliable threshold of <50 swifts being observed leaving the roost in the daytime during inclement weather, and not returning within the observation period, it may be assumed that mitigation measures have been successful.** Lastly, it will be important to conduct follow-up monitoring after decommissioning to determine whether decommissioning has had any longer-term effects on the swifts.

Scientific Advice on Monitoring the Effectiveness of Mitigation Measures on Chimney Swifts from Planned Decommissioning Activities

PO #: 474880

TSW #: 64-508320-320-000

A Report On: Assessing the effectiveness of mitigation measures to reduce the potential impact on Chimney Swifts from planned decommissioning activities (64-509200-ENA-003) while they continue residing in the current ventilation stack.

Decommissioning Activities. The Nuclear Power Demonstration Nuclear Generating Station (NPDNGS) is situated in a remote area on the south bank of the Ottawa River. The facility was operational from 1962 to 1987. A Nuclear Power Demonstration Closure Project has been initiated to decommission the Nuclear Power Demonstration Waste Facility (NDPWF), which will be done in an *in situ* manner. The above ground structure will be removed and demolition materials will be placed below grade. Grouting will be used to seal the below grade structure, reactor vessel and systems and components. The structure will be capped with concrete and a barrier, creating a concrete monolith.

The NPDWF site hosts a main building storing the reactor and associated systems, a diesel-generator, ventilation stack, and guardhouse. Thus, there is limited infrastructure onsite, and temporary addition of mobile offices, washrooms, increased electrical services, and a temporary concrete batch mixing plant will be required.

The grout batch mixing plant will require aggregate, sand, and cement to be shipped by truck and stockpiled. Further, a water tank, piping, power and settling ponds will be constructed. All below grade areas will be filled with grout. The Main Building, the above ground portion of the Pressure Relief Pit walls, and Guard House will be demolished and placed in the facility. A final reinforced concrete cap will be poured over the foot print of the *in situ* decommissioned reactor facility. An engineered barrier is anticipated to be installed over the concrete cap to reduce infiltration. The area will be graded and drainage ditching installed to manage precipitation run-off. After the final concrete has been poured, the temporary facilities including the concrete batch plant, construction trailers, temporary fencing and barriers will be removed. Clean building slabs, foundations and non-essential roadways will be rubblized *in situ* and the area restored with native vegetation. All buried utilities and systems will be capped or disconnected but remain in place to limit environmental disruption. The above grade electrical distribution systems will also be deactivated including removal of the backup power diesel generator from site.

The grouted area will be fenced and additional groundwater monitoring wells will be installed if required. The project will limit the amount of waste requiring off-site shipment by entombing wastes within the below grade structure. All construction debris from the above grade structures demolition will also be re-used as fill for below grade voids.

Environment and Wildlife. The decommissioning activities are predicted to have minor environmental impact. However, nine species-at-risk have been detected at the NPD site during targeted surveys: Bald Eagle, Chimney Swift, Common Nighthawk, Eastern Wood Pewee, Eastern Milksnake, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Monarch Butterfly.

The ventilation stack, a 45.7 m reinforced concrete structure, discharges airborne effluent from the Main Building. However, Chimney Swifts use the ventilation stack as a roost at night and during inclement weather (as defined in Contribution #1, November 2016).

Chimney Swifts. Chimney Swifts are aerial insectivores, a guild of birds that has been in dramatic population decline in North America. The species is listed as *Threatened* in Canada, and in the province of Ontario. Chimney Swifts spend most daylight hours in flight foraging for aerial insects, returning to roost and nest sites at dusk. During spring migration, Chimney Swifts arrive at Ontario nesting sites in late April to mid-May. During spring and fall migration, Chimney Swifts congregate at communal roosts (predominantly chimneys) at dusk. Chimney Swifts exhibit high site fidelity. Sites are used from year to year, as long as habitat remains suitable.

Large numbers of the birds can enter some roosting chimneys, and the ventilation stack at NPDWF is a relatively large roost. Roost counts were initiated by CNL in 2010 and have been performed annually on a weekly basis. Chimney Swifts sheltering in the stack during spring migration can reach just over 2,500 individuals per night. During the summer months, swifts disperse from these roosts to find nesting sites. Non-breeding birds will continue to roost communally throughout the summer.

Monitoring Potential Effects of Decommissioning on Chimney Swifts (as described in Contribution #1, November 2016)**.** CNL seeks to preserve the integrity of the ventilation stack during decommissioning, and minimize disturbance to roosting swifts. In all seasons, Chimney Swifts usually leave the roost at dawn and spend the day foraging until they return at sunset. Therefore, daytime decommissioning activities *should* have little direct effect on roosting swifts (unless those activities somehow physically alter the roost's habitat quality). Direct effects of decommissioning activities are most likely to occur when the activities overlap with swifts being present in the roost. Swifts roost only at night, or during the day when the weather is inclement. Therefore, the only decommissioning activities that pose a risk of directly disturbing roosting swifts are those that occur at night (which would only be during an abnormal situation) or on poor weather days.

A seasonally-appropriate and consistent approach to monitoring Chimney Swifts at the ventilation stack roost has been previously outlined (Contribution #1, November 2016) that will allow detection of disturbance to swifts from decommissioning activities.

During the third week of June and late July (breeding season), we expect a slow steady increase in bird numbers at the roost. If a marked decrease is seen, this may indicate that swifts have been disturbed by a contemporaneous activity in the decommissioning process. A marked decrease is a >50% decrease in the average of the counts from the previous 4 nights during which decommissioning activities have taken place during the day. When such a threshold of evacuation has been reached, an examination of the associated decommissioning activities must ensue to identify the likely source of disturbance, with mitigation measures taken (see recommendations in Contribution #2; January 2017).

During the non-breeding periods (1 May – 21 June and 31 July – 1 September), roosting swifts should be monitored for exiting the stack in the daytime during inclement weather. When >25 swifts are observed leaving the roost in the daytime during the first day of inclement weather, and do not return within the observation period, or, if >200 swifts are seen exiting the roost on day 2 or more of inclement weather and do not return within the observation period, an examination of the associated decommissioning activities to identify the likely source of disturbance, with mitigation measures, should be taken (see recommendations in Contribution #2, January 2017).

Mitigation Activities (as described in Contribution #2, January 2017)**.** During daylight hours, when weather is not inclement (as defined in Contribution #1, November 2016), swifts are not expected to be in the stack as they will be away foraging. However, abnormal situations may require that decommissioning activities occur outside daytime working hours. At such times, roosting swifts in the stack could experience moderate impacts. These impacts may be mitigated through a) using best practices throughout decommissioning work and, b) where necessary, using specific measures during disruptive activities.

Best Practices. If all decommissioning work could be accomplished during daylight hours, the disturbance to swifts is predicted to be negligible. The first and primary means of mitigation to prevent disturbance to roosting swifts is, therefore, to limit decommissioning activities to daylight hours as much as possible. Further, when feasible, efforts should be made to keep decommissioning activities away from the roost, especially minimizing decommissioning activities near the roost (within 5m) as much as possible. Placement of infrastructure (e.g., batch plant) should be avoided within 5 m of the roost. Further, any reduction in decommissioning activity between 5-90 m of the roost would be beneficial.

Specific Measures. A set of ten specific measures to minimize disturbance during decommissioning have been suggested in a previous report (Contribution #2, January 2017). The potential for significant adverse impacts is low for all work conducted on fair-weather days during daylight hours. Outside of this, with these measures instituted, the impacts from decommissioning should be of no more than minor significance. However, monitoring should still be conducted during and after mitigation to determine effectiveness (as described below).

Suggested Mitigation Response Monitoring. A response by roosting swifts to having been disturbed by decommissioning activities will first be indicated by observations of roost abandonment and/or noted reductions in the expected roosting population (as laid out in Contribution #1, November 2016). Any such detected disturbance should trigger mitigation measures (as laid out in Contribution #2, January 2017). The effectiveness of the resultant mitigation should then be monitored in regards to reductions in abandonment of the roost and/or the level to which the roosting swift population returns to its expected size for that time period.

The three main biologically-relevant periods for swifts in Ontario are the 1) spring non-breeding (migratory) period, 2) breeding period, and 3) fall non-breeding (migratory) period. Density of roosting swifts should be expected to differ among these periods. Seasonally-appropriate population monitoring methods have already been described (Contribution #1, November 2016). The greatest density of roosting swifts occurs during the migratory (non-breeding) periods in the spring (late April to early June) and fall (late July to September). During migration, the number of swifts using the ventilation stack as a roost fluctuates greatly between nights. Chimney Swifts will either return to the roost early during inclement weather or remain in the roost all day. Chimney Swifts respond to disturbance at roosts by temporarily leaving or abandoning the roost. Mitigation measures should assuage this effect. It is this response to mitigation that the below monitoring protocol is designed to detect in regards to the decommissioning process.

Monitoring during the non-breeding period. The abundance of roosting swifts during the non-breeding (migratory) periods can fluctuate widely and sizeable decreases among days are to be expected. In this period, the only feasible and sensitive population-level indicator that could be observed would be relative abandonment of the roost. Thus, during the non-breeding periods (1 May – 21 June and 31 July – 1 September) monitoring for disturbance of the roost focusses on swifts exiting the stack in the

daytime during inclement weather. The details of how to conduct such monitoring have already been provided (Contribution #1, November 2016). A significant disturbance (which would require mitigation) can be assumed to have happened when >25 swifts are observed leaving the roost in the daytime during inclement weather, and do not return within the observation period. **Monitoring of mitigation effectiveness will use the same monitoring protocols as used to detect disturbance**, described in Contribution #1 (November 2016). Although the monitoring methods will remain the same, **the response thresholds differ between disturbance monitoring and mitigation monitoring**. As such, a suitable threshold for responsiveness to mitigation, during non-breeding periods, is:

Provided that swifts are still using the roost, a positive response to mitigation will see <10 swifts (ideally zero) subsequently being observed leaving the roost in the daytime during inclement weather, and not returning within the observation period.

It is important to note that the above recommended threshold is a) is predicated on that a sizeable number of swifts are still using the stack, and b) is not exactly zero swifts being observed deserting the stack, although zero would be ideal. Instead, the threshold is a reduced amount of desertion from that which would otherwise indicate a disturbance. This acknowledges the fact that individual variation in motivation can cause a few swifts to make unexpected daytime movements, such as deserting a roost, based on intrinsic factors.

If inclement weather persists into multiple days, observations as described above should still be performed. However, the criterion for what constitutes a response must change. This is because as swifts are forced to sequester in a roost over multiple days, their motivation for leaving the roost to forage increases, regardless of the type of weather.

Therefore, if swifts are seen exiting the roost on day 2 or more of inclement weather, a threshold of <50 swifts being observed leaving the roost in the daytime during inclement weather, and not returning within the observation period, should indicate a positive response to mitigation measures.

Monitoring during the breeding period. By the third week of June, roost size numbers stabilize during the breeding period, and a slow steady increase is seen until a peak is reached in late July. From late July onward, the fall migration is protracted (relative to spring migration) and numbers steadily decrease until the last swifts are observed in the last week of August. It is the period between the third week of June and late July that daily roost counts would provide the most sensitive indicator. During this period, we expect a slow steady increase in bird numbers. We assume that decommissioning activities have created a disturbance if there is a >50% decrease in the average of the counts from the previous 4 nights during which decommissioning activities have taken place during the day.

Following mitigation of the disturbance, a positive response to the mitigation may be assumed if, during the breeding period, there is a >25% increase in the average of the counts from the previous 4 nights during which decommissioning activities have taken place during the day.

Monitoring after decommissioning. Follow-up monitoring should occur after decommissioning to determine whether decommissioning has had any longer-term effects on the swifts. It is suggested that the swifts in the stack be monitored for at least one year after decommissioning; at least three years post-decommissioning would be a more ideal follow-up monitoring period. Because all acute and/or chronic decommissioning activities will no longer be present, the monitoring protocols suggested above and in Contribution #1 (Nov 2016) will no longer be needed. Instead, a return to the previous forms of monitoring conducted by CNL will be required.

For several years, CNL has used a protocol, adapted from the SwiftWatch protocol of Bird Studies Canada (see http://www.birdscanada.org/volunteer/ai/resources/Ontario_Swiftwatch_Protocol.pdf),

for *weekly* monitoring of the abundance of swifts using the ventilation stack as a roost. This protocol has been important in determining peak usage dates of the stack, and relative changes in the abundance of roosting swifts over seasons. This protocol should again be used to monitor swifts from mid-May to late-August (i.e., 20-22 weekly counts per year). It will be important to keep the observational protocol the same as it was prior to decommissioning so as to allow for standardized comparisons of roosting swifts before and after decommissioning. Any changes would make standardized comparisons problematic.

As such, detecting a long term response will require comparison to previous years. In previous years, the following data parameters (CNL unpub data) were observed at NDPWF:

Year	First count date	Last count date	Mean # roosting swifts	High count of roosting swifts	Low count of roosting swifts	# of counts conducted
2010	21 Jun	30 Aug	541	1090	0	4
2011	18 May	10 Aug	474	903	184	10
2012	15 May	21 Aug	651	1188	78	14
2013	9 May	28 Aug	835	2489	0	19
2014	21 May	2 Jun	2105	2563	1910	4
2015	20 May	1 Jun	772	1456	433	4
2016	4 May	31 Aug	673	2147	1	21

Substantial (>50%) *negative* departures from these parameters *may* represent a long-term effect of decommissioning. For example, the mean number of swifts observed roosting in the stack in a given year was never lower than 474. A 50% reduction to a mean of <237 swifts observed roosting in the stack in a given year could indicate a long-term response to decommissioning. However, it will be important to remember that chimney swift populations are in decline across their range and this may contribute (although annually modestly) to reductions in observed swifts. Interpreting the data between and among years will require an understanding that correlation does not necessarily equal causation.

End Statement. The monitoring protocols outlined in a previous report allow for the detection of disturbance to swifts from decommissioning activities. If such disturbance is detected, the mitigation measures proposed in a subsequent report offer a partial solution. The effectiveness of these mitigation actions is likely to be variable based on the nature of the disturbance. As such, it will be important to monitor swifts roosting in the stack to determine whether the mitigation activities have been successful.

The same monitoring protocols as used to detect disturbance are to be used in detecting response to the mitigation. However, although the methods do not change, the criteria for evaluation do. The efforts suggested in this document are important means of detecting responses by swifts to mitigation.

Lastly, it will be important to conduct follow-up monitoring after decommissioning to determine whether decommissioning has had any longer-term effects on the swifts.