

Discussion of Protocols for the Quarantine of the Chernobyl Exclusion Zone Domestic Canine Population

An Interactive Qualifying Project Report

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

Submitted by

Joseph LeBlanc

Date: May 1, 2018

Submitted to:

Professor Germano Iannacchione

Professor David Medich

Professor Izabela Stroe

Abstract

Following the events of the nuclear meltdown in Chernobyl, a vast number of domestic dogs were left abandoned in the outskirts to survive on their own. Because they are domesticated, these creatures do not have the means to defend themselves against the growing population of wildlife that are taking over the area. Therefore, construction workers of the New Safe Confinement sarcophagus have seen these dogs approach them in need of help. But, with the soon completion of the project, human activity in the area will soon be close to none. That is why a decision must soon be made to determine the fate of these dogs. Thanks to the Clean Future Fund, the dogs have been spared of a previously inevitable mass elimination, and instead are currently in the process of being spayed and neutered to control their population. The research conducted at Worcester Polytechnic Institute endeavored to prove it possible to quarantine the dogs until they are eligible for transfer across the globe and be adopted into loving homes. As a result, this paper explores the potential quarantine protocols that can be utilized to cleanse the dogs of radiation contamination and extend their life expectancy.

Contents

1. Introduction.....	5
1.1 The Dogs of Chernobyl.....	5
2. Discussion of Quarantine Protocols.....	7
2.1. Containment.....	7
2.2. Diet.....	8
2.3. Waste Disposal.....	9
3. Conclusion	10

Acknowledgement of Contribution

This paper acknowledges the IQP report of Taylor Trottier, which will be frequently referenced in this paper.

1. Introduction

1.1 The Dogs of Chernobyl

The Chernobyl nuclear catastrophe is one of the worst industrial incidents of the 20th century. Caused by the ignorance of engineers and the mechanical malfunction of nuclear reactor No. 4, a disastrous explosion flooded the region surrounding current-day Pripjat, Ukraine with deadly ionizing gamma radiation, displacing hundreds of thousands of people. During these evacuations, residents were instructed to bring only what they could carry with them. This unfortunately excluded their pets, leaving them to wander the now-abandoned streets. Soviet soldiers were instructed to eliminate these strays, but they were not successful in killing all of them.¹

Presently, there are several hundred domesticated dogs roaming the Chernobyl Exclusion Zone. These dogs are the descendants of those pets left behind in the wake of the nuclear event. Being domesticated, these animals are not fit to survive without the aid of humans, which has led to various health problems among their population. Many fail to live beyond six years of age.¹

Because of this dilemma, the Clean Future Funds has endeavored to raise funds to vaccinate, spay, and neuter these animals to one day relocate them to forever homes across the world, where they can experience the love that their predecessors enjoyed. However, the ultimate hurdle to overcome is to de-contaminate the dogs, who are suffering from cesium-137 radiation. Their current diet is of greatest concern, consisting mainly of irradiated plants.¹

The concentration of Cs-137 radiation present in the dogs' muscle tissues can be excreted over time through their waste products, suggesting that cesium contamination can be lowered to

negligible levels through proper quarantining procedures, enabling the possibility of adoption.¹ To accomplish these levels, dogs must be relocated to a controlled environment with negligible background radiation levels and be provided with a balanced diet to help them gain weight and extend their life expectancy. Quarantine protocols must also include methods to remove dogs' waste materials from the environment and be properly disposed of.

2. Discussion of Quarantine Protocols

2.1. Containment

Quarantining the domestic dogs in or near the Chernobyl Exclusion Zone will not lower the cesium-137 levels presently in their muscle tissue. As such, the dogs will need to be relocated to a facility in Ukraine where the background radiation levels are negligible. Such a facility can be the interior of a building, or an enclosed outdoor environment. The facility must be established in which the dogs will be isolated from the outside environment to prevent physical contact and contamination of the indigenous flora and fauna by the dogs.²

Because the goal for these dogs is to integrate them into living with families around the world, consistent human contact is important for the dogs for the duration of the quarantine. Therefore, the quarantine facility must host personnel capable of interacting with the animals in such a manner that will teach the dogs how to live amongst humans. The facility must also provide ample space for the dogs to socialize among themselves; this will teach them how to behave around other dogs that their prospective adoptive families may already own or may encounter elsewhere.

During quarantine, the dogs' health should be monitored as to not introduce zoonotic diseases to each other or in the future after adoption. The quarantine period should consist of fecal sample collection on a regular schedule to be analyzed for gastrointestinal parasites. Each dog should be updated on vaccinations for zoonotic diseases and blood should be collected and stored in a freezer for retrospective disease evaluation. Dogs must be marked via ear tag to correlate medical records.²

2.2. Diet

It is important that the Chernobyl dogs receive a balanced diet during the quarantine period to help them reach a healthy body weight. However, because the dogs have been living off a meager diet of grass, plant foliage and berries, there could be potential health risks to introducing the animals to a meat-based diet. It is necessary to find a supplemental alternative to provide the dogs with protein. One such supplement that is widely used in animal feeds is soybean meal (SBM). SBM is an excellent source of high-quality protein, with 48% of the meal being comprised of protein.³

Because the dogs will not be used to having a sustained diet, it is important to determine the proper volume per day of food supplements to allow the animals. Should the dogs be given too large amount of food, the dogs' bodies could react violently in response. In accordance with a study lead by Richard D. Kealy and company of the Journal of the American Veterinary Medical Association, this would not necessarily lead to a decline in the dogs' health. Because of this study, dogs in the experimental group who were fed 25% less than the dogs in the control group showed a lower body fat content and lived a longer median life span.⁴ This study supports an initially low-calorie diet for the Chernobyl dogs until they are used to the higher food intake.

2.3. Waste Disposal

The Chernobyl dogs will be excreting their cesium-137 contamination through their waste products, namely their feces. So, any waste produced by the dogs must be treated as hazardous radioactive waste. A possible solution for the proper disposal of waste is to bury the waste products underground, done similarly as nuclear power plant wastes. Geological disposal is the underground burial of radioactive wastes with no intention to retrieve it.⁵

However, the feces waste of the dogs does not need to be handled in the same manner as used nuclear reactor rods. Dog feces is biodegradable, and the wastes of the Chernobyl dogs possess a radiation activity level of less than or equal to 1 Bq g^{-1} , whereas typical spent nuclear fuel rods today possess a radiation level activity of 0.1 TBq , 10^{11} times greater activity than the dog feces.¹⁶ Because of this, it should suffice for the dog wastes to be buried under natural rock sediments instead of a specially designed facility underground and without special protective sample housing. The natural rock sediments will serve to be a barrier against radiation leakage and allow the feces to decompose harmlessly.

3. Conclusion

The previously mentioned quarantine protocols can effectively render the dogs of Chernobyl eligible for adoption and transplantation after a year's time, but additional protocols may need to be considered as limited information exists as the time of submission of this paper. With the proper medical care, the dogs of Chernobyl can experience several more years in the comfort of homes around the world. With the imminent completion of the New Safe Confinement sarcophagus, a solution to move the dogs off-site is vital as the rate of human visitors, whom the dogs currently rely on for sustenance, could drastically fall as the need for construction workers lessens. Animals that we have domesticated to live among us do not deserve to suffer from man's past mistakes, and we should endeavor to repent for the mistake in Chernobyl by sparing as many dogs as possible from further plight.

Bibliography

- [1] Taylor Trottier, Analysis of radioactivity in the Chernobyl Exclusion Zone domestic canine population, 1-59, 2018.
- [2] R.e. Miller, Quarantine protocols and preventive medicine procedures for reptiles, birds and mammals in zoos. *Revue Scientifique et Technique de l'OIE*, 15(1):183-189, 1996.
- [3] Ryan M. Yamka, Ultra Jamikorn, Alma D. True, and David L. Harmon, Evaluation of soyabean meal as a protein source in canine foods, *Animal Feed Science and Technology*, 109(1-4):121-132, 2003.
- [4] Richard D. Kealy, Dennis F. Lawler, Joan M. Ballam, Sandra L. Mantz, Darryl N. Biery, Elizabeth H. Greeley, George Lust, Mariangela Segre, Gail K. Smith, and Howard D. Stowe, Effects of diet restriction on life span and age-related changes in dogs, *Journal of the American Veterinary Medical Association*, 220(9):1315-1320, 2002.
- [5] Neil Chapman and Alan Hooper, The disposal of radioactive wastes underground, *Proceedings of the Geologists' Association*, 123(1):46-63, 2012.
- [6] Allan Hedin, Spent nuclear fuel – how dangerous is it?, *Swedish Nuclear Fuel and Waste Management Co.*, 19-20, 1997