東日本大震災における被災動物対応の現状と今後の課題
―放射性物質汚染への対応を考える―

The Current Situation Concerning the Handling of Animals Affected by the Great East Japan Earthquake - Considering Responses to Radioactive Material Contamination

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Good morning everybody. Thank you very much for taking the trouble to attend this workshop from such an early hour.

A little later, under the theme of "The Current Situation Concerning the Handling of Animals Affected by the Great East Japan Earthquake - Considering Responses to Radioactive Material Contamination," two of our speakers will be talking about small animal and farm animal cases respectively. Even between us, it will be impossible to comprehensively cover such a broad-based theme so if any of you among the audience would like to add your opinion, suggestion, or comments based on your own experience, please do not hesitate to join in. We have allowed for approximately half an hour at the end and we'd like to use that time to develop active discussions.

Please allow me to begin by telling you a little bit about myself. I was born in Fukushima Prefecture but moved to Sendai when I was five years old. Soon after that I moved again to Tokyo. Until recently, I was not very conscious of where I had spent my earliest days. Indeed I had almost completely forgotten. But after the earthquake and having to make frequent visits to Fukushima, I realized again that my parents' roots were in that prefecture. My mother comes from Aizu and my father comes from Hara-no-Machi in Minamisoma. I remember that, as a young child, I was often taken to Hara-no-Machi to go swimming in the sea. Next year I will reach retirement age and I feel that Fate is once again drawing me there to grapple with the terrible problems. I had been expecting to live a quiet life of retirement but it seems I must actively continue working on the problems there. At least, that is how I am reconfirming my situation.

Currently I am teaching at Kitasato University in Tokyo, where I serve as the Dean of the School of Medicine. My specialties include therapeutic radiology and radiodiagnostics, and for a long time I have also researched environmental radiology. As you know, Aomori Prefecture is the site of a nuclear fuel reprocessing plant. Construction of the plant began soon after I started working at Kitasato University and I began to measure environmental background radiation even before it became operational. Ever since, I have continued taking these environmental measurements. Recently, I was told that my work is not an academic subject and is of no value to the world. And while I would prefer that such work never need become useful I am now having to push myself to face this (radioactive contamination) problem in the closing years of my life.

Now, I would like to introduce today's lecturers. Our first speaker will be Mr. Jun Kawamata a veterinarian who works at the Chiba Small Animal Clinic in Fukushima City. In addition to being active in numerous other roles, he is currently serving as Chairman of the Fukushima Veterinary Medical Association's Great East Japan Earthquake Disaster Animal Rescue Task Force, so he is deeply engaged in dealing with this problem. I believe he will be talking to us from that perspective.

Our second speaker will be Mr. Toshihiro Sato, Head of the Medical Care Division in the Production Department of Fukushima Prefecture Dairy Farming Association. A graduate of Azabu University, he has worked as a

veterinarian at the Association for 23 years. For the first ten years his medical practice work centered on dairy cattle, and since 1999 he has been involved in making rounds and instructing farming families while working at the Association's Headquarters. Since the issue of handling animals affected by he earthquake disaster not only encompasses relationships between people and animals but also touches on a variety of problems such as food problems, etc., I expect Mr. Sato will also be talking about those topics.

This is a photograph of some newspapers. I took it in a newsagents inside the evacuation zone when I had permission to enter. I noticed how these undelivered newspapers were all piled up and took some photos of them. This is a newspaper dated March 12th, the day after the earthquake. There had been the tsunami, of course. These photos show the situation inside the evacuation zone. Even large boats were swept inland by the tsunami and in many places they had not yet been removed. The photo at the bottom shows that the tsunami had passed through the building interior.

This is the interior of a building close to the station. I took a shot of the inside from the outside through the glass. I think the room had remained in the same disordered state since the people who lived here evacuated on the day after the earthquake.

Since the damage caused by the tsunami was on such a large scale, we tend to forget about the earthquake itself. But as this photo shows, there were lots of old buildings that suffered either partial (first floor) collapses or total (first and second floor) collapses.

This is a newspaper dated March 13th. On the 12th, there had been the hydrogen explosion in Fukushima. If this had not occurred, the situation would have been different. I forget which is the No.1 reactor, but the reactors here are lined up in order from No.1 to No.4. It seems that the chemical environment inside the reactor buildings made it easy to produce hydrogen and that this resulted in the explosion. First there was an explosion at the No.1 reactor, on March 12th, and then the same thing happened on the 14th at the No.3 reactor. The other reactors seem to have suffered meltdowns, with their fuel rods melting and radioactive materials being released into the peripheral environment.

This is a photograph of people measuring radioactivity. The Geiger counter shows quite a high reading of 300 microsieverts per hour. I don't think anybody is living around here but if somebody did stay here for a year, I calculate they would receive about 26 sieverts of radiation. So you can see that this is a place where people would risk a lot of radiation exposure. Actually, later on we found many places with higher radiation exposure levels than this. Particularly around the reactor buildings, there were places where the radiation levels were pretty high. I imagine cleaning up that mess must be very hard work.

Often we measure the concentration of radioactive substances with an instrument called a survey meter, but when we want to measure a sample precisely, we use a germanium semiconductor detector. Each type of radioactive nuclide produces its own characteristic type of gamma ray emission with a specific energy level. We can use this to simultaneously measure radiation both quantitatively and qualitatively. These are the figures we measured on April 10th. At that time point, the amount of radioactive contamination adhering to the grass and trees was greater than the amount in the soil. This is a line-up of spectra from grass, soil and milk samples, which were measured at the same time. I was asked to measure milk, pasture grass and fodder for cattle by residents of Date City, and we performed these measurements on April 10th. These spectra are from the samples we collected there. Radioactivity was not detected in the drinking water or milk.

Among the soil and pasture grass samples, the grass samples yielded higher radioactivity levels than the soil. The grass subsequently died and fell flat. However, when the new grass for the next year came up, the situation reversed and the soil now has higher levels of radioactivity. Once radioactive particles get into the soil they remain in place and will hardly wash away at all. Then eventually farm animals browse on the

contaminated pasture, and the radioactivity moves up the food chain, eventually reaching people.

I wrote that animals are always victims in these situations and this photograph of a dead animal sadly illustrates the point. Cats will enter the area so we then come to a situation in which wild animals and feral dogs have eaten the flesh of dead cattle and pigs.

There is a video of some ostriches and watching it saddens me but I'll just show a bit of it to you. Normally, this is a peaceful landscape with only the sound of birdsong. So the ostriches must be puzzled by the situation. I think they creatures were captured after the video was taken.

Some house pets were evacuated together with their owners or keepers, but a lot of people had their hands totally full with evacuating themselves and had to leave their animals behind. Those that were released were able to forage and many did survive, but others were left tied up and died of starvation or thirst. I'm sure the owners expected to be able to come back soon but were unable to. Many surviving animals still remain inside the evacuation zone.

I took this information partially from the Ministry of the Environment's website. The contents show the activities we carried out on May 11th. According to this, the animal rescue activities started soon after the earthquake struck, but it proved very difficult to capture the animals. Mr. Kawamata will be talking about this later on.

As of April 1st, we posted this statement on the Japan Veterinary Medical Association's website. Dr. Masahiro Natsuhori of the Japan Animal Referral Medical Center and I were also involved in its formulation, so I have some responsibility there too. Around March 15th, we started to talk about what to do. We had to decide an animal decontamination standard but at the time there was no such standard, not even for people. However, the National Institute of Radiological Sciences came to announce some decontamination guidelines which we decided to follow for companion animal decontamination also. From my previous experience with radiation therapy I felt that, essentially, there is little difference between people and dogs or cats when it comes to the effects of radioactivity. So we posted this on the Japan Veterinary Medical Association's website. Basically, it states in a nuanced way that we should treat companion animals in the same way as people. Because it was a tentative statement, although it instructs vets to use a survey meter, it doesn't specify which type of survey meter should be used, or under what conditions it should be used. It just explains how to wash the entire surface of an animal's body, etc. At that time, we were considering only body surface contamination. Even for people, we had little recognition about radioactive particles entering the body and internal exposure. I will talk more about this point later.

Regarding farm animals used for food, on May 12th, Prime Minister Naoto Kan, as the Head of the Nuclear Emergency Response Headquarters, ordered Fukushima Prefecture to euthanize all living farm animals inside the evacuation zone after obtaining the agreement of the animals' respective owners.

The main targets for this order were dairy cows, beef cattle and pigs. Abandoned chickens had already died of starvation or thirst. And yesterday, I heard from Keiko Yamazaki of the Companion Animal Study Group "Go" that all the animals kept in schools in the evacuation zone were dead. Sadly, many animals left behind in the zone died totally neglected.

However, not all of the farm animals could be euthanized and the problem of escaped farm animals including cows, remains. These animals are gradually turning feral such that the usual human control methods are ineffective and the animals are now becoming dangerous. Another problem is that unneutered male calves have now grown into bulls and begun to impregnate cows. A lot of of new calves have been born and the animals have now formed into herds. The bulls' horns have grown larger for protecting their herds and some of them are dangerous to approach. Now, compared to escaped dairy cows, escaped beef

cattle are now more numerous. Mr. Sato will be talking about beef cattle later on.

This shows the situation faced by some pigs. The pig pens were locked and all the pigs left inside died and their decomposing bodies congealed into a sticky mess. However, many were also released or escaped from farms and subsequently became feral, forming themselves into groups. I don't know whether the animals in this photo escaped or were released. There is a little piglet here, although it is difficult to see. I tried to get close in order to take a better shot of it, but the mother moved in front to hide it. Next moment a boar also came out and threatened us so we quickly retreated. It seems these pigs had broken into a grain storage warehouse and had fed on the rice there. That's how they survived.

I have some photographs of horses that were caught up in the tsunami and died. As you can imagine, they are too miserable to show so I won't burden you with them today. However, many others did survive and were basically treated in the same way as companion animals. The injured ones would receive medical treatment and be taken out of the evacuation zone. But even after all that, there was still another problem. They had been grazing on grass within the evacuation zone and had ingested radioactive particles. Radioactive cesium was detected in their feces and urine. So when attempts were made to move them to other places, they were not accepted. The result is that they remain and their keepers have to ensure they do not eat the local grass. This is Minamisoma Baji-Koen Equestrian Park, and the horses here seem to be lacking energy too.

Finally, I'd like to talk about wild animals. When I was taking radiation measurements of wild animals in the early period after the earthquake (around April and May), the Fukushima Wildlife Rehabilitation Center sent us many different items which I measured. As we also had to measure body surface contamination of wild animals we collected road kill and checked the levels of cesium 143 and 137, finding similar levels of both nuclides present. Please note that, although the concentration of cesium in the muscle tissue of this raccoon dog was quite high, it was low in the case of other raccoon dogs. So I think these figures reflect the degree of contamination in the locations where the individual animals were living. The figures differ markedly from one individual animal to another. Please note that the figures here are presented using a modified scale that omits highly contaminated individuals like the raccoon dog I showed you just now. These figures show Japanese serows, badgers, martens, and masked palm civets. And this is a raccoon dog that had a low degree of contamination.

We discussed how much these animals reflect the contamination in the locations where they lived. But with the Japanese serows, because they range over a wide area, we felt that their readings do not necessarily reflect the contamination situation of a given location. What we focused on was the overall condition of the mountain areas. Contamination adheres firstly to the leaves and bark of trees, so forests tend to capture radioactive particles fairly easily. Once radioactivity adheres to organic materials it is not easily dislodged. These organic materials eventually fall to the ground and accumulate in the soil where they decay over time, eventually becoming covered by fresh material. But they are not very deeply buried so other plants growing in the soil easily absorb them. It is due to this circulation between plants and soil that radioactive contamination in mountain forests can continue for a very long time.

When rain falls, radioactive cesium does initially flow through the surface soil layers but after some time has passed the flow becomes less. For this reason it is said that, apart from the physical attenuation due to radioactive decay stemming from the half-life of radiocesium of about 30 years, the immobilization process will reduce the bioavailability of cesium after a year or two. I am not absolutely certain, but I suppose that about two-thirds of the Fukushima Prefecture area consists of mountain forests. Accordingly, a considerable part of the prefecture will be in a fairly contaminated situation. That radioactive materials have built up in the forests is quite well known, but detailed research has not yet been undertaken. That's the

current situation regarding the forest environment.

It is said that wild boar territories tend to be small. These animals live in a certain small area for a certain period. They do sometimes move to a new location but will return to their original area again. When feeding they dig down into the soil and eat the things they find. Checking their stomach contents tells us that they also eat leaf mold. So the readings we have obtained from wild boar correlate well with the level of radiation contamination in the locations in which they live.

This map shows the 20km and 30km zones surrounding the nuclear power plant as well as the area outside them. When nuisance animals in the Minamisoma, Soma and Nihonmatsu districts were exterminated we obtained samples of the local wildlife. This slide shows the contamination situation in these areas. We asked Fukushima Wildlife Rehabilitation Center to send us some samples, and we measured a variety of things including body surface contamination.

Air dose rates are measured at a height of 1m above the ground. We checked the relationship between air dose rates and degree of contamination in animal bodies found at specific locations. This shows how the level of radioactivity on the body surface overlaps with the concentration of radioactivity in the muscle tissue on which we later performed precision analysis. There seems to be an overall correlation, but some of the body surface measurements turned up negative figures. This means that it is problematic to evaluate contamination inside the body merely by measuring the body surface.

This slide shows the results of measuring gastrointestinal contents. As to whether ambient air dose rates and figures obtained from feces correlate or not, since what an animal eats is excreted as feces in a rather short time, one might assume that feces contamination levels would reflect air dose rates. But in fact we found no strong correlation. However, gastrointestinal and stomach contents consist of the food an animal has eaten quite recently, so we know that they must have quite a high correlation coefficient, although this matter has not yet been sufficiently discussed.

Now, let us consider radioactive contamination in muscle tissue. For the muscle as a whole, we obtain fine positional information using precise instrumentation and then we perform dose-rate conversion. The muscle results show us the air dose rate in the area where the animal lived. Accordingly, we know that we can grasp the contamination situation in the relatively small zone where, for example, an individual boar is caught by measuring the levels of radioactivity in the boar' s muscle and organ tissues. We are now applying for research funding so that this research can be carried out on a continuous basis. However, competition for funds is very intense because many researchers not previously been involved in radioactivity studies are now entering the field and taking advantage of the opportunity provided by the current nuclear situation.

We have obtained some data from the survey we began. For instance, it has been established that when livestock farmers provide contaminated livestock with clean feed, the previous contamination is excreted and the livestock have no subsequent problems. This is a study undertaken to see whether the data we gathered is of use in this context. This photograph was taken in the Kodaka district of Minamisoma, which is inside the evacuation zone. This is a farmhouse not currently occupied because the residents have been evacuated. Our plan was to house some contaminated cattle on this farm and provide them with clean feed. The situation was that dozens of cattle had been captured and were waiting to be euthanized. When we visited, we were told that the cattle would be euthanized over the course of several days beginning the next day. So we asked the handlers to let us use the cattle for our research instead which they agreed to. The cost of this research was covered by a budget for various research projects obtained by Dr. Yamane, President of the Japan Veterinary Medical Association. So we decided to begin this research with JVMA cooperation. And because this research has several data-gathering goals useful for livestock rearing, we are also joining with researchers from several universities.

At the end of October, the hygiene conditions at the farmhouse were poor, and people were only going there occasionally. The farmhouse owners who had originally lived there came to help only once every three days. We visited and worked there every few days but conditions can only be described as miserable. The cattle were sometimes eating PVC and their feces was just left to fester. Even when there was fresh feed it had just been rolled in and left on top of the feces, and the cattle were left to eat it with no control. Because the place was being managed in this haphazard way the cattle' s nutrition status was quite poor and we would not be able to use them for research in that state. Unless the hygiene in the keeping areas and the cattle's nutrition status could be improved, we would not be able to collect usable data. We would only be making the cattle suffer for the sake of research. So having been kept like this, after about six weeks, we began to supply them with clean food that was imported and measured and we optimized the nutritional balance by mixing American and Australian feed. We started our research while improving the cattle's nutrition in this way. A total of ten veterinarians were involved in the work. From around Christmas time we switched the cattle to ordinary feed and, one month after that, at the end of January, we performed autopsies on some of them and measured the extent of radioactive contamination.

Our results indicated that radioactive contamination attenuated faster than we had expected. Over several months it had attenuated at a faster rate than the radioactive half lives of the nuclides would lead one to expect. We have been continuing this research by dividing the cattle into four groups including one group to which we administer Prussian blue as a decontamination aid.

As for cesium, we had expected to find it distributed almost evenly throughout the body in the same way as potassium, but when we performed the actual measurements we found that radioactivity concentrations differ significantly between different muscles. We also found that the distribution results are reproducible and that there are no differences between individual animals. In addition, we found that certain organs take up not only cesium but also nuclides of other elements.

After studying everything in greater detail, we expect to be able to complete our data compilation and announce our results to the public in May. We will attempt to summarize the data so that it will be useful in regenerating the local livestock raising industry in the future.

That concludes my talk. Next I would like to call on Mr. Kawamata.