JAPAN's NUCLEAR ACCIDENT: ANIMAL RESPONSE

Lisa Murphy VMD, DABT
Kelley L. Evans, DVM

SAADRA/MSP Meeting
New Orleans, LA
May 2, 2013

Dr. Evans' DISCLAIMER

- **Ideas, attitudes, and opinions presented are my own and do not necessarily reflect the opinions of the Department of Defense**
- **Not about the Department of Defense's response**
- **Unclassified**
  - **Information not deemed Actionable Medical Information**
- **NOT 'an' or 'the' Expert**

THANK YOU

- **Dr. Heather Case – American Veterinary Medical Association**
- **Dick Green – formerly with International Fund for Animal Welfare (IFAW)**
- **Drs. Kelly Preston and Kuniaki Suzuki - USDA-APHIS, American Embassy, Japan**
- **Dr. Ian Robinson - IFAW**

AGENDA

- **What Happened on March 11, 2011?**
- **IFAW Needs Assessment**
- **IFAW Sponsored Summit**
- **Recommendations**
- **Post-Summit Status**
- **Conclusion**

WHAT HAPPENED MARCH 11th?

- **Earthquake: 2:46 PM (local)**
  - **8.9/9.0 magnitude**
  - **Largest earthquake in Japan's history**
  - **5th largest earthquake in world since 1900**
  - **230 miles (370 km) northeast of Tokyo**
- **Tsunami: by 3:46 PM (local)**
  - **30-33 foot (10 m) high wall of water**
  - **waves reached six miles (10 km) inland**
- **Fukushima Daiichi Nuclear Power Plant: 10:29 PM (local)**
  - **Cooling system reported not working**
  - **March 12th 2:06 AM radiation levels rise**

WHAT DOES THAT LOOK LIKE?

- **Japan earthquake tsunami footage**
  - **http://www.bbc.co.uk/news/world-asia-pacific-12725646**
  - **http://www.bbc.co.uk/news/world-asia-pacific-12709850**

IFAW: SENDING A TEAM

- **Immediate humanitarian needs met first**
- **Invitation from Fukushima Prefecture Dept of Environment**
- **Initial visit cancelled due to uncertainty about nuclear contamination and human resources concerns (insurance)**
- **IFAW assessment team finally arrived on March 25, 2011**
- **Two full weeks after the earthquake**

Photos: IFAW

IFAW JAPAN ASSESSMENT VIDEO

- http://www.youtube.com/watch?v=dumVPTqx_h8&feature=player_embedded

IFAW: NEEDS ASSESSMENT

- **Need to rescue/remove animals from within the restricted zone**
- **Need for co-located human and companion animal shelters**
- **Japan is a developed country and not short of either financial or human resources**
- **<u>Help was not requested</u>**

IDENTIFING SUITABLE SITES FOR ANIMALS AT SHELTERS

Photos: IFAW

BUT:

- **Lack of understanding of the effects of radiation on animals by both government and rescuers**
- **Obvious need for an agreed protocol/standard procedures, that all could abide by**
- **This would require expert input to establish best practice based on available knowledge**

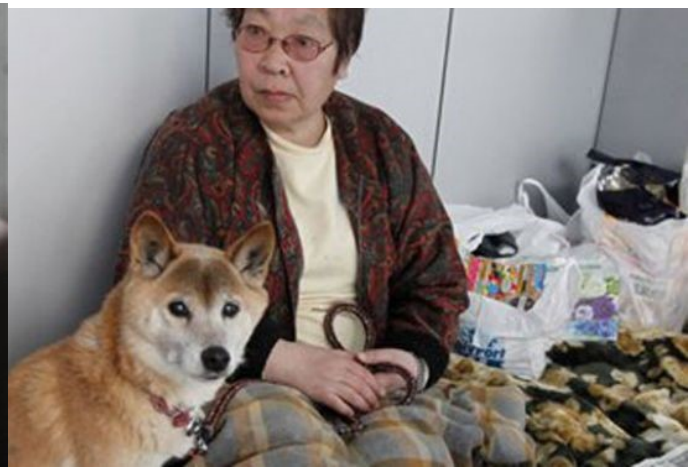
LACK OF FACILITIES FOR ANIMALS AT SHELTERS

Photo: IFAW

HUMAN-ANIMAL BOND IN JAPAN

- **"For Japanese Pet Owners, Home is Where Their Pets Are"**
  - **March 19, 2011**





All Photos-Source: AP

http://www.foxnews.com/world/2011/03/19/rescue-operations-japan-target-countrys-furry-friends/

HUMAN-ANIMAL BOND IN JAPAN

Koji Sasahara/AP Photo

JAPAN'S NUCLEAR POWER PLANTS

NUCLEAR POWER PLANTS & ANIMALS

- **Not a lot of information**
- **Chernobyl**
  - **Some areas normal**
  - **3 year study (2006-2008), 700 sites**
    - **Decreased insect, bird and other animal populations**
    - **Increase radiation -> decrease invertebrates**
    - **High level of mutations in many different species of plants, birds, and animals**

Source: University of South Carolina Chernobyl Research Initiative

IFAW SPONSORED MEETING

- **Goal: To develop procedures and protocols for the monitoring, evacuation, and treatment of animals contaminated by radiation**

- **Held May 2-3, 2011 at International House of Japan, Tokyo**

- **17 SMEs animal disaster response - search and rescue, decontamination, transportation, and sheltering and radiation/nuclear**

JAPANESE DELEGATES

- **Kazuyoshi Uemtasu, DVM, MS**
  - **Director of NRDD Asia and AAHO**
- **Masahiro Natsuhori, DVM, PhD**
  - **Director of JARMeC Hospital, Radiology**
- **Tokuma Yanai, DVM, PhD**
  - **Professor of Gifu University Pathology**
- **Katsuaki Sugiura, DVM, PhD**
  - **Professor of Tokyo University Research Center for Food Safety**
- **Toshio Mizoguchi, DVM, MS**
  - **Director of Fukushima Wildlife Rehabilitation Center**
- **Toshinori Sako, DVM, PhD**
  - **Professor of Nippon Veterinary and Life Science University**
- **Toshihito Noto**
  - **Government of Japan, Ministries of Agricultures, Forestry, and Fisheries (MAFF)**

US DELEGATES

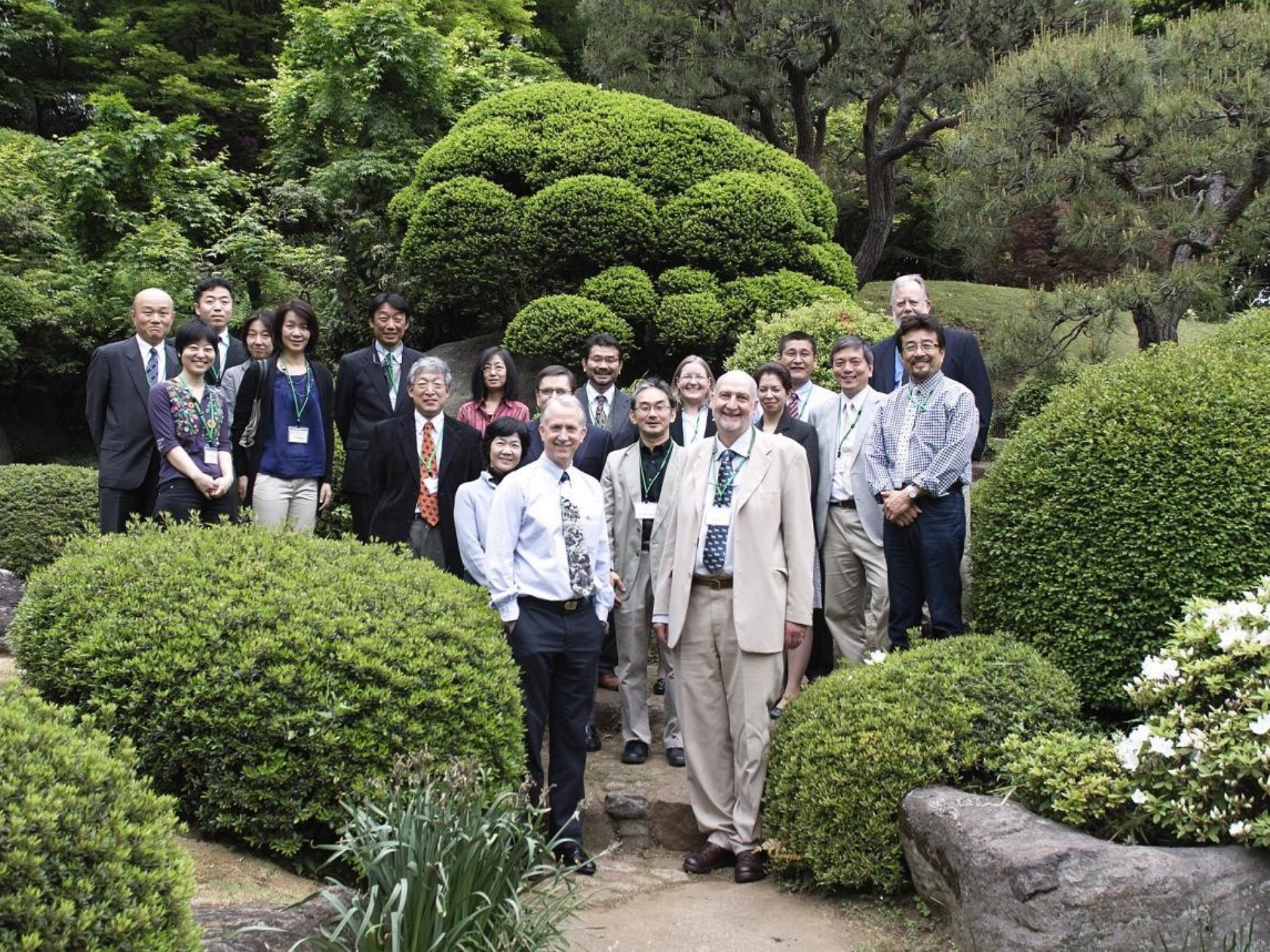
- **Dick Green, EdD**
  - **Emergency Relief Manager – Disasters, IFAW**
- **Ian Robinson, BVSc, FRCVS**
  - **Emergency Relief Program Director, IFAW**
- **Lisa Murphy, VMD, DABT**
  - **Assistant Professor Toxicology, University of Pennsylvania**
- **Kelley Evans, DVM**
  - **Major, U.S. Army Veterinary Corps Staff Officer**
- **Gordon Cleveland**
  - **Radiological Program Analyst, USDA-APHIS-VS NCAHEM**
- **Kelly Preston, DVM**
  - **USDA-APHIS, American Embassy, Japan**
- **Kuniaki Suzuki, PhD**
  - **USDA-APHIS, American Embassy, Japan**

JAPANESE OBSERVERS

- **Mai Yamamoto**
  - **Office of Wildlife Management of Ministry of Environment (MOE)**
- **Neagari Yasuko**
  - **Office of Wildlife Management, Nature Conservation Bureau, MOE**
- **Konishi Yutaka**
  - **Office of Animal Companionship, Nature Conservation Bureau, MOE**

GOVERNMENT of JAPAN (GOJ) ANIMAL REGULATION

- **Ministry of Agriculture, Forestry, and Fisheries (MAFF)**
  - **Livestock**
  - **Fish**
- **Ministry of Environment (MOE)**
  - **Wildlife**
  - **Companion Animals**
- **Act on Welfare and Management of Animals 1973**



MAJOR CHALLENGES/ISSUES NEEDING IMMEDIATE ATTENTION

- **Based on interviews with evacuated residents and video evidence, large numbers of livestock, horses, and companion animals were left behind**

- **Research in the United States shows that as many as 30% of evacuees will attempt to re-enter a disaster zone to rescue their pets**

MAJOR CHALLENGES/ISSUES NEEDING IMMEDIATE ATTENTION

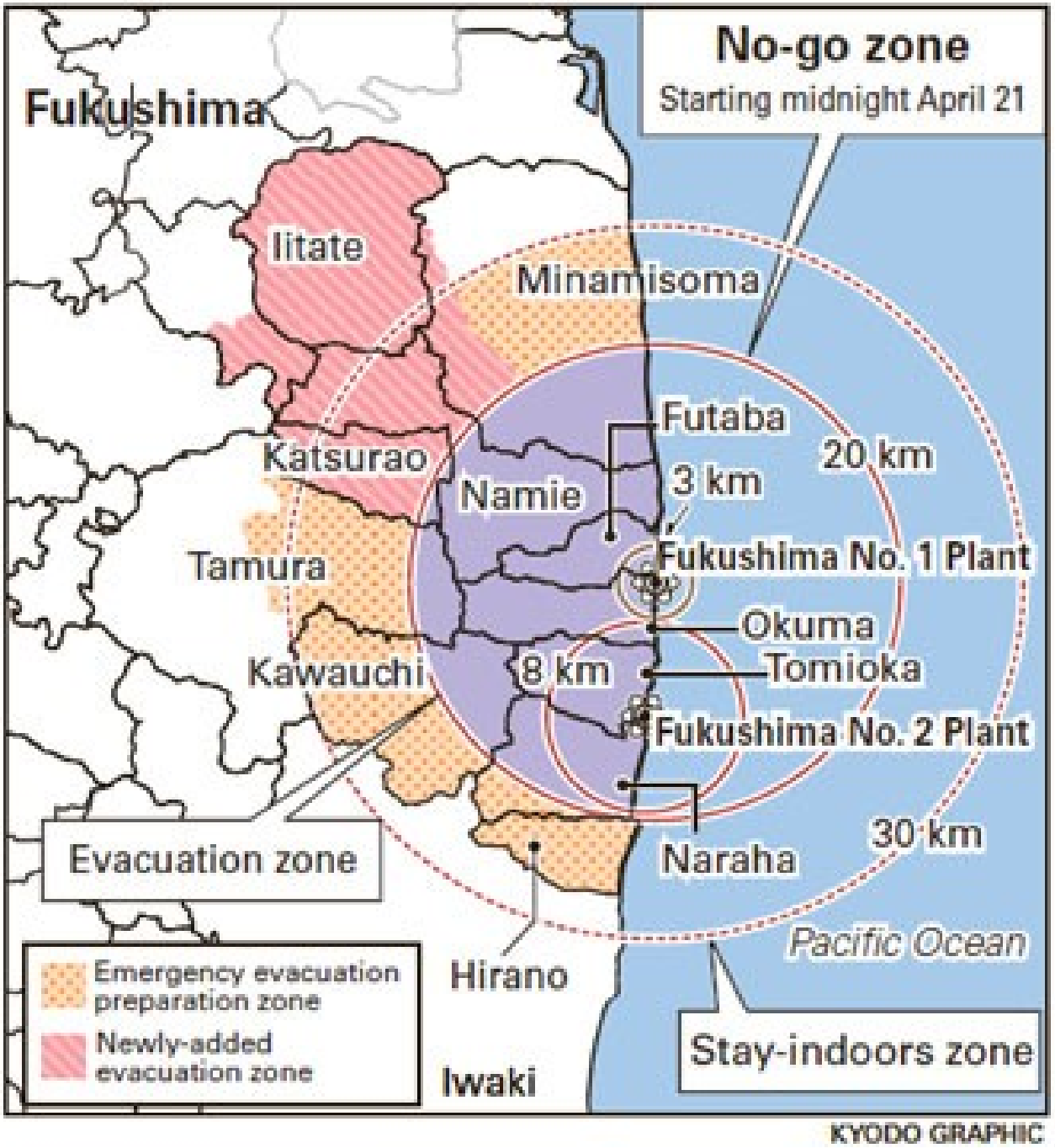
- **Reports of "rogue" rescue groups:**
  - **Entering restricted zones without PPE or radiation monitoring equipment**
  - **Removing companion animals and when able returning them to their owners housed in shelters or other temporary housing**
  - **Potentially exposing themselves and others to chemical, biological, and radioactive contaminants**

ANIMAL ESTIMATES: FUKUSHIMA PREFECTURE

- **Dairy Cattle -17,900**
- **Beef Cattle - 32,900**
- **Swine – 200,000+**
- **Dogs* – 5,800**
- **Chickens - ?**
- **Horses - ?**
- **Cats - ?**

25 April
GOJ Estimate Dead
- **Cattle – 3,000**
- **Swine – 130,000**
- **Chickens – 680,000**

***Pre-earthquake/tsunami estimates based on rabies licensure**



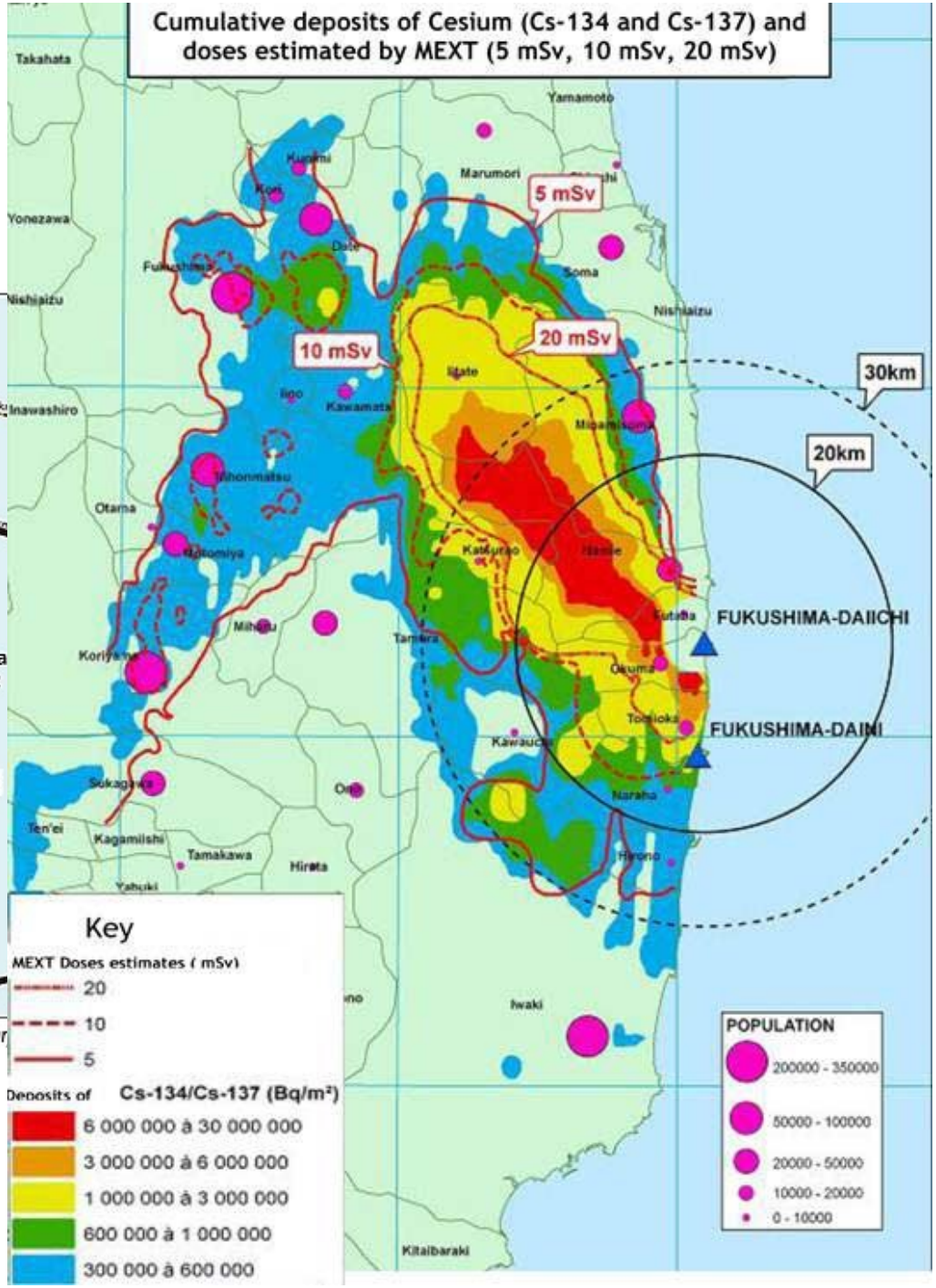
Radionuclides

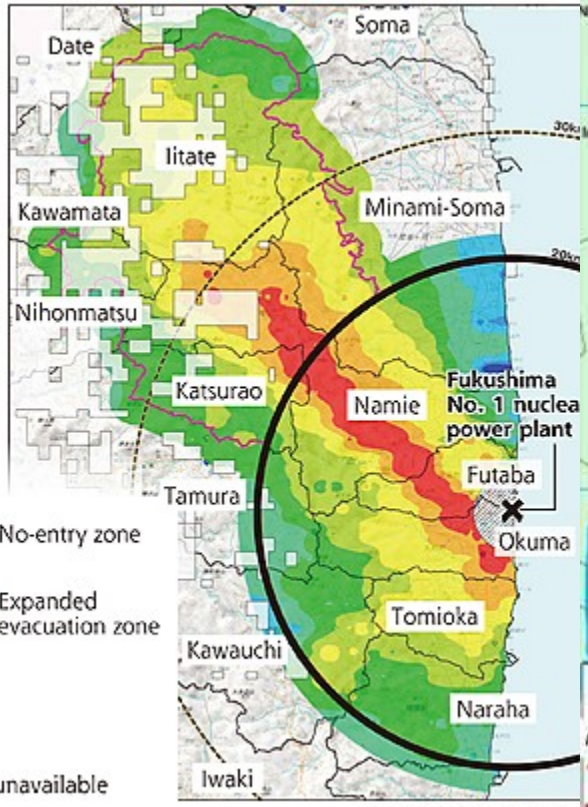
Iodine 131:
½ life 8 days

Cesium 137: ½ life 30 years

Strontium 90:
½ life 29 years

FUKUSHIMA PLUME





Radiation levels one meter above the ground in no-entry and expanded evacuation zone as of Feb. 10

19.0 <
9.5~19.0
3.8~9.5
1.9~3.8
1.0~1.9
0.5~1.0
0.2~0.5
0.1~0.2
≦ 0.1
Areas where data unavailable

No-entry zone
Expanded evacuation zone

(microsieverts per hour)

Source: http://www.simplyinfo.org/?p=5194

Source: http://www.deliberation.info/truth-fukushima-isis-report/

COMPANION ANIMALS

- **Identified and formulated recommendations for the rescue, decontamination, transport, and sheltering of cats and dogs with the ultimate goal of keeping people and their animals together**
- **Discouraged the exportation of pets out of Japan under any circumstances**
- **Made recommendations for the appropriate use of humane euthanasia**

Photos: Dr. Lisa Murphy

COMPANION ANIMALS- DECONTAMINATION

- **Initial evaluation and decontamination process should be conducted in the warm zone by teams equipped with the proper personal protective equipment (PPE)**

- **Suggested that every animal brought to the staging area be surveyed, washed, and re-surveyed with an accompanying flowchart outlining the decontamination process**

- **The staging area will also serve as a temporary sheltering location**

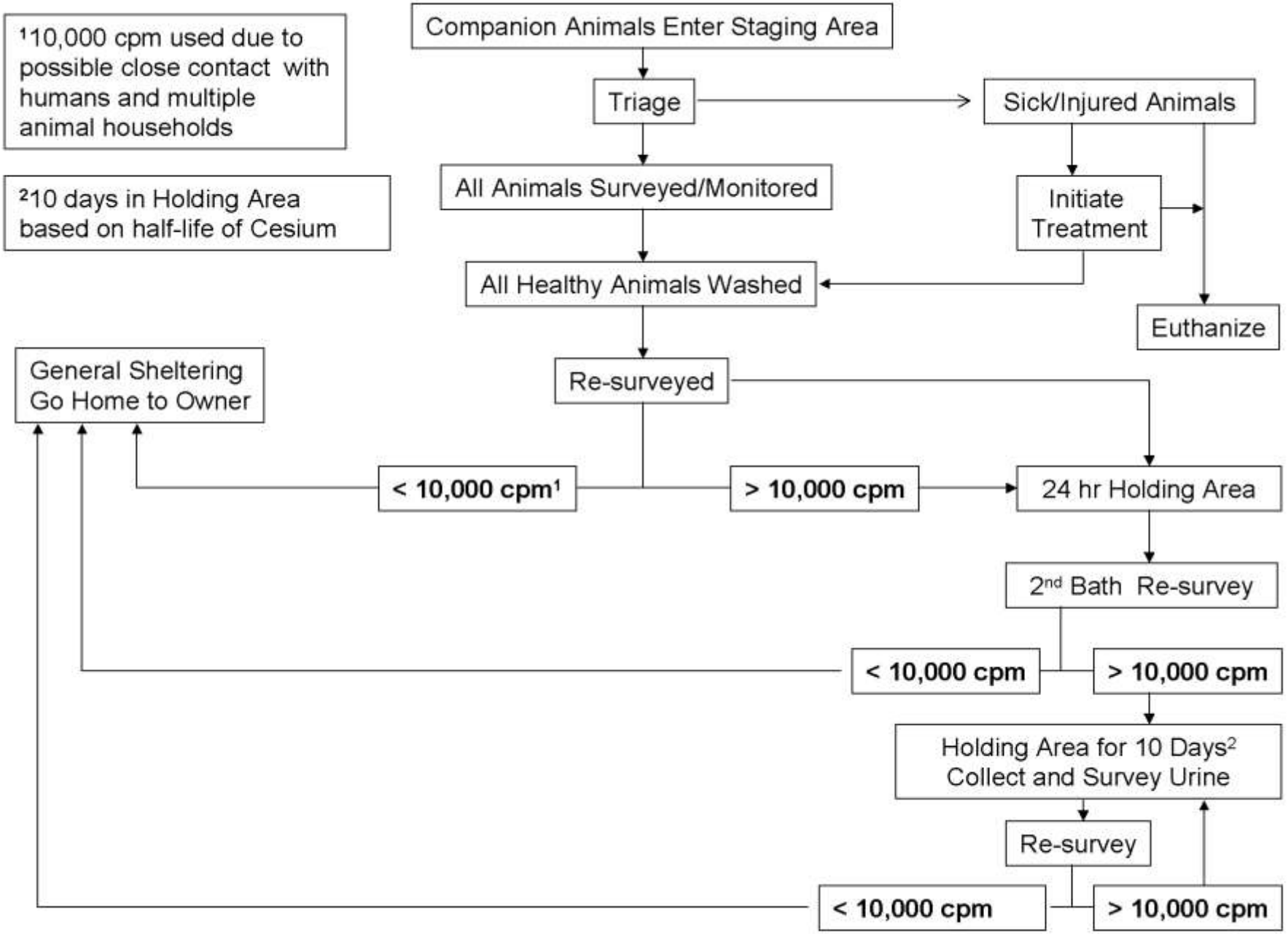

[1]10,000 cpm used due to possible close contact with humans and multiple animal households
[2]10 days in Holding Area based on half-life of Cesium
Companion Animals Enter Staging Area
Triage
Sick/Injured Animals
All Animals Surveyed/Monitored
Initiate Treatment
All Healthy Animals Washed
Euthanize
General Sheltering
Go Home to Owner
Re-surveyed
< 10,000 cpm[1]
> 10,000 cpm
24 hr Holding Area
2nd Bath Re-survey
< 10,000 cpm
> 10,000 cpm
Holding Area for 10 Days[2]
Collect and Survey Urine
Re-survey
< 10,000 cpm
> 10,000 cpm

Photo: IFAW

LIVESTOCK

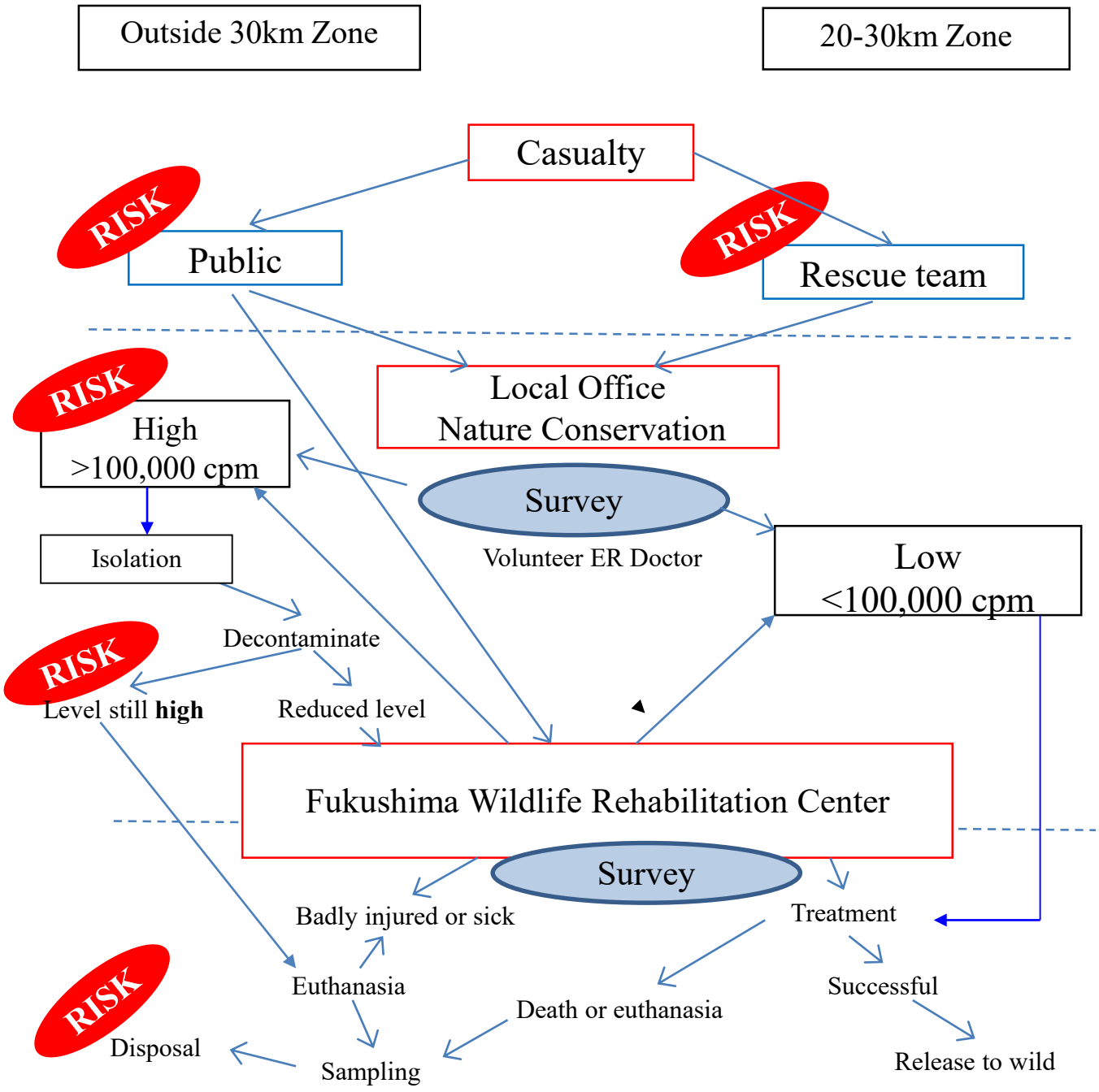
- **Reviewed existing protocols from MAFF**
- **Supported ongoing surveying of animals within the restricted zones in order to ensure rapid movement of viable animals out of the affected areas**
- **Recommended rescue, movement, or humane euthanasia following OIE euthanasia guidelines**

WILDLIFE

- **Recognition of wildlife as important under the 'one world, one health' concept**
- **Both resident and migratory species involved**
- **Difficult to monitor – methodology presently not fully determined**
- **Monitoring needs to be both short and long term**

SHORT TERM RECOMMENDATIONS

- **Start both rescue and monitoring procedures immediately**
- **Utilize and reinforce the capacity of the Fukushima Wildlife Rehabilitation Center (FWRC)**
- **Wildlife can move over large areas and therefore monitoring beyond the presently recognized zones is necessary**
- **Ensure that recommendations for livestock and companion animals do not have a negative impact on wildlife (eg methods of carcass disposal; feeding animals in situ etc)**


Outside 30km Zone
20-30km Zone
Casualty
RISK
Public
RISK
Rescue team
Local Office
Nature Conservation
RISK
High
>100,000 cpm
Survey
Volunteer ER Doctor
Isolation
Low
<100,000 cpm
Decontaminate
RISK
Level still high
Reduced level
Fukushima Wildlife Rehabilitation Center
Survey
Badly injured or sick
Treatment
RISK
Euthanasia
Death or euthanasia
Successful
Disposal
Sampling
Release to wild

LONG TERM RECOMMENDATIONS

- **This is not just a problem locally, nor just for Japan – but a worldwide problem and needs an international multidisciplinary approach**
- **Both terrestrial and marine habitats are affected**
- **Use study models based on past experience eg Chernobyl**

POST-SUMMIT STATUS

- **Based on the information provided to the committee and subsequent summit discussions, it was strongly recommended that animal rescue work should be immediately permitted within the 20 and 30-kilometer zones**

- **Protocols were provided to ensure both human and animal safety while addressing different risks to companion animals, livestock, and wildlife**

- **Detailed report was officially submitted to the Government of Japan (GOJ) on May 10, 2011**
  - **http://www.ifaw.org/africa/resource-centre/nuclear-accidents-and-impact-animals**

POST- SUMMIT STATUS

- **GOJ quick to accept the findings of the workshop**
- **But on the ground, it requires cooperation between the Federal, Prefecture and Town administrations – this was slow to happen**
- **Also the Animal Disaster Response Team (coalition of Japanese NGOs) were slow to mobilize rescue teams**
- **Local shelters did stop euthanasia of unclaimed pets**

POST-SUMMIT STATUS

- **On May 11, 2011 the GOJ launched an operation to remove abandoned animals from inside the 20 kilometer evacuation zone in Fukushima Prefecture**
- **"Temporary Coming Home Project" allows residents back into the evacuation zone to locate and secure their pets for subsequent removal by authorized personnel**
- **Cooperative effort between the Ministry of Environment (MOE) and Fukushima Prefecture authorities**

POST-SUMMIT STATUS

- **Initial MOE reports indicate that no companion animals screened so far have needed decontamination**
- **Officials have also reportedly allowed evacuees to bring pets out of the danger zone and live with them in temporary housing**
- **Rescue teams were expected to evacuate 100-200 companion animals in the first week**

POST-SUMMIT STATUS

- **Evacuation within 20 kilometers of the Fukushima Daiichi Nuclear Power Plant became mandatory April 22, 2011 with plans to then further evacuate out to 30 kilometers by May 22, 2011**

- **Livestock activities being conducted by the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF)**

Photos: Dr. Lisa Murphy

POST-SUMMIT STATUS

- **May 9th 9300 Cattle within 20-30 km zone**
  - **As of June 1, approximately 4400 cattle moved**
    - **Dairy cattle - 560**
    - **Beef cattle – 3820**
- **Cattle prioritized over swine and chickens for removal**
- **May 13th Mercy Killing of Livestock ordered by Prime Minister within 20 km zone**
  - **Found 1300 cattle and 200 pigs still alive**
  - **May 27th had difficulty catching animals and personnel for mission**

2011 STATUS

- **June 6th**
  - **Amount of radiation is twice what was originally reported**
    - **770,000 instead of 370,000 terabecquerels on April 12th**
  - **The official Soviet estimate for Chernobyl - 5.2 million terabecquerels**

2011 STATUS
RESCUED COMPANION ANIMALS

- **As of June 15, 2011**
  - **Sheltered – 157 dogs**
    67 cats
  - **Confined – 26 dogs**
    66 cats
  - **Seen – 87 dogs**
    8 cats
  - **Dead – 1 dog**
    0 cats

Photo: IFAW

2011 STATUS CATTLE

- **"Ranch of Hope" June 10, 2011**
  - **Has been an appeal to send cattle to from affected area this ranch to live out their days**
  - **300 cattle already kept at the Ranch of Hope**

2011 STATUS CONTAMINATED BEEF

- **July 8 and 9, 2011 reports from Japanese government**
  - **At processing, radioactive cesium detected in beef from 11 cows shipped to Tokyo on July 7th from Minamisoma, Fukushima**
  - **Farm lies within the Emergency Evacuation Preparation Zone**
  - **However all cows reportedly passed body surface screening on June 26, 2011 before shipment**

- **July 10, 2011 newspaper report**
  - **6 other cows from the same farm had already been processed in meat packing factories in Tokyo and Tochigi and apparently marketed in May and June**

2011 REPORTS CONTAMINATED BEEF

- **July 15, 2011 newspaper reports**
  - **Excessive levels of cesium (almost 73 times the permissible limit) detected in rice straw at a farm located 60 kilometers from the power plant**
  - **Same farmer had recently shipped 42 animals**
    - **Asakawa, Fukushima is outside the area that had been requiring body surface screening prior to shipping**
    - **Meat marketed in the Kanto region, including Tokyo and Kanagawa**
  - **MAFF has decided to conduct an emergency check of animal husbandry practices including storage of feed in 7 other prefectures**
    - **Approximately 27,000 beef and dairy cattle in these areas**

2012 STATUS

- **Fukushima Prefecture Farm Animals***

	February 1, 2011	February 1, 2012
Dairy Cattle	17,100	14,800
Beef Cattle	74, 200	58,100
Pigs	184, 200	130,700
Layers (poultry)	5,807,000	3,636,000

***statistics from Japan MAFF website**

2012 STATUS

- **The National Diet of Japan's *The Fukushima Nuclear Accident Independent Investigation Commission's Report***
  - **July 2012**
  - **19 Commission meetings between December 19, 2011 and June 9, 2012**
  - **Conclusion – A "manmade" disaster**
  - **www.nirs.org/fukushima/naiic_report.pdf**

2012 STATUS

- ***Pets left in no-entry zone at the mercy of do-gooders***
  - **December 06, 2012**
  - **"The Environment Ministry and the Fukushima prefectural government are tasked with caring for the animals in the no-entry zone. They say they cared for 895 dogs and cats between April 2011 and October 2 this year (2012).**
  - **"Last December (2011), the ministry allowed 16 animal welfare organizations to spend a month in the no-entry zone to carry out their activities."**
  - **"Some evacuated residents also show concern over stray dogs and cats getting into their homes for pet food activists delivered and causing havoc."**
  - **"The [animal welfare] group reckons it is caring for 200 or so cats and dogs…delivers 700 kilograms of pet food each week…"**

http://ajw.asahi.com/article/0311disaster/life_and_death/AJ201212060006

2013 STATUS

- ***Why Japan's 'Fukushima 50' remain unknown***
  - **January 3, 2013**
  - **“I will never be able to grow rice again on this land," he [58-year-old Masami Yoshizawa] "No vegetables, no fruit. We can't even eat the mushrooms that grow in the woods; they are too contaminated. But I will not kill my cows. They are a symbol of the nuclear disaster that happened here.”**
  - **‘In the immediate aftermath of the disaster, the foreign media, including the BBC, hailed the men as the "Fukushima 50“… And yet almost nothing has been heard from them. No awards, no newspaper articles or TV interviews. We don't even know their names.’**

http://www.bbc.co.uk/news/world-asia-20707753

Photos: IFAW

UNANSWERED QUESTIONS UNSOLVED ISSUES

- **What effects that this nuclear reactor accident will have on animals and agriculture?**
  - **different than Chernobyl**
- **Why the Government of Japan (GOJ) did not have a plan to handle animals issues in disasters?**
  - **not learned from US and hurricanes**
- **What was/is the true contamination levels and isotopes in soil, water, plants, animals?**

LEARNING POINTS

- **Have a plan different levels of government**
  - **Needs to address livestock, companion animals, wildlife, zoos, research facilities**
  - **Need to have procedures with proper training, PPE, and equipment to respond**
- **Ask for help early/reach out**
- **Control access to area**
- **Be honest with public**

CONCLUSION

- **Rare for 3 catastrophic disasters happen within hours of each other**
- **The GOJ's delay in addressing animal issues led to animal suffering and death**
- **Still many unanswered questions about how radiation will affect the animals and agriculture**

AGROSECURITY

SAADRA/MSP Meeting 2013

United States Department of Agriculture:
Roles and Capabilities in Radiological Emergencies

Contrasted with Events Following
the Fukushima Dai-ichi Radiation Release

Gordon Cleveland
United States Department of Agriculture
National Center for Animal Health Emergency Management
Advisory team for Environment, Food, and Health

USDA

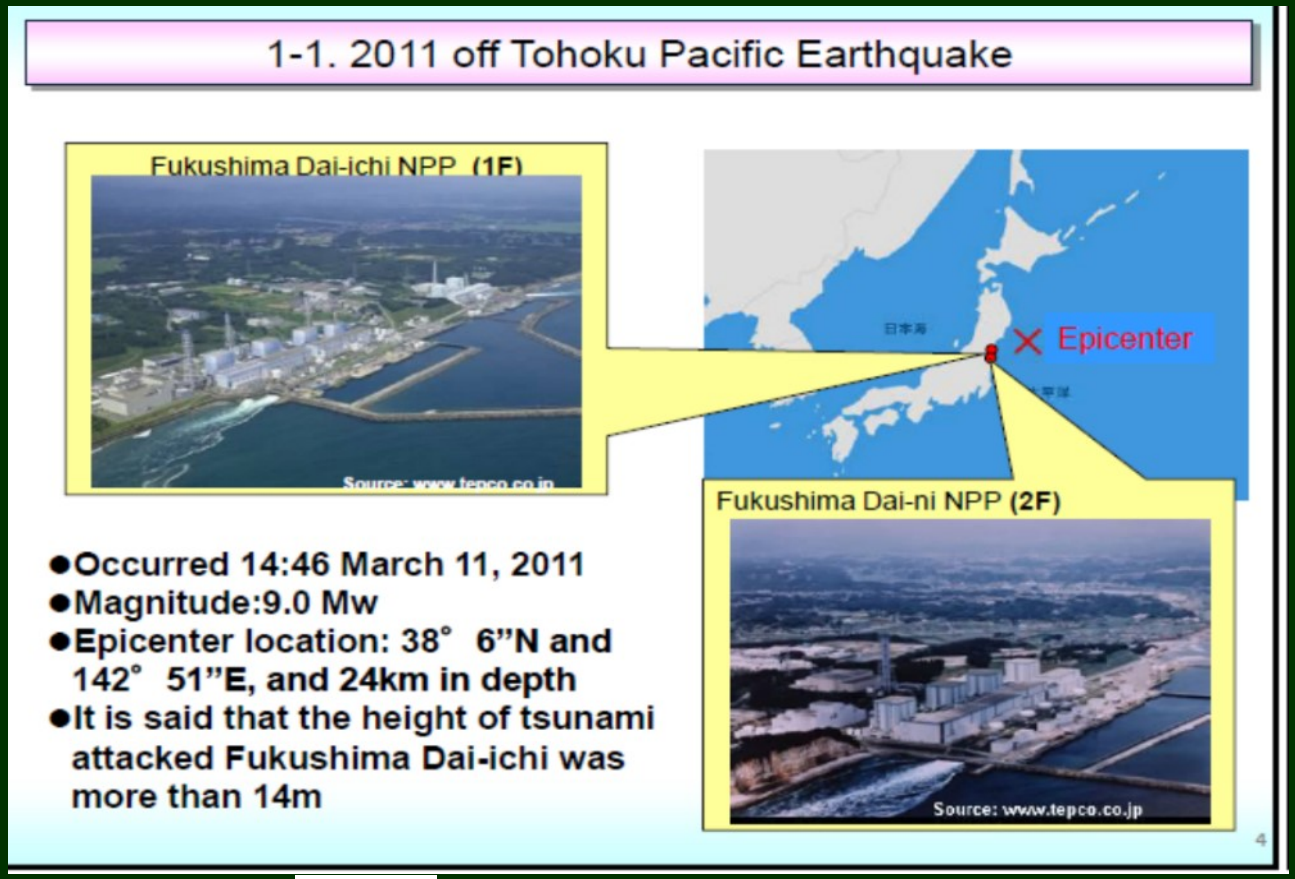
Advisory Team on Environment, Food, and Health





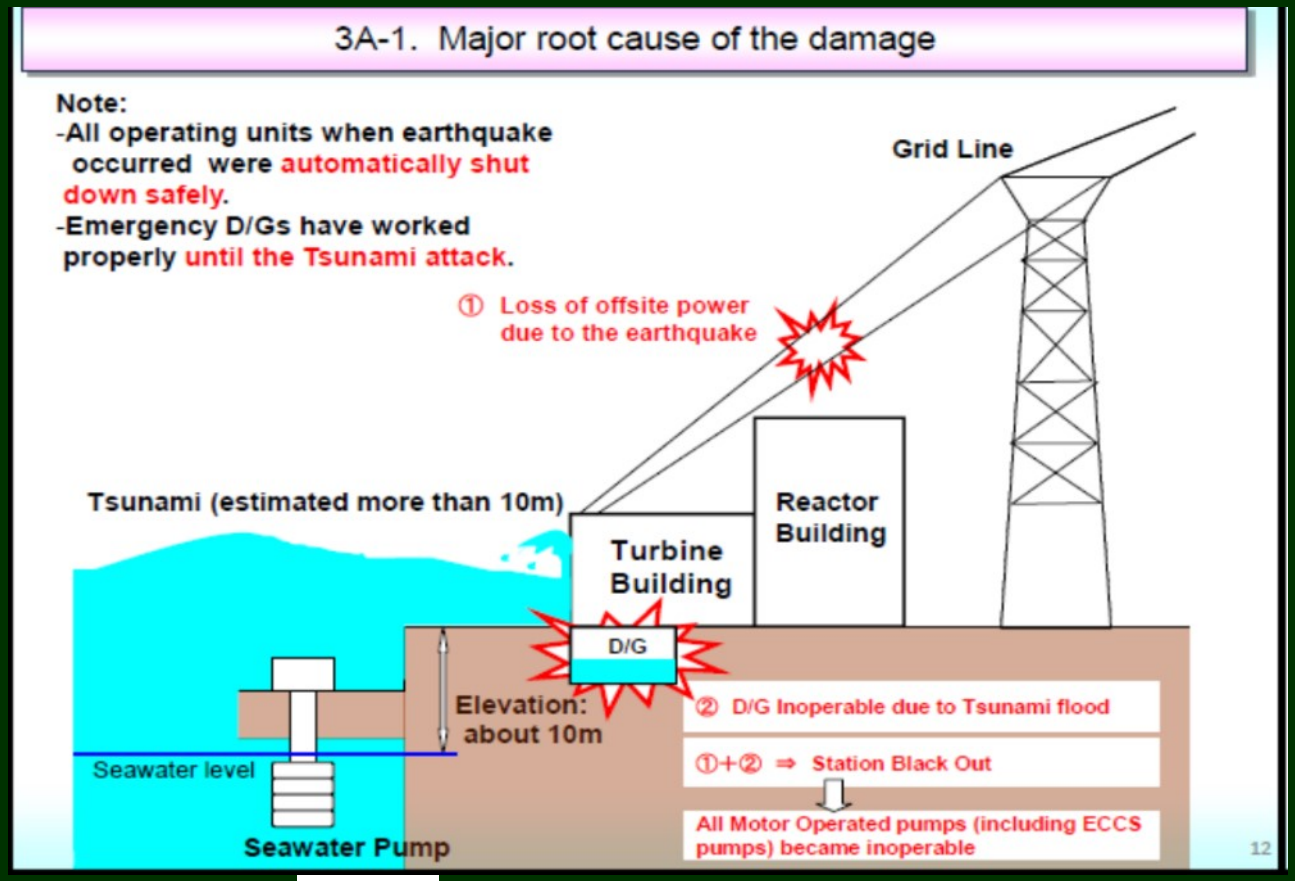
The Great Tohoku Earthquake and Fukushima Dai-ichi Nuclear Power Plant Disaster

Fukushima Dai-ichi Nuclear Power Plant Disaster




MIYAKO

Fukushima Dai-ichi Nuclear Power Plant Disaster



Fukushima Dai-ichi Nuclear Power Plant Disaster

- 47 foot tsunami overwhelms the protective barrier
- Emergency Diesel Generators flooded
- Reactors and spent fuel pools now have inadequate coolant (water supply)
- Cores begin to heat.
- Zirconium fuel cladding overheats giving off hydrogen

$$Zr + 2\ H_2O + 1700\ F \rightarrow ZrO_2 + 2\ H_2$$

International Fund for Animal Welfare Mission

Fukushima Dai-ichi Nuclear Power Plant Disaster

National Diet of Japan, Report of the Fukushima Nuclear Accident Independent Investigation Commission (NAIIC) 7/5/2012:

- Government had no response measures for a severe accident in place
- Power company did not have emergency response plan and had no manual or training regimens

In Contrast: USA

Robust Radiological Emergency Response Preparedness

National Response Framework

- Establishes a comprehensive, national, all-hazards approach to domestic incident response

National Incident Management System

- A national approach to incident management at all jurisdictional levels across all functional disciplines.

Incident Command System

- Single standardized emergency management system used by all emergency response disciplines
- Disaster response Command and Management
- Provides accurate information, strict accountability, planning, cost effective operations, and logistical support for any incident

In Contrast: USA

Robust Radiological Emergency Response Preparedness

- **NRC/FEMA:** Provides strict training regimen for plants and local and state responders.
  - RAD exercises yearly
- **Department of Energy:** Regional Radiological Assistance Program teams.
- **Department of Energy:** Center for Radiological/Nuclear Training provides technical and operational training for state regional, and local responders.

In Contrast: USA

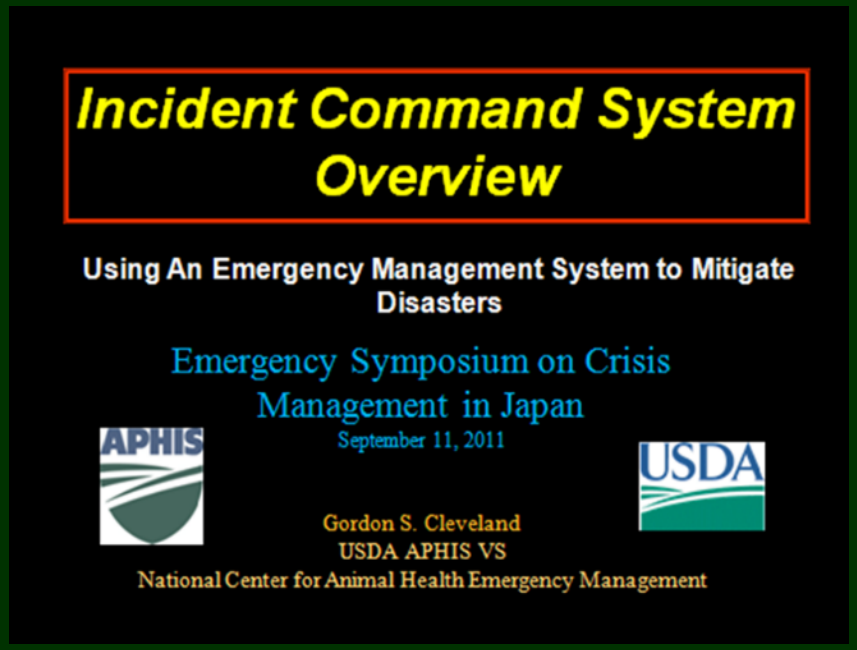
Robust Radiological Emergency Response Preparedness

- All states have **Radiological Response Plans**
- All states have **Radiological Emergency Preparedness teams**
  - Conference of Radiation Control Program Directors
- States provide Nuclear Regulatory Commission informed brochures to the community within the 50 mile EPZ
- **National Alliance for Radiation Readiness**
- **Advisory Team for Environment, Food, and Health**
  - Provides Protective action Recommendations based on scientifically validated information and best practices

Japan Moves Forward

Emergency Symposium on Crisis Management in Japan: Adopting Incident Command System

- Panel of ICS advocates and experts organized by Rhisso University in cooperation with members of the Government of Japan, House of Representatives



Japan Moves Forward

The International Science Symposium on Combating Radionuclide Contamination in Agro-soil Environment:

- Post-Chernobyl radioecology researchers from Ukraine, Belarus, Russia, Kazakhstan and Germany

And

- Japanese researchers and technologists developing procedures for decontaminating soils and agricultural products

USDA Responsibilities: Nuke-RAD Incident Annex to the NRF:

- **Assists** in the planning and collection of agricultural samples
- **Assesses** damage to crops, soil, livestock, poultry, and processing facilities
- Inspects and **assists** in the disposition of agricultural animals and monitors the production, processing and storage of their products
- Provides **support** and **advice** on screening and decontamination of contaminated animals

USDA's Preparedness Challenges

- **Radiological surveillance** for contaminated or irradiated animals/crops/feeds
- **Radiological decontamination** for livestock/poultry/pets/zoo animals/wildlife
- **Therapeutic countermeasures** to mitigate the effects of radionuclide contaminants ingested by animals/Euthanasia strategies if necessitated
- **Remediation strategies** for soils and crops contaminated by radionuclides

USDA APHIS NCAHEM Radiological Program Analyst: Role

- Develop robust and practicable strategies for maintaining agricultural production and a safe food supply following a nuclear or radiological release
  - **Surveillance strategies** to identify contaminated or irradiated pets, service animals, livestock and wildlife
  - **Decontamination strategies** for livestock, poultry, pets and service animals, zoo animals

USDA APHIS NCAHEM Radiological Program Analyst: Role

- Develop robust and practicable strategies, Cont'd
  - **Remediation strategies** for soils and crops
  - **Therapeutic strategies** for the development and use of radiation prophylaxes and therapies for animals
  - **Euthanasia** and **carcass disposal strategies** for contaminated livestock, poultry, pets and service animals, zoo animals and wildlife and their contaminated effluent.

USDA APHIS NCAHEM Radiological Program Analyst: Role

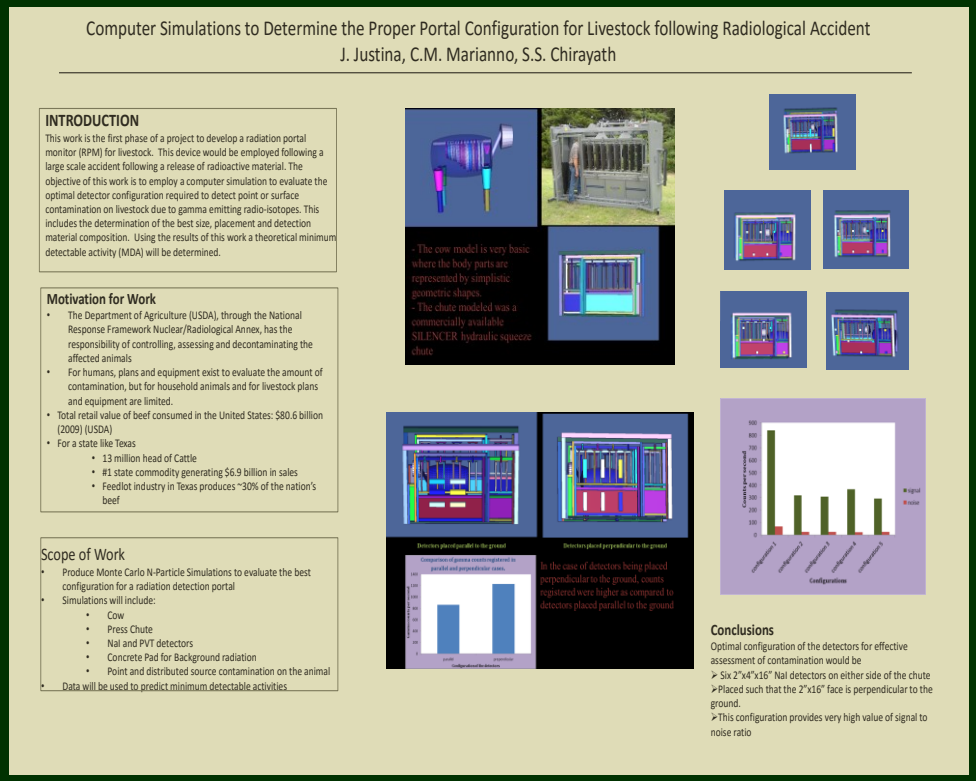
- Maintain membership in the **Radiological Advisory Team for Environment, Food, and Health**
  - Provide agricultural subject matter expertise, support, and **Protective Action Recommendations** to federal, state, local, and tribal radiological emergency responders
  - Participate in, and provide guidance for development of, **RAD emergency exercises**

Advisory Team Duties Overview

The Advisory Team works with the Department of Energy Federal Radiological Monitoring and Assessment Center to provide scientifically validated ***recommendations*** concerning:

- Minimizing radiation exposure from deposition and through the ingestion pathway
- Regarding the disposition of contaminated livestock, **pets**, poultry, and foods
- Dose assessments, evacuation, reentry, relocation

Radiological Program Analyst



Computer Simulations to Determine the Proper Portal Configuration for Livestock following Radiological Accident

J. Justina, C.M. Marianno, S.S. Chirayath

INTRODUCTION

This work is the first phase of a project to develop a radiation portal monitor (RPM) for livestock. This device would be employed following a large scale accident following a release of radioactive material. The objective of this work is to employ a computer simulation to evaluate the optimal detector configuration required to detect point or surface contamination on livestock due to gamma emitting radio-isotopes. This includes the determination of the best size, placement and detection material composition. Using the results of this work a theoretical minimum detectable activity (MDA) will be determined.

Motivation for Work

- The Department of Agriculture (USDA), through the National Response Framework Nuclear/Radiological Annex, has the responsibility of controlling, assessing and decontaminating the affected animals
- For humans, plans and equipment exist to evaluate the amount of contamination, but for household animals and for livestock plans and equipment are limited.
- Total retail value of beef consumed in the United States: $80.6 billion (2009) (USDA)
- For a state like Texas
  - 13 million head of Cattle
  - #1 state commodity generating $6.9 billion in sales
  - Feedlot industry in Texas produces ~30% of the nation's beef

Scope of Work

- Produce Monte Carlo N-Particle Simulations to evaluate the best configuration for a radiation detection portal
- Simulations will include:
  - Cow
  - Press Chute
  - NaI and PVT detectors
  - Concrete Pad for Background radiation
  - Point and distributed source contamination on the animal
- Data will be used to predict minimum detectable activities

- The cow model is very basic where the body parts are represented by simplistic geometric shapes.
- The chute modeled was a commercially available SILENCER hydraulic squeeze chute

In the case of detectors being placed perpendicular to the ground, counts registered were higher as compared to detectors placed parallel to the ground

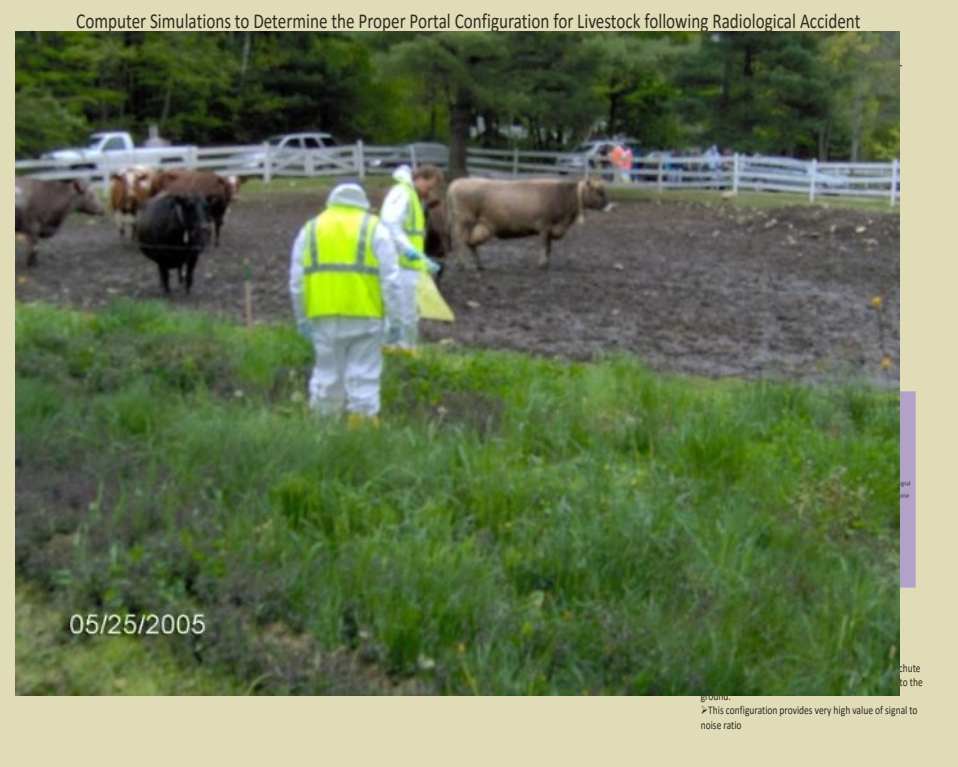
Conclusions

Optimal configuration of the detectors for effective assessment of contamination would be

- Six 2"x4"x16" NaI detectors on either side of the chute
- Placed such that the 2"x16" face is perpendicular to the ground.
- This configuration provides very high value of signal to noise ratio

- Develops Radiological **surveillance and monitoring strategies** and capabilities for remediating contaminated or crops and feeds and contaminated or irradiated animals

Radiological Program Analyst



- **9** USDA APHIS Safety Officer volunteers, 4 sets of DOE compatible gear
- **12** USDA Office of Inspector General HAZWOPER Forensics Team AgERT trained, 4 RAD surveillance trained

Radiological Program Analyst

- Develops strategies for screening and decontamination of pets, companion animals and livestock
- DHS/FEMA IND Pet mass evacuation assessment and evaluation working group

Operational Topic

A methodology for decisions regarding contaminated livestock.

A Plan for the Handling of Externally Contaminated Livestock

*Dayton McMillan, Thomas Johnson, Yuanqing Guo, and Alexander Brandl**

Abstract: *Nuclear accidents and access to radiological weapons for terrorist organizations and countries with hostile intentions towards the United States are realistic scenarios in the current global landscape. A dispersion of radionuclides can result from a nuclear weapon detonation or from a nuclear accident occurring in facilities handling or using radioactive material, such as nuclear power reactors. Any target of a radiological dispersal device (RDD) or an attack with a nuclear weapon and the surrounding area of a reactor accident could be subject to a significant amount of fallout and radioactive contamination. Therefore, a nuclear event in close proximity to agricultural areas will cause significant concern regarding the contamination of food products. In order to respond quickly and effectively to a large amount of contaminated agricultural products, such as livestock, a prepared and effective plan for handling and processing of these products is necessary. A protocol outlining the evaluation of and procedures for handling and processing radioactively contaminated livestock is proposed, to ensure safe animal food production and economic stability in the livestock industry in the wake of such a nuclear or radiological event. An evaluation of the salvageability of the contaminated livestock is performed based on the degree of exposure, the cost of decontamination, expected demand for food products, and economic impact to the owner/producer. Important factors that impact the salvageability of affected livestock are listed and analyzed to support the decision process for handling contaminated animals. Health Phys. 101(Supplement 3):S164–S169; 2011*

Key words: *operational topics; decontamination; emergency planning; fallout*

INTRODUCTION

External radioactive contamination of livestock is a concern after any nuclear or radiological event. Difficulties in managing contaminated livestock after Chernobyl resulted in a massive destruction of animal stock, which subsequently created large quantities of radioactive waste that required additional handling and disposal (Fesenko 2007; IAEA 2006). High costs associated with radioactive animal waste disposal and losses of investment in livestock are deterrents for indiscriminate slaughter of contaminated animals, apart from the hygiene problem associated with the management of large numbers of animal carcasses and the practical and economic impact of such measures (IAEA 2006). In order to avoid any unnecessary disruption to food production and premature or unnecessary slaughter of livestock, emergency planning should include appropriate provisions for agricultural animals. An economically-efficient method of handling mass quantities of contaminated livestock is currently not available for the agricultural industry.

Previous studies have shown that the financial viability of radioactively decontaminated animal products is quite complex and depends on multiple factors (Grande et al. 1999). Few data are available on consumer perception and behavior after a radiological event; some information can be extracted from studies in Norway and Scotland after the 1986 Chernobyl accident (Grande et al. 1999). A general observation, however, has been that the public acceptance of various emergency countermeasures is increased when social and economic factors are considered in the design and planning of these countermeasures (IAEA 2006). Recognizing that consumption patterns, availability of alternative food sources, and cultural influences will play a major role in the post-event market, extrapolation from these data can hardly provide for sound market projections. However, the general principles to which the affected livestock will have to be evaluated can be investigated and are summarized here. Possible market values of decontaminated animal products and costs to decontaminate animals to safe levels were extrapolated based on current market prices.

MATERIALS AND METHODS

A plan for the handling of contaminated livestock was devised by review and analysis of the relevant literature, national and in-

* Department of Environmental and Radiological Health Sciences, Colorado State University, Fort Collins, CO 80523.

Alex Brandl is Assistant Professor in the Environmental and Radiological Health Sciences Department at Colorado State University. Previously, he was Head of the Operational Safety Department at Nuclear Engineering Seibersdorf in Austria. He received MS and Ph.D. degrees in physics from the University of New Mexico. His research focuses on issues related to dosimetry, radioactivity measurements, environmental monitoring, and radionuclide dispersion and transport in the environment and emergency response. His email address is alexander.brandl@colostate.edu.

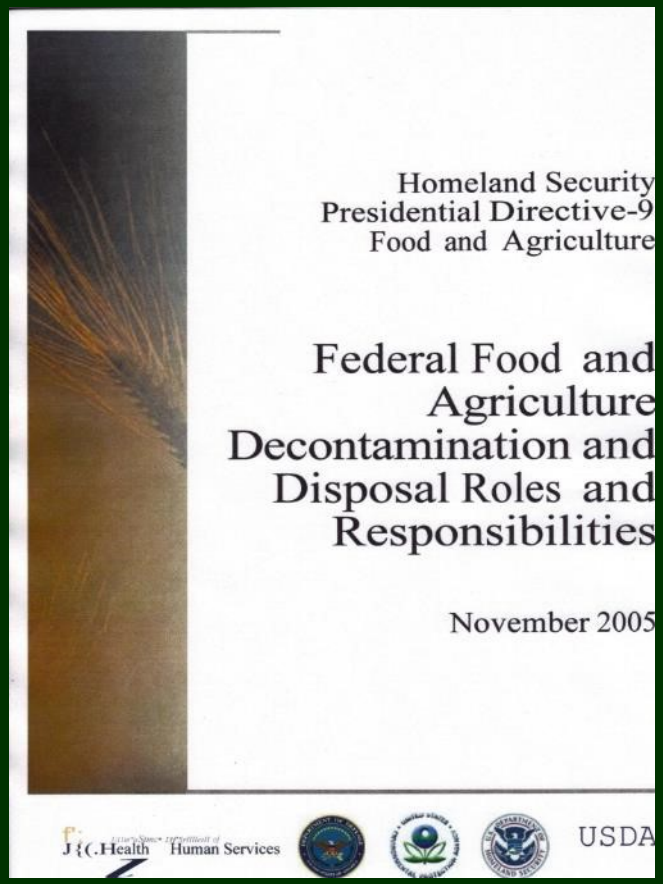
Radiological Program Analyst

- Collaborates with Veterinary Services Animal Care on tactics for **decontamination** of livestock, poultry, pets, service animals, zoo animals, and wildlife
- Researches **Therapeutic countermeasures** to mitigate contaminants ingested by animals
  - Ferro cyanate (**Prussian blue**)

Radiological Program Analyst

- Develops strategies for the disposition of, animal carcasses:

Call EPA!!



"This document describes the general Federal roles and responsibilities for decontamination and disposal in response to animal, crop, and food incidents."

"Radiological incidents are not addressed."*

NCAHEM ACTIVITIES

- International Expert Meeting on Decommissioning and Remediation after a Nuclear Accident
  - Stakeholder Buy-in
  - Decision Tool

NCAHEM ACTIVITIES

- Dairy Crisis Communications Drills
- Water Environment Research Foundation
- EPA Wide Area Wide Area Recovery and Resiliency Program (WARRP) Technical SME Workshop

2013 DAIRY INDUSTRY
FOOD SAFETY CRISIS DRILLS

June 5-6, 2013
June 5 – Drill Kick-Off, 5:30 – 7 p.m. ET
June 6 – Drill, 7 a.m. – 4 p.m. ET
Washington, D.C.
Hilton Alexandria Mark Center,
Alexandria, Va.

Fire drills, tornado drills, evacuation drills... Government agencies regularly practice these to prepare for disasters. Likewise, the dairy industry must test its response given the potential impact such incidents could have on food safety.

Dairy Management Inc. (DMI) has developed a new crisis drill scenario that will test the dairy industry's longstanding crisis response plan in this context – a natural disaster strikes and dairy food safety is called into question.

Government participation in this drill is essential. One of the guiding principles of dairy's crisis response plan is to follow the government's lead. We need your department or agency to work alongside members of the dairy supply chain to determine how best to address and communicate about the situation at hand. In the drill, a tornado devastates a community, leaving farms, processing facilities and a nuclear power plant damaged in its wake. Radiation leaks from the plant and is detected in the local food supply, triggering food safety concerns on a national level and a massive communications challenge for both the dairy industry and the government.

Why You Should Attend
The session is open to representatives from state and federal government, dairy industry leaders from across the supply chain and third-party subject matter experts.
Government participants will:

- Work side-by-side with dairy industry and fellow government representatives to share and discuss response and communication plans
- Share perspectives with other government officials on their roles and responsibilities during a large-scale food-safety crisis
- Test your media interview skills, if applicable
- Experience how social media will shape public perception and industry response – and how your department or agency can contribute to the conversation
- Familiarize yourself with industry and government resources that support readiness and response

Sign Up Today!
You can register for the Northeast Region Dairy Industry Food Safety Crisis Drill via the drill microsite (http://sites.redwoodeditor.com/dmi-crisis-training). Registration is open until May 10. Sign up early – space is limited and fills quickly!

"Coordination and cooperation between the dairy industry and the government are paramount to the industry's crisis response plan. This drill will give us an opportunity to practice and plan in advance so we're better prepared when a crisis hits."
***– David Pelzer,** Senior Vice President of Strategic Communications, DMI*

Research

- Livestock Decontamination: Colorado state University
- Fungal Gel Decontamination: Aberdeen Proving ground
- USDA Agricultural Research Service: phyto-mitigation Crop Selection, soil remediation
- Portable, scalable, large animal monitoring: Texas A & M University
- Segmented Gate technology for contaminated soil and agricultural product segregation
- Wildlife Services Research center: $NaNO_2$ humane euthanasia

MOST CRITICAL LESSON LEARNED?

PREPAREDNESS IS ESSENTIAL!!

QUESTIONS?

Gordon.S.Cleveland@aphis.usda.gov
Office: **(301) 851-3597**

IND Response and Recovery Planning – Animal Workgroup

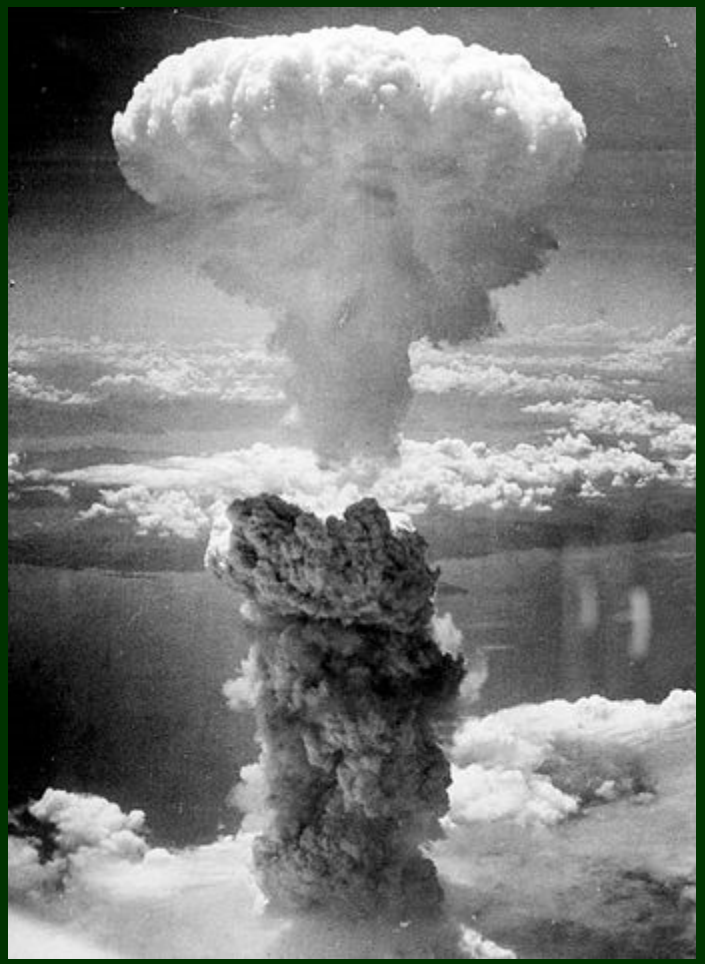
Kevin Dennison, DVM
USDA APHIS Animal Care
May, 2013

FEMA IND Response and Recovery

- Sponsored by FEMA CBRNE
  - Ongoing project with multiple work groups
  - Annual Forum
- Identifying challenges and solutions pertaining to a nuclear detonation on US soil
- Animal group added in 2011
  - Kevin Dennison, Gordon Cleveland, Mark Tinsman, and Todd Smith leading

Improvised Nuclear Device

- 5-10 kiloton yield
  - 5,000-10,000 tons of trinitrotoluene (TNT)
  - Like several hundred semitrailers of TNT detonated
  - Hiroshima 16 KT
  - Nagasaki 21 KT



Catastrophic incident

- Likely urban center target
  - "Decapitation"
- Loss of infrastructure
  - 1st response
  - Communication
  - Transportation
  - Utilities

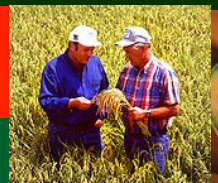
Animal Work Group Goals

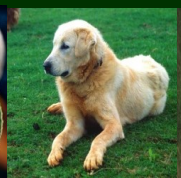
multi-year timeline

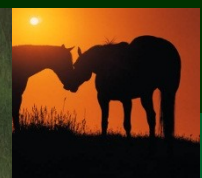
1. Develop productive workgroup of “experts”
2. Identify mechanisms for approximation of animal populations in affected areas
3. Identify the specific animal response and recovery missions and mechanisms to integrate such into overall ICS and MACS

Goals (continue)

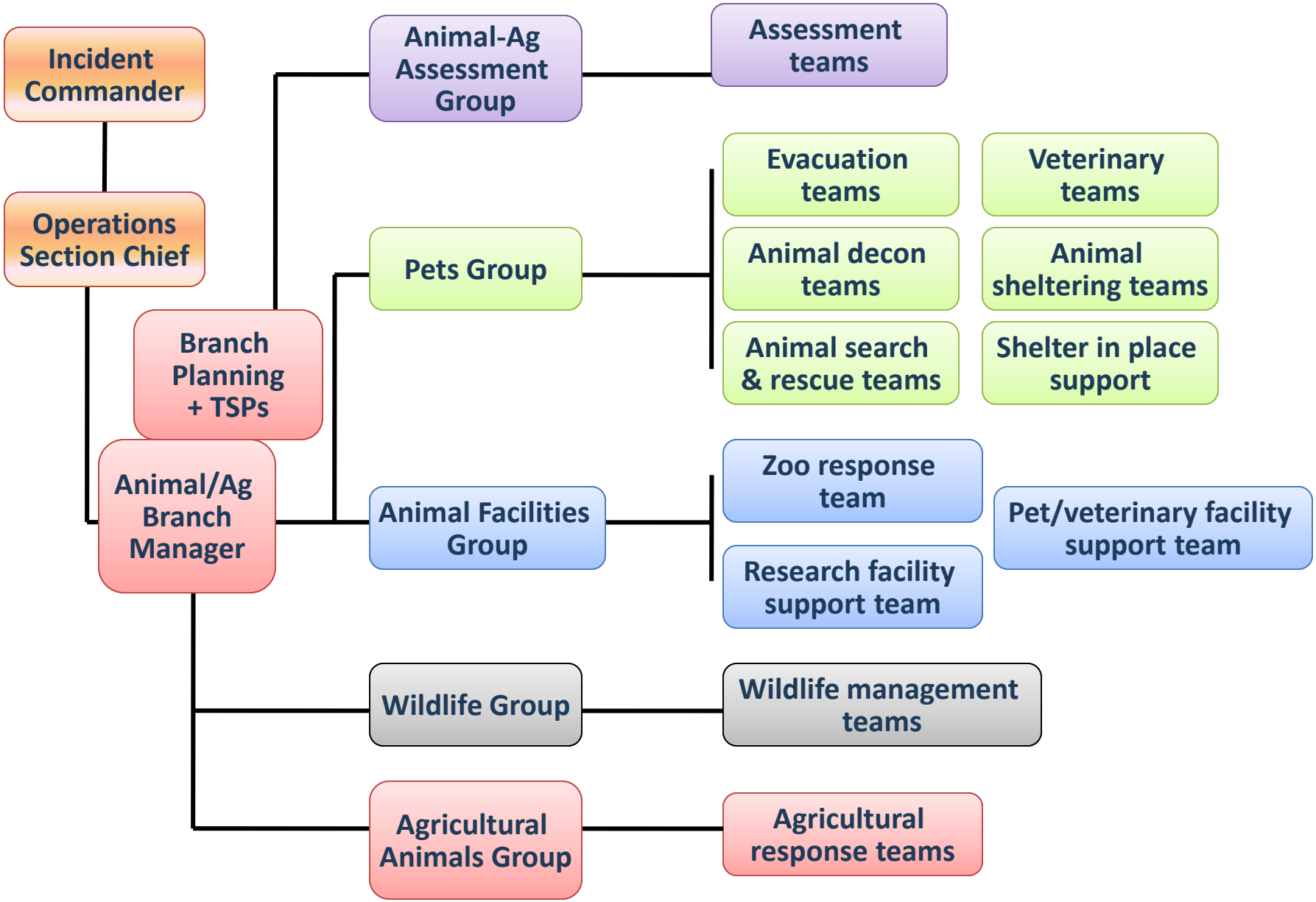
4. Identify mechanisms of mobilization of qualified personnel and other resources, including “just-in-time” training options
5. Analyze current state of scientific understanding of animal management during radiological emergencies
   - Bibliography
   - Research recommendations







Example of animal response mission areas for analysis purposes



Challenges

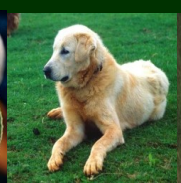
- Multiple Area Commands
  - Dozens of ICPs?
- **Intense** competition for life-saving resources
  - Fuel
  - Vehicles
  - Radios/Comm
  - Medical supplies
  - Potable water
  - Generators
  - Personnel

Operational priorities – Day 1-7

Animals, agriculture, food

- Support of mass care missions
  - Sheltering of animals evacuated by/with owners
    - Decon, veterinary care, etc.
  - USDA FNS support of mass feeding
- Agricultural protective actions
  - Warning/instructions to producers
    - Protective actions for livestock, people
  - Movement controls –livestock, crops, food





How much exposure is too much?

- Incident authorities will establish detailed guidelines
- Average annual US dose = 300-600 mrems
  - *http://www.epa.gov/rpdweb00/understand/calculate.html*
  - Approximately 1-2 mrems daily
  - Occupational limit = 5000 mrems per year
  - Clinic signs: acute >100 rem exposure, >400 rem lethal
  - Example: 3 weeks at 2x background ~ 21-36 mrems
    - ~ 3.5-11% added to annual background dose
    - ~1/200 of annual occupational dose limit

Demographics estimation - pets

- National average: For every 1000 households
  - 2600 people
  - 1529 household pets: 1368 (AVMA) 1671 (APPA)
    - .59 pets per person
  - Easy Button: # of people x .6
- Agricultural and other animals more difficult

How many pets… really?

Factors that increase pet population	Factors that decrease pet population
Suburban or rural locations	Urban locations, particular concentrated urban
Smaller communities	Cities over 2,000,000
Single family homes, mobile homes	Condos, apartments
Families with children	Elderly, very young, singles
Region or State	Region or State
Increased income	Decreased income

Washington, D.C. pet population:

- 619,000 residents, ~10,000 per sq. mile
- 123,000 pets (2012 AVMA Sourcebook)
  - 0.2 pets per person compared to .59 national average
  - Highly urban, less single family housing
  - Increased income median, but more at poverty levels
- MD/VA averages ~ .5 per person
- Need **NIGHTTIME** human population!

Formula hypothesis –NCR (SWAG)

Nighttime human population x 0.1 for "inner city" areas of DC

+

Nighttime human population x .25 for other urban areas within DC/MD

+

Nighttime human population x .5 for suburban areas - MD

+

Nighttime human population x .6 for rural areas

Example:

- 10 KT IND detonation
  - DuPont Circle
  - Daytime detonation
- But….
  - Pet figures should be extrapolated from night or weekend population
  - Changed detonation time to midnight on Sunday.

Nuclear detonation effects and fallout predictions provided by the DOE National Atmospheric Release Advisory Center (NARAC) and DHS Interagency Modeling and Atmospheric Assessment Center (IMAAC)

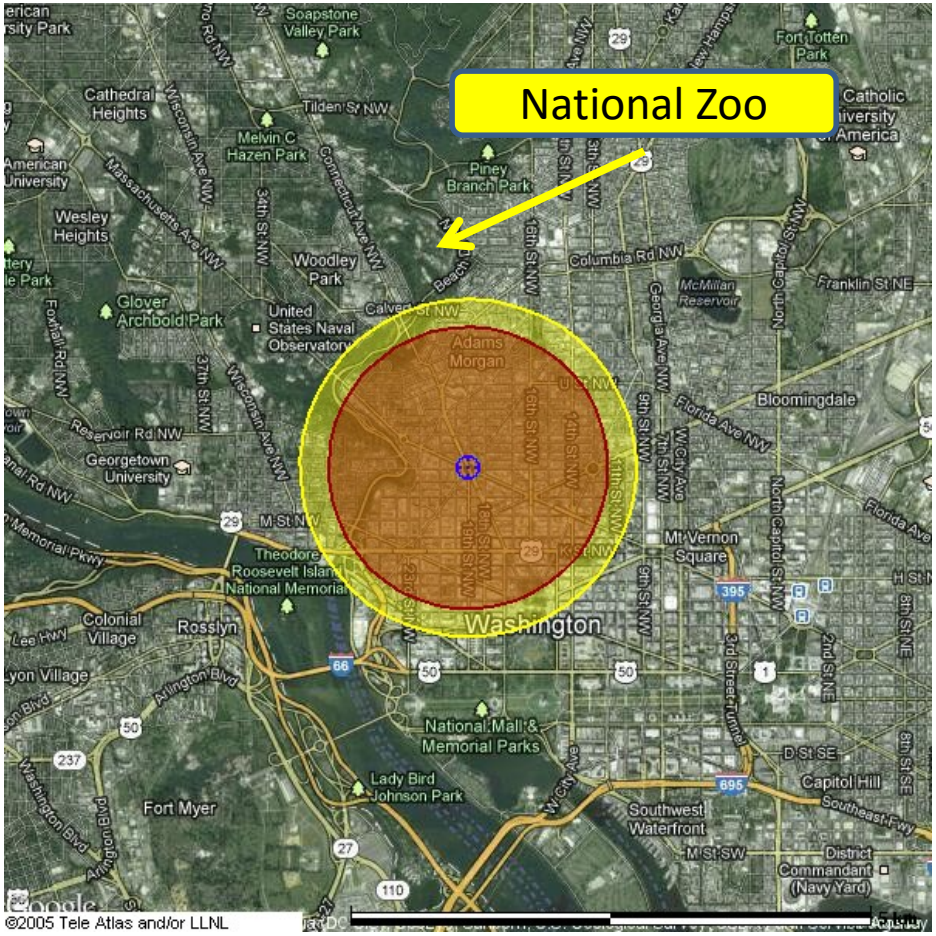




Automated Report: Testing
(38.9097,-77.0435)
Nuclear Detonation at 21 Apr 2012 04:00 UTC

Predicted Prompt Effects of Nuclear Detonation on Population

Effects of overpressure, heat, and immediate radiation on unprotected population producing immediate to near-term injury, illness or death



Few, if any, unprotected survivors. Survivors possible in intact shelters (may require medical care). Total Exposed Population: 46500 Area: 5.7 km2 Extent: 1.3 km

Numerous injuries with increasing rate of fatality moving inward. Immediate assistance will greatly improve survivability. Total Exposed Population: 64900 Area: 8.2 km2 Extent: 1.6 km

Notes:

- There may be ongoing dangerous radiation levels due to fallout (see Predicted Dangerous Fallout Zone (DF) product).
- Use in conjunction with Predicted Damage Response Zones product for planning areas to focus available resources.
- Effects are committed within a few seconds after detonation.
- Some immediate survivors may have been fatally exposed to radiation.
- Effects are not uniformly radial as shown. Effects may intensify or diminish due to buildings and structures.
- Those in substantial shelters have increased survivability
- Population cited is total exposed, not number of casualties.

Assumptions:

- Assumes 10 kt detonation at 0 ft elevation.
- Areas shown are model predictions based on an estimated source term but no measurements.
- Radioactive cloud has passed area displayed, radiation from fallout remains a serious hazard.

Briefing Product for Public Officials
Current: 27 Apr 2012 20:07 UTC
Check for updates

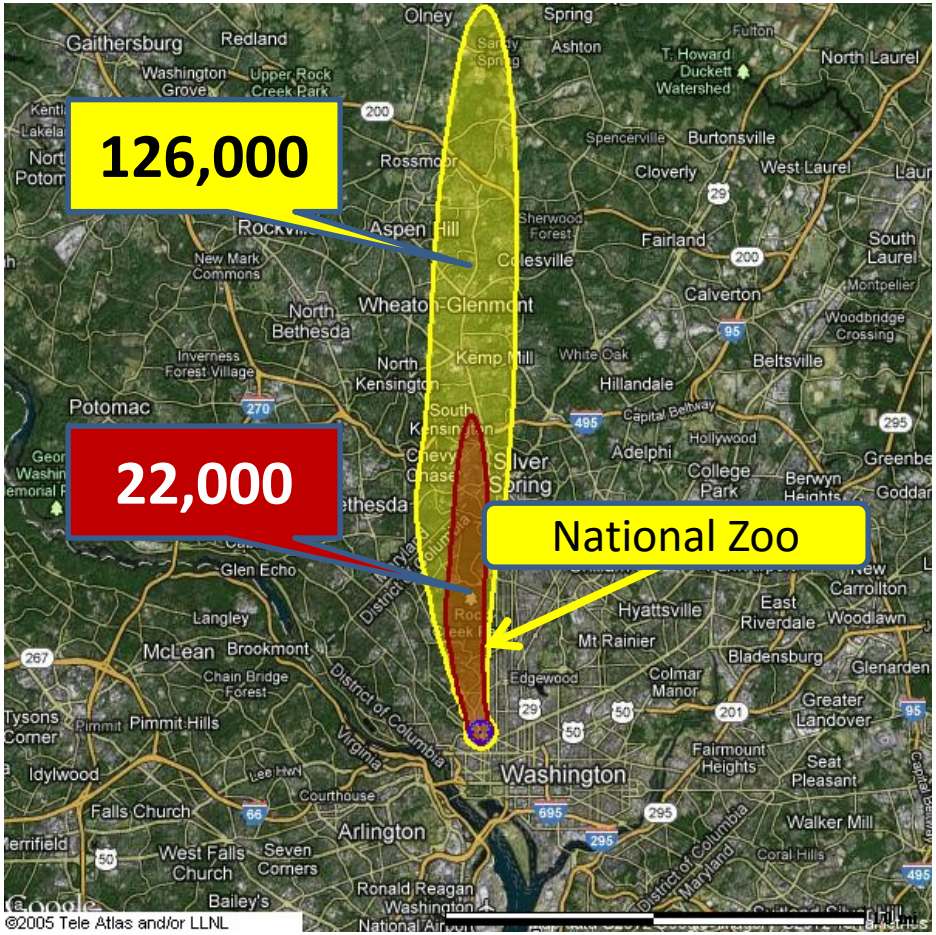
Interpretation

- Few, if any, unprotected survivors. Survivors possible in intact shelters, 46500 night-time residents
  - Inner city zone, estimate .1 pets per person
  - ~4,500 pets
- Numerous injuries with increasing rate of fatality moving inward. 64900 night-time residents (cumulative)
  - Inner city zone, estimate .1 pets per person
  - ~6500 pets

Automated Report: Testing
(38.9097,-77.0435)
Nuclear Detonation at 21 Apr 2012 04:00 UTC

Predicted Area for Potential Fallout Casualties at 28 Apr 2012 04:00 UTC

Total external dose from radioactive fallout during first 168 hr of exposure leading to near-term (days to weeks) illness or death



Fallout lethal to most without adequate shelter (exceeds 450 rad). Best action is early shelter followed by informed evacuation to control exposure. Total Exposed Population: 22600 Area: 14.1 km2 Extent: 12.1 km

Dangerous fallout levels can cause death, injury or illness (exceeds 100 rad). Zone of greatest opportunity for life saving and injury reduction. Dose management for first responders essential. Total Exposed Population: 126000 Area: 73.0 km2 Extent: 27.8 km

Notes:

- The best initial action is to seek adequate shelter immediately.
- Sheltering with delayed evacuation is preferred, unless evacuation can be completed before fallout arrival.
- Highest radiation hazard during first hours, then rapidly declines.
- Expect few deaths or serious injuries due to radiation outside the maximum extent of these regions.
- Area size will increase rapidly the first few days, then vary slowly, as they show total dose accumulated since detonation.

Assumptions:

- Assumes 10 kt detonation at 0 ft elevation.
- Areas shown are model predictions based on an estimated source term; confirm with measurements.
- Model assumes that no shelter or other protective actions have been taken to decrease exposure.

Briefing Product for Public Officials
Current: 27 Apr 2012 20:05 UTC
Check for updates

Interpretation

- Fallout lethal to most without adequate shelter, 22600 night-time residents
  - Use .25 pets per person ~5,500 pets
- Dangerous fallout levels can cause death, injury or illness, 126,000 night-time residents
  - Use .5 pets per person ~63,000 pets
- National zoo?

What about the zoo?

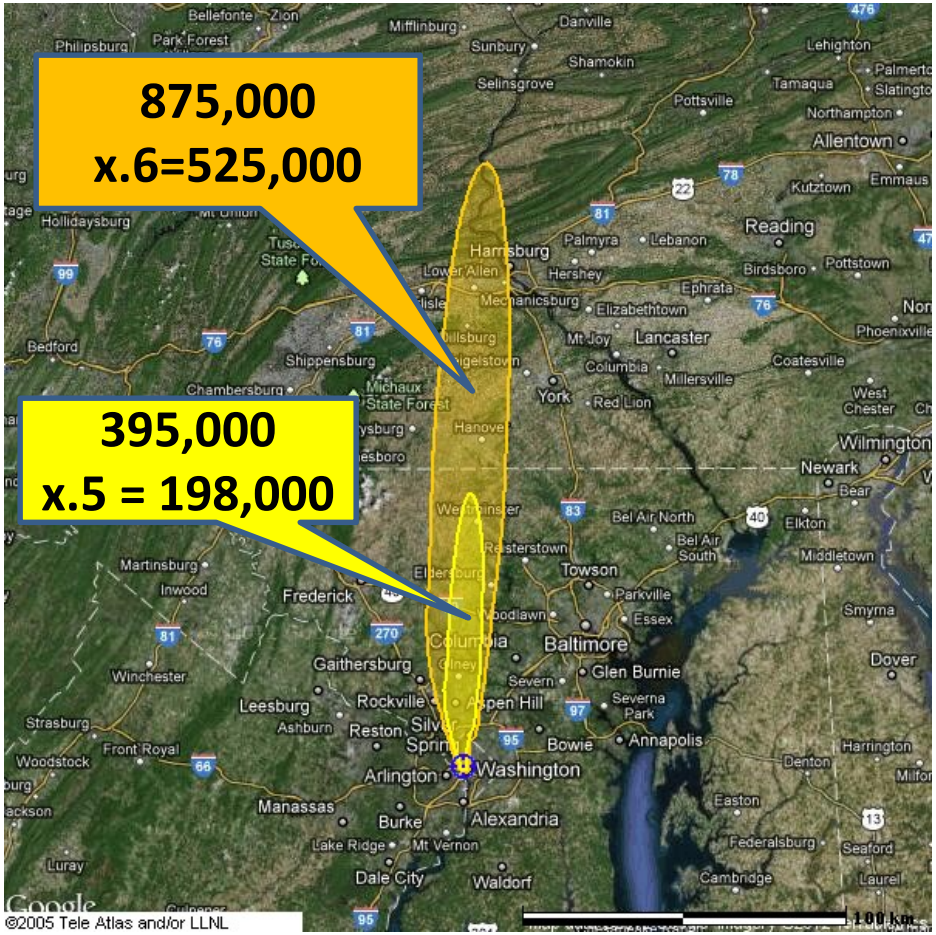
- 400 species, over 2000 individual animals
- 163 acre compound
- Several hundred FT, PT, seasonal staff
- <1800 volunteers total
- **<u>Thousands of visitors and staff at any one time</u>**
- Lots of substantial exhibits and buildings

Modaqua sp.

Automated Report: Testing
(38.9097,-77.0435)
Nuclear Detonation at 21 Apr 2012 04:00 UTC

Predicted EPA/DHS Relocation Areas

Addresses avoidable additional long-term cancer risk, not acute radiation injury or death



Relocation warranted due to dose expected to be received during the 2nd year (begins 21 Apr 2013 04:00 UTC). Exceeds 0.5 rem. Total Population: 395000 Area: 666 km2 Extent: 82.6 km

Relocation warranted due to dose expected to be received during the 1st year after 22 Apr 2012 04:00 UTC. Exceeds 2 rem. Total Population: 875000 Area: 3,197 km2 Extent: 183 km

Notes:

- Relocation addresses only increased cancer risk due to long term exposures.
- Predicted dose assumes unsheltered individual with no protective actions or mitigation.
- First-Year zone decreases in size with time, because dose received in the past and before the relocation is not included. Protective actions are based only on dose that can be avoided.
- Individuals may have received a much higher total dose if present since detonation time.

Assumptions:

- Assumes 10 kt detonation at 0 ft elevation.
- Areas shown are model predictions based on an estimated source term; confirm with measurements.
- Model assumes that no shelter or other protective actions have been taken to decrease exposure.

Briefing Product for Public Officials
Current: 27 Apr 2012 20:07 UTC
Check for updates

Exponents do make a difference!

10^1, 10^2, 10^3, 10^4, 10^5, 10^6

- CDC reception area goal is 1000 persons per hour
  - ??? Pets per hour
- Need better options for efficiency in mass decon operations
  - Vacuum gross decon?
  - Interim/warm zone shelters
- Awareness level training on basic radiological response principles + just in time training ready to go

Contact Information

Dr. Kevin M. Dennison
USDA APHIS Animal Care
- Western Region Emergency Program Manager
- Advisory Team on Environment, Food, and Health

Kevin.M.Dennison@aphis.usda.gov
970-494-7433 office
970-231-3477 cellular

Thank you!