

### Application of the AVMA Guidelines for the Depopulation of Animals to Biomedical Research



OLAW Online Seminar  
September 26, 2019

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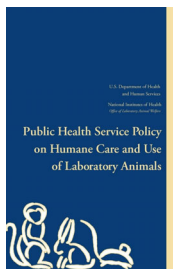
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### PHS Policy and Euthanasia

PHS Policy on Humane Care and Use of Laboratory Animals (IV.C.1.g.)

*"Methods of euthanasia used will be consistent with the recommendations of the American Veterinary Medical Association (AVMA) Panel on Euthanasia, unless a deviation is justified for scientific reasons in writing by the investigator."\**

\* AVMA Guidelines for Euthanasia of Animals: 2013 Edition or succeeding revised editions.



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### AVMA Guidelines for the Depopulation of Animals: 2019 Edition

- Guides veterinarians in making humane decisions when large numbers of animals must be killed quickly in response to a disease outbreak or natural disaster.
- Depopulation refers to the rapid destruction of a population of animals in response to urgent circumstances with as much consideration given to the welfare of the animals as practicable.



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### AVMA Guidelines for the Depopulation of Animals: 2019 Edition and the Disaster Plan

- It is recommended that the disaster plan include contingencies for applying the AVMA Depopulation Guidelines in an emergency.



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**Depopulation of Laboratory Animals**

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September 26, 2019

AVMA  
 American Veterinary Medical Association

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### Humane Endings Guidance: What is it? AVMA Guidelines on...

Euthanasia (2013)	Humane Slaughter (2016)	Depopulation (2019)

**"A method of killing that minimizes pain, distress, and anxiety experienced by the animal prior to loss of consciousness, and causes rapid loss of consciousness followed by cardiac or respiratory arrest and death"**

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## Humane Endings Guidance: Depopulation

### What is Depopulation?

- Refers to the rapid destruction of a population of animals in response to urgent circumstances with as much consideration given to the welfare of the animals as practicable.
- May employ euthanasia techniques, but not all depopulation methods meet the [AVMA] criteria for euthanasia.
- Balances rapid response with prevention of further devastation and suffering with the most humane method possible.
- Occurs when doing nothing can result in greater animal suffering and endanger responders.



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## Humane Endings Guidance: Depopulation

### Classifying Methods

#### Preferred

- These methods are given highest priority and should be utilized preferentially when developing emergency response plans and when circumstances allow reasonable implementation during emergencies.
- They may correspond to AVMA Guidelines for the Euthanasia of Animals or the AVMA Guidelines for the Humane Slaughter of Animals techniques but adjusted for situational considerations.



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## Humane Endings Guidance: Depopulation

### Classifying Methods

#### Permitted in Constrained Circumstances

- These methods are permitted only when the circumstances of the emergency are deemed to constrain the ability to reasonably implement a preferred method.
- Examples include zoonotic disease risk, response time, human safety, depopulation efficiency, deployable resources, equipment, animal access, disruption of infrastructure, and disease transmission risk.



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## Humane Endings Guidance: Depopulation Classifying Methods

### Not Recommended

- These methods should be considered ONLY when circumstances preclude the reasonable implementation of any of the “preferred or permitted in constrained circumstances” methods, **AND** when the risk of doing nothing is deemed likely to have a reasonable chance of resulting in significantly more animal suffering than that associated with the proposed depopulation technique.
- Examples of such situations include, but are not limited to, structural collapse or compromise of buildings housing animals, complete inability to safely access animals for prolonged period of time or any circumstance that poses a severe threat to human life.
- Not Recommended ≠ Unacceptable



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## Depopulation: Examples

### Low-medium expansion foam for poultry

- Involves covering birds with blanket of foam, to a depth of 15-30 cm
- May be used in a variety of housing types (e.g., open sided, naturally ventilated; damaged structures that are unsafe to enter)
- Birds must be contained to the floor



Photo: Thornber PM, Rubira RJ, Styles DK. Humane killing of animals for disease control purposes. Rev. sci. tech. Off. Int. Epiz., 2014;33(1):303-310. Available at: <https://pdfs.semanticscholar.org/6897/4bbf2bec6178312f0a7d2863409767980420e.pdf>



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11

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## Planning for Emergency Killing in Research Settings

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2018 Humane Endings Symposium  
November 4, 2018  
Chicago, IL



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12

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## Acknowledgments

### Panel on Depopulation

#### Laboratory Animal Working Group

- Dr. Sam Cartner, Chair (UAB, Birmingham, AL)
- Dr. Bob Adams (Johns Hopkins, Baltimore, MD)
- Dr. Emily Patterson-Kane (AVMA, Schaumburg, IL)
- Dr. Kate Pritchett-Corning (Harvard, Cambridge, MA)
- Dr. Jennifer Pullium (NYU Langone Med Ctr, NY, NY)
- Dr. Helen Valentine (U of Illinois, Urbana-Champaign, IL)
- Dr. Michael Huerkamp (Emory, Atlanta, GA)

• AVMA: Dr. Cia Johnson, Lindsey McKinney

Images: Dr. Ryan Curtis, Dr. Bob Livingston



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13

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## Depopulation

### Small laboratory and wild-caught rodents

#### Preferred: Euthanasia techniques

- Carbon Dioxide (CO<sub>2</sub>)
- Isoflurane overdose
- Intraperitoneal (IP) euthanasia solution
- Physical methods



#### Permitted in Constrained Circumstances

- Compatible: confluent monolayer + CO<sub>2</sub>
- Incompatible: CO<sub>2</sub> in home cage
- Pre-charged chamber + high-flow



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14

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## Depopulation

### Laboratory dogs, cats, ferrets, rabbits, sheep, goats, and swine

#### Preferred: Injectable anesthetic overdose or injectable euthanasia solutions

- Two-step method:
  1. anesthesia followed by
  2. physical or adjunctive method or injection of Potassium chloride (KCl) or Magnesium sulfate (MgSO<sub>4</sub>)

#### Permitted in Constrained Circumstances

- Use of effective compounded or non-pharmaceutical-grade, expired anesthetic or euthanasia agent
- Reuse of needles (5x)



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## Depopulation Nonhuman Primates

**Preferred:** Euthanasia or slaughter techniques

- Two-step method:
  1. anesthesia followed by
  2. physical or adjunctive method or injection of KCl or MgSO<sub>4</sub>

**Permitted in Constrained Circumstances**

- Use of effective compounded or non-pharmaceutical-grade (NPG), expired anesthetic, or euthanasia agent
- Gunshot by trained operator in appropriate outdoor environment



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16

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## Depopulation Aquatic Vertebrates

**Preferred:** Euthanasia or slaughter techniques

- Rapid chilling of small tropical fish
- Anesthesia followed by adjunctive method
- Pithing, blunt force followed by adjunctive method

**Permitted in Constrained Circumstances**

- Use of effective compounded or non-pharmaceutical-grade, expired anesthetic, euthanasia, or toxic agent



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## Depopulation Avian and Poultry

**Preferred:** Euthanasia or slaughter techniques

- Inhaled or injectable agents
- Anesthesia followed by adjunctive method

**Permitted in Constrained Circumstances**

- Use of effective compounded or non-pharmaceutical-grade, expired anesthetic, or euthanasia agent



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18

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## Depopulation Special Considerations

### Dangerous animals

- Keep nets, snake hooks, darting apparatus on hand

### Animals exposed to hazardous agents (e.g., BSL3 or 4)

- Should not require responders to enter primary containment

### Fetal or neonatal animals

- Altricial: physical methods (e.g., cervical dislocation, decapitation)
- Precocial: euthanized as adults of the same species

### Embryonated poultry eggs

- Cooling or freezing



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19

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## Agricultural vs. Laboratory Settings



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## Facility & Program Attributes Research Facilities

- Physical plant
- Protective distances
- High value, sometimes irreplaceable animals
- High population density
- Epizootic approach
- Extensive experience
- Mandatory emergency preparedness plans
- Attending Veterinarian



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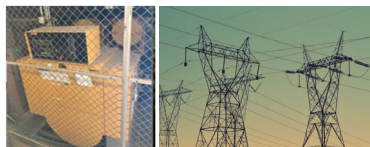
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### Facility & Program Attributes

#### Physical Plant

- Indoors containment, resilient construction, system redundancy
- Utilities: hardened supply with or without self-generation, emergency power



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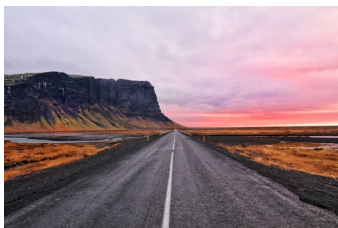
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### Facility & Program Attributes

#### Distance Matters

- Biosecurity: isolated from different institutional animals
- Minimal fomites such as service vehicles between institutions



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### Facility & Program Attributes

#### High Value Census

- Irreplaceable attributes and high value of many research models
  - Novel founder mice: \$7,500 each
  - Cryopreservation of genetics



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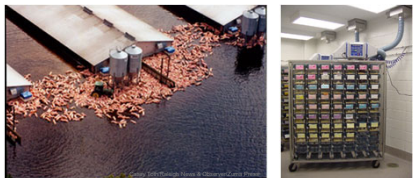
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### Facility & Program Attributes Dense, Mobile Populations

- High concentration of large numbers
  - Mice: ~30-40/Net Square Foot (NSF), 100K+/institution
  - Broilers: 1-2/NSF (National Chicken Council)
- Mobility of some housing systems: racks and pens on wheels



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25

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### Facility & Program Attributes Epizootics

- Different impact
- Usually managed in-place
- Isolate, test, and cull by cage, room or greater scale



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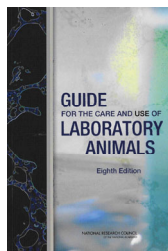
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### Emergency Planning Regulations and Requirements

- “Facilities must ...have a disaster plan” (p. 35)
- “Animals that cannot be relocated or protected...must be humanely euthanized.” (p. 35)
- May involve ranking of species
- Defined decision tree
- Communication most likely disrupted



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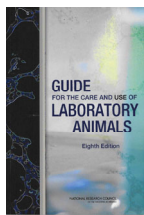
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## Emergency Planning Attending Veterinarian

- Required by the *Guide for the Care and Use of Laboratory Animals (Guide)*
  - Responsible for the health and well-being of all laboratory animals (p. 14)
  - Facilities must have a disaster plan (p. 35)
- Allowed to deviate from conventional practices, AVMA guidelines
  - Professional judgement
- Depopulation guidelines
  - IP injection of 70% ethanol to mice, immature rats
  - Use of compounded or non-pharmaceutical-grade injectable anesthetics, euthanasia agents
  - Expired drug deployment
  - Needle reuse



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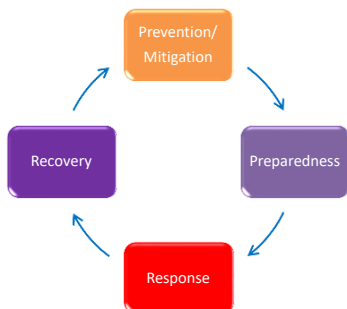
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## Disaster Response Plan



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Natural Hazards

**HAZARD AND VULNERABILITY ASSESSMENT TOOL**  
NATURALLY OCCURRING EVENTS

EVENT	PROBABILITY	SEVERITY - (MAGNITUDE, MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPAREDNESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
SCORE	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 = Not a Risk 1 = Minor 2 = Moderate 3 = High	0 - 100%
Tornado	3	2	3	2	2	2	2	72%
Pandemic Flu	1	3	0	2	2	2	2	20%
Severe drought with service disruption	1	1	1	2	3	3	3	24%
Ice Storm	2	1	2	2	2	2	1	31%
Severe Thunderstorm	3	1	1	1	1	1	1	33%
Earthquake	1	1	1	1	3	3	3	22%
Hurricane	1	1	2	2	2	2	2	29%
Blizzard	1	1	1	2	2	2	1	17%
Flood, External	1	0	1	1	3	2	2	17%
Snow Fall	1	1	1	1	1	1	1	11%
Temperature Extremes	1	1	1	1	1	1	1	11%
Flood, River	0							0%
Wild Fire	0							0%
Landslide	0							0%
Dark Inundation	0							0%

2018 Analysis Adapted From Kaiser Foundation WVA  
Emory University Office of Critical Event Preparedness and Response

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### Research Institution Census

(approximate rank order by head-count)

1. Mice	8. Livestock
2. Zebra fish	9. Dog
3. Rats	10. Cat
4. Guinea pig	11. Amphibian
5. Rabbit	12. Ferret
6. Hamster	13. Gerbil
7. NHP	14. Other species of birds, amphibians, fish and rodents

Sources: USDA annual report & ACLAM test template



31

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### "Big Academe" Scenario

#### Mass Euthanasia / Total Depopulation

- Pandemic flu
  - Flu: state quarantined, animal food milled out-of-state and depleted
- 20,000 mouse cage depopulation
- Euthanex SmartBox™ chambers x 7
  - 16 cages + 400 L CO<sub>2</sub> per cycle
  - 12,310 L per 50-lb CO<sub>2</sub> tank
  - Mass depopulation requires 21 **FULL** 50-lb tanks,
  - 45 hrs x 14 people
- 35 gallon waste containers x 20 stations x 40 people = 20 hrs and 20 50-lb CO<sub>2</sub> tanks



32

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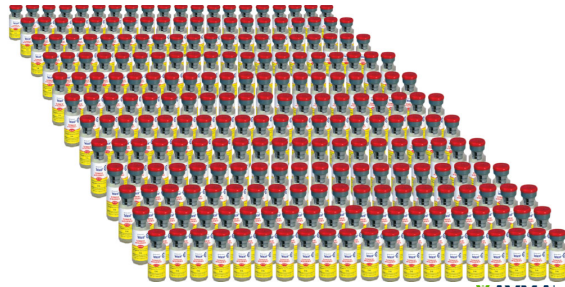
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### Sizable Populations of Large Animals

To anesthetize 3,000 NHPs requires ~240 bottles of Telazol or Ketamine HCl



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### Conclusions

- Complete pre-emptive depopulation event is unlikely
  - Hardened facilities/programs + unpredictable, fast-moving event
- Adapt and apply the Panel on Euthanasia & Panel on Humane Slaughter guidelines
  - AV can assess effectiveness of non-pharmaceutical-grade and expired drugs
- Include in disaster planning & practice table top exercises
- Inventory anesthesia and euthanasia agents
- Advocate for cryo storage

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## Disaster Response and Recovery

Jennifer K. Pulliam, MVB, DACLAM  
Senior Director, Division of Comparative Medicine  
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36

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### Topics Covered

- Disaster response
  - Incident command
  - Vivarium
    - Animals
    - Staffing
- Disaster recovery
  - Short-term measures
  - Other considerations and innovative planning

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### Incident Command

- Integrated institutional disaster response
- Participants:
  - Animal Resources Director/AV
  - Facilities and environmental health and safety
  - Information technology
  - Institutional senior leadership
  - Public relations
  - Purchasing
  - Human resources and labor relations

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### Responsibilities

- Everyone in the institution has their area of focus
  - Don't assume everyone will (or is able) to drop everything and assist you
- Need to ensure multiple people are capable of leading the vivarium disaster response
  - Don't assume the Director or AV will be onsite

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### Responsibilities

- Issues that previously would have required multiple meetings and much hand wringing – now just require decisions
- Remember – indecision is a decision
- Differences between clinical and research staff become more apparent

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### Vivarium

- Personnel safety comes first
  - May be working in an unfamiliar site
  - Need to know the emergency egress(es)
- Began by rounding all animal facilities and satellites for: animal health, food, water, +/- bedding, temp, relative humidity
  - Had already stockpiled food, bedding, etc.
  - Bottled water (water cooler) for everything



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43

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### Vivarium

- Consider a stash of cash (few thousand)
- Relocated satellite animals for easier care
- Store emergency supplies in multiple locations



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44

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### Vivarium

- To what point do you allow environmental parameters outside the *Guide* or Animal Welfare Act before euthanasia?
  - Days? Week(s)?
  - Assuming the animals are clinically normal...
  - Are you going to euthanize everything because there are no air exchanges but temp and relative humidity are OK?



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### Vivarium

- Just because the storm/earthquake/event has passed...doesn't mean the disaster is over
  - Couple weeks after the storm, another building was not going to resume utilities
  - ~4,000 cages; 8 different species; 50 PIs
  - Winter is coming...
- Recommend local institutions determine what housing can be offered in a disaster

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### Smilow rescue

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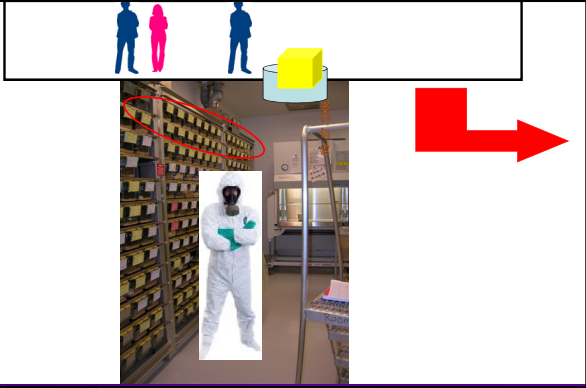
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**Staffing**

- Don't assume people will come to work just because they are "essential personnel"
- Effective disciplinary program
- Have people staying onsite in advance
- Make it as comfortable as possible
  - Hotel room(s), food (before, during, after)
- Satellite phones

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**Press**

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**Press**

- Myths from my residency training:
  - Lab animal vets don't speak to the press
  - Your Public Relations (PR) people will take care of everything
  - Just give them a briefing about animal research
- Realities I learned the hard way:
  - No one knows your operation as well as you
  - A briefing to PR folks is not enough
  - If you want something done right, do it yourself

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### Press

- News cycle isn't aware that you've been working almost 48 hrs with no sleep
- "Not available for comment" = "Not sitting by the phone with nothing to do but answer endless questions"
- Encourage staff not to read internet comments
- And if you still think briefing PR folks is enough...

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### Personnel

- Now members of an "exclusive club"
  - Find a way to communicate this fact to outsiders
- Mandatory Post Traumatic Stress Disorder (PTSD) counseling
- Look for hidden opportunities with previously difficult staff members
- Look after each other
  - Make sure people are eating, sleeping, home OK

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### Recovery: Short-term Measures

- Replacement animals
  - Cryo makes it much easier
  - Takes time to bring back and need housing
- Replacement facilities
  - Temporary and permanent
  - Better hope you've been nice to people

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### What can we do to *really* plan?

- Tabletop exercises are **not** enough
  - Reading comprehension test of disaster plan
  - Doesn't tell you how anyone would perform in an actual emergency
- Tactical Decision Games (TDGs)
  - Developed by the military
  - Civilian use by industrial psychologists
    - Crichton, M. *Horiz. Psychol.* **10**, 7–22 (2001)
  - Can't simulate a disaster, but failure is not an option

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### What can we do to *really* plan?

- What really matters are the human factors (non-technical skills)
- Participants are given an emergency scenario and asked to make decisions under stress
  - Distractions, time limits, role play
  - Recommended for ALL levels of employees
  - Pullium et al., *Nature* 2014, Oct 23
- Leadership for Disaster Response (LeDR)
  - Conducted TDGs throughout the US, as well as UK, Ireland, Australia (academia and industry)

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### Depopulation guidelines

- We were fortunate in not having to depopulate for Hurricane Sandy
- Useful guidelines if we had to depopulate:
  - Combining cages of mice for euthanasia (perhaps in large containers)
  - Using all available pentobarbital (possibly expired)
  - Re-using needles until dull

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58

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## Questions

Submit to the chat box in the GoToMeeting control panel



59

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## Question 1

How can depopulation be accomplished to minimize compassion fatigue?



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Question 2

Who should be included in the decision to depopulate?



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Question 3

Please talk more about networking with other nearby Institutions during an emergency. How do you initiate and maintain arrangements so that they are in place when a disaster occurs?



62

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Question 4

Can you share some strategies for developing talking points on depopulation for media communications?



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### Questions

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64

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### 21<sup>st</sup> Century Cures Act: Next Steps



OLAW Online Seminar  
December 5, 2019

65

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