What Can Healthcare Learn from the BP Gulf of Mexico Oil Spill Disaster?

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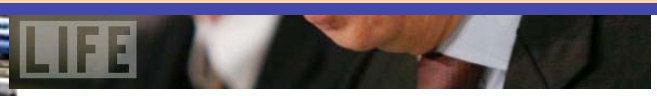
Introduction

- Preview
  - Deepwater Horizon (briefly)
  - Parallels to healthcare
  - A system safety engineering perspective
- Acknowledgments
  - Scott Shappell, Wiegmann, Shappell, & Associates
  - John Wreathall, Wreathall and Co.
  - Theresa Guarrera, University at Buffalo

2005 Texas City Explosion

BP Response:

- Vow to recommit company to a culture of safety, "think ahead, forward planning"
- CEO: I became "laser-focused" on safety



- 2005 EXPLOSION: 15 dead and 170 injured in Texas City
- 2006 OIL LEAK: 16-mile stretch of corroded BP pipeline in Prudhoe Bay Alaska

Deepwater Horizon

- April 20: Explosion on oil rig
  - 15 injured, 11 missing
  - Blowout preventer failed to activate
- April 22: Second explosion
  - Rig sinks in 5,000 ft of water
  - five-mile-long oil slick forms

Initial Analysis:
BP had ignored all lessons

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Contributing Factors?

- Very high risk, complex
  - Floating platform, GPS guided, Deep water
- 2 Major players
  - Transocean – platform, equipment, drilling
    - Reputation: Very Safe
  - BP – leases Platform, owns rights to oil
    - Reputation: cutting corners, pushing to get it done
    - Costs $500k/day
    - Safety mechanisms- not fully functional
    - Poor culture of safety

Testimony

- alarms were switched off to enable workers sleep undisturbed- disabled weeks
  - Working 12 on/ 12 off
- software was fa
  - criti onitoring key safety equipment crashed
- 3 months before the disaster BP Manager warned by Halliburton that rig's blowout preventer could be faulty

How did the culture allow this to persist?

Comparison

- Exxon, after the 1989 Valzez:

Healthcare in the USA:
Are we BP or Exxon?

Resp… effective a…

…ddressed, systems redesigned

…O serious incident in subsequent 21 years

New York Times, June 16, 2010

Healthcare: BP or Exxon?

What happens after an adverse event?

Are our results sustainable?

How do we develop a culture of safety in Healthcare?

How do we minimize adverse events?

- A safety engineering perspective
  - Systems Approach
  - Human Factors Engineering

Case Study

- 32 year old healthy male:
  →Rapid heartbeat & hypotension
  - Non-life threatening rhythm (SVT)
- Synchronized shock @100j → refractory
- Try again @ 200j → **VF Arrest**
- 45m resuscitation attempt → **patient dies**
- RCA reveals that MD failed to put device in SYNC mode for second shock

Case Study

- Primary
  - H error: failed t ace in sync mode
  - k c miliarity with ipment
- R ponse:
  - unsel & Ret
  - rvice all users
  - Ch olicy / se emo
  - Reminder a meeting

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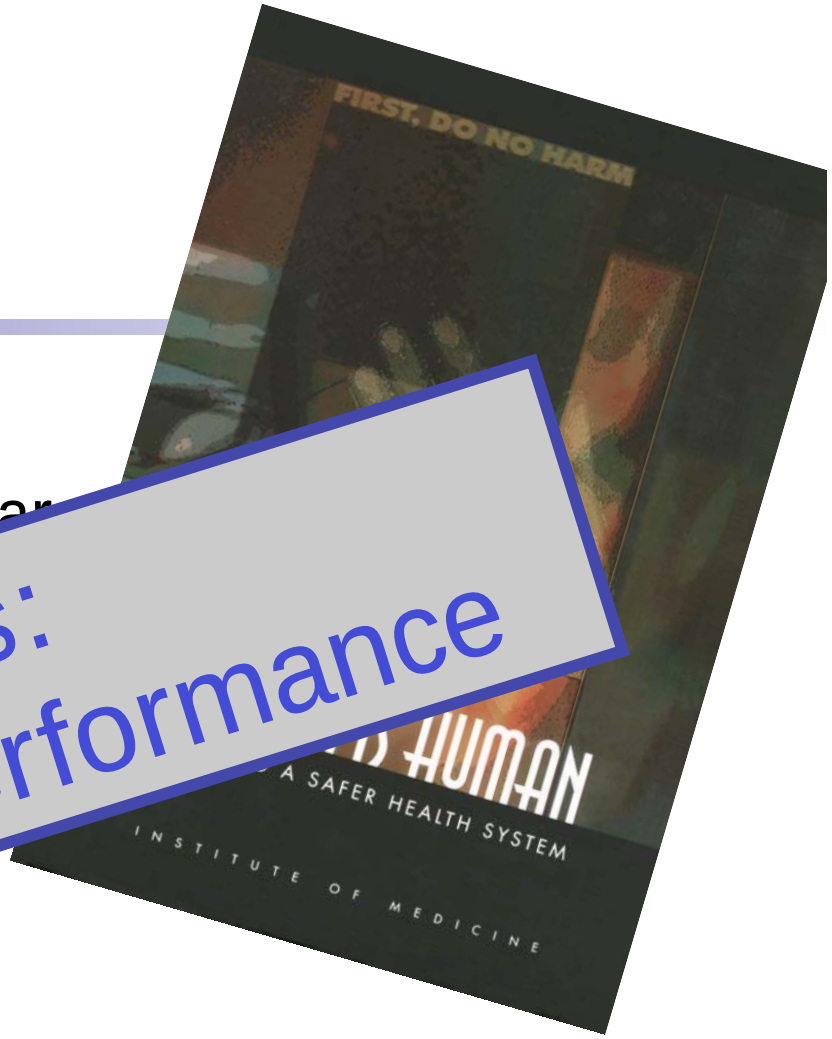
The Problem

- IOM Report in 2000:
  - Est. 44,000-98,000 deaths/year
- Government mandate:
  50% less
- Yea
  NO E!!

-----WHY?-----



Focus:
Individual Performance

Leape LL, Berwick DM. Five years after To Err Is Human: what have we learned? *JAMA.* May 18 2005;293(19)

Wachter RM. The end of the beginning: Patient Safety Five Years After 'To Err Is Human'. *Health Aff .* 2004(11)

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Systems Approach

Is the goal to : "Eliminate Error?"

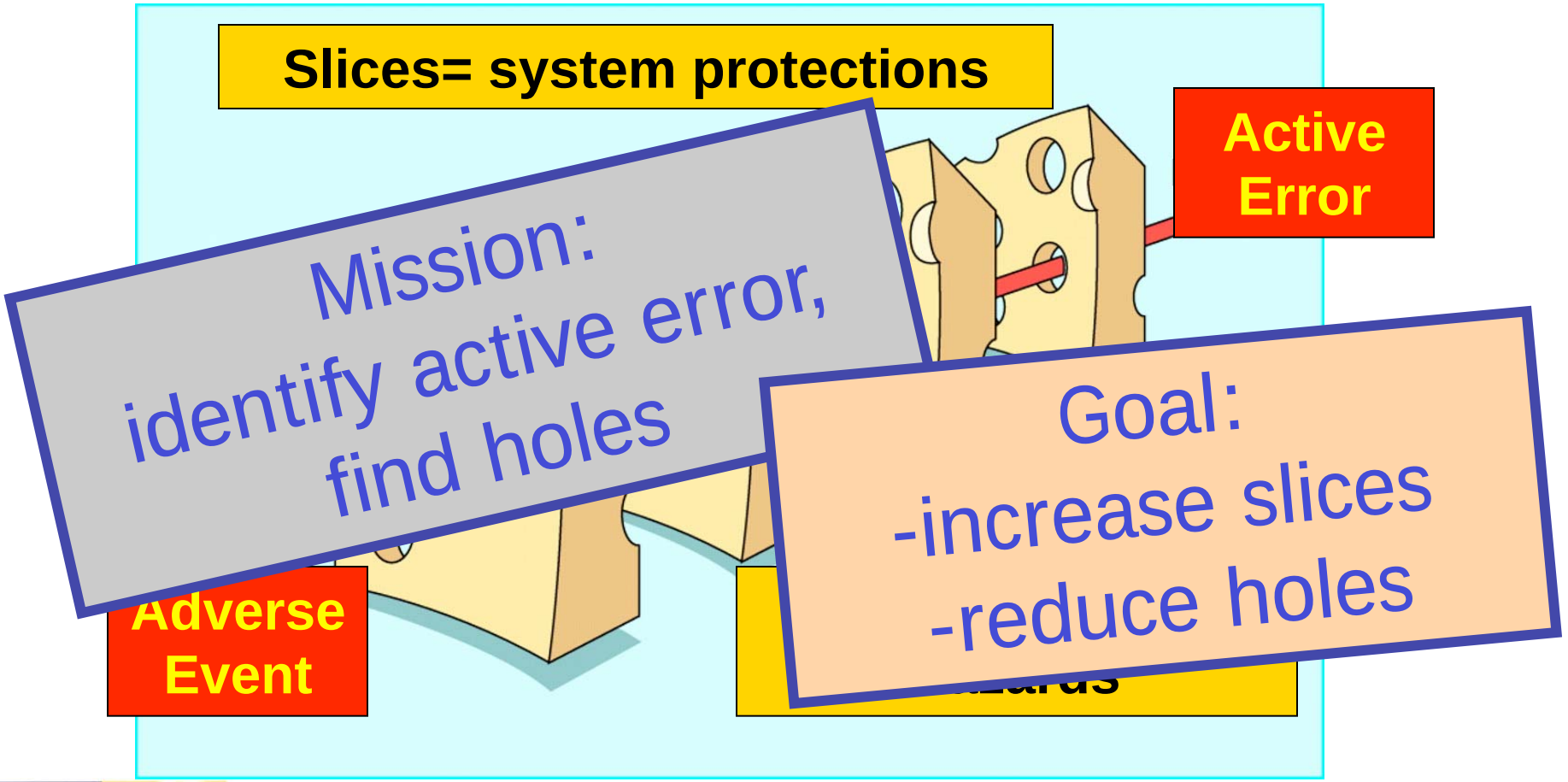
➔NO

- Human Error cannot be eliminated
  - Futile goal; misdirects resources/focus
  - Causes culture of blame and secrecy
    - "name, blame, shame, and train" mentality
- It is about **reducing HARM**

Mitigating Human Error

- If error is inevitable...
  - Reduce the occurrence of human error
    - With better design, support, allocation of function
    - NOT re-training and policy as response to events
  - Mitigate the effects of inevitable error
    - With better design: of system, components
  - To predict error, must have an open culture
    - Near miss reporting

Swiss Cheese Model (Reason)



Modified from Reason, 1990

Human Factors Engineering (HFE)

- Human Factors Engineering:
  - Optimizes the relationship between technology and the human user
  - Designs the system to match abilities
- "Designing for human use"
- How humans err is <u>not</u> the focus
- <u>Normal</u> in aviation, nuclear, military

Principles

- Know human capabilities
  - Know where to expect error (hazards)
  - Use Hazard Reporting, Heuristic, etc
  - Understand how the work is done
  - Create system requirements match human capabilities
- Create system protections in hazards
- Focus on the human-machine interface
  - Displays and controls

Design of Medicatio

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Back to Defibrillator Case

- Design issues
  - Lack of user feedback
    - Device silently leaves sync mode
  - Lack of forcing function
    - Allows unsynchronized shock for SVT
- Standardization issues
  - Defaults varied among devices
- Liability issues, culture of blame
  - Prior cases known, others not

Defibrillator Usability Study

- Fourteen expert participants
- Four tasks: 2 routine, 2 emergent
- Two defibrillator models
- SimMan™ patient simulator
- ***50%*** *of participants inadvertently delivered an unsynchronized countershock for SVT*
  - **71% of participants never aware**

➢*Fairbanks RJ, Caplan SH, et al. Usability Study of Two Common Defibrillators Reveals Hazards. Annals of Emergency Medicine Oct 2007; 50(4): 424-432.*

Potential Hospital Responses: What is the impact?

- Fire or discipline the physician?
  - Creates culture with incentive to hide errors
  - Results in less experienced workforce
- Retrain the ED staff?
  - Ineffective way to improve system reliability
- Study past events?
  - Requires culture change
  - True protected reporting
- Can we impact medical devices design?

Manufacturer Response

"Monitor was determined to be operating as configured according to manufacturer's specification"

(Use Error vs. User Error)

Defibrillator Case #2

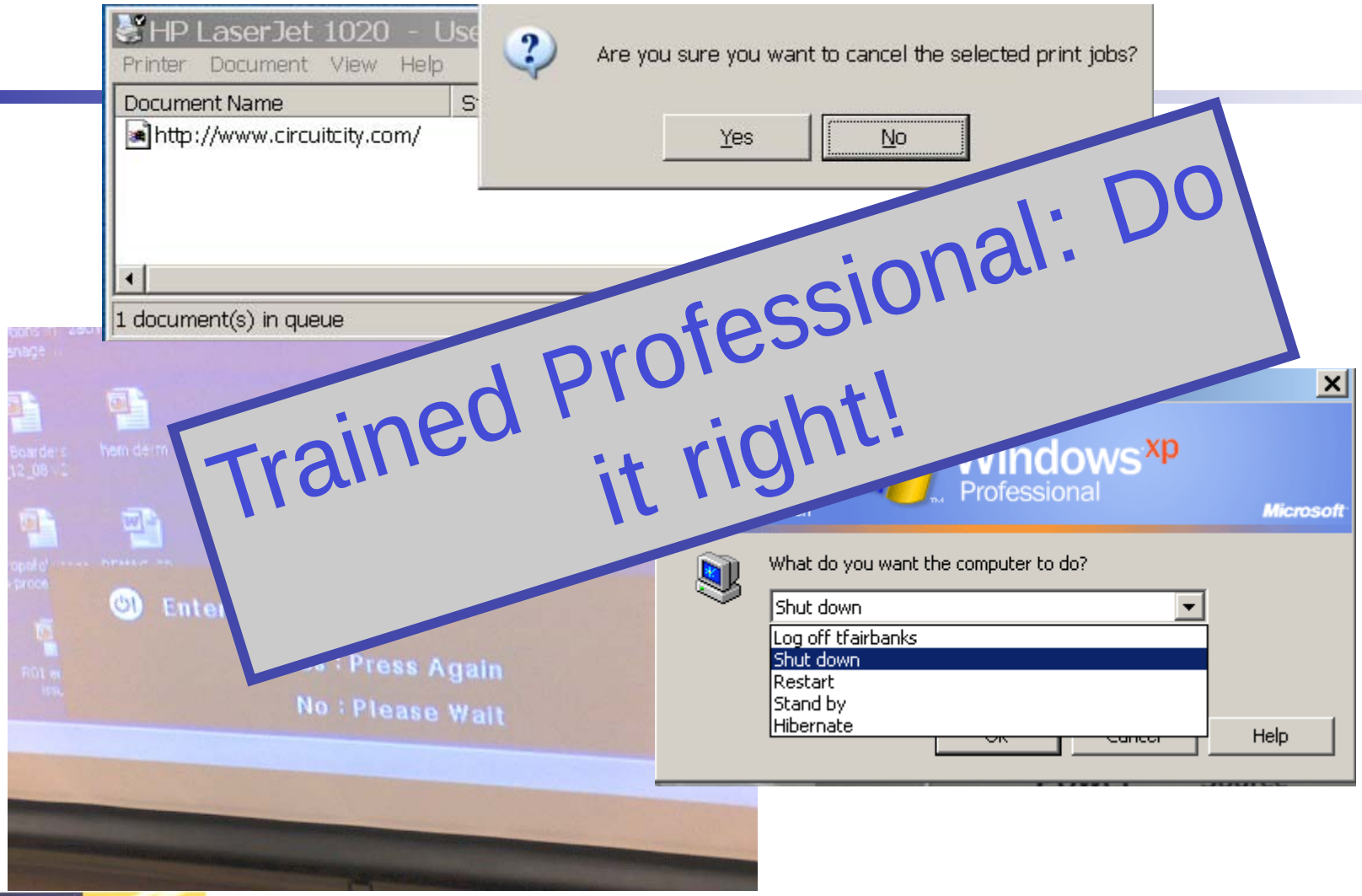
- VF cardiac arrest
- Nurse with patient
- charges unit...
- clears patient...
- then presses “power”
- Machine powers down

Defibrillator Case #2

- MEPARS.com: two EMS Reports
- Simulation study (Denmark)
  - 72 physicians using common device
  - 5 of 192 defib attempts: device powered down
    - Mean delay: 24 seconds
  - Device could be turned off even if charged & ready

Hoyer, Christensen, et al. (2008). "Adverse design of defibrillators: turning off the machine when trying to shock." Annals of Emergency Medicine **52**(5): 512-514.

Huh?


HP LaserJet 1020 - Use
Printer Document View Help
Document Name
http://www.circuitcity.com/
1 document(s) in queue
Are you sure you want to cancel the selected print jobs?
Yes
No
Trained Professional: Do it right!
Windows xp
Professional
Microsoft
What do you want the computer to do?
Shut down
Log off tfairbanks
Shut down
Restart
Stand by
Hibernate
Help
Press Again
No : Please Wait

Would this work elsewhere?

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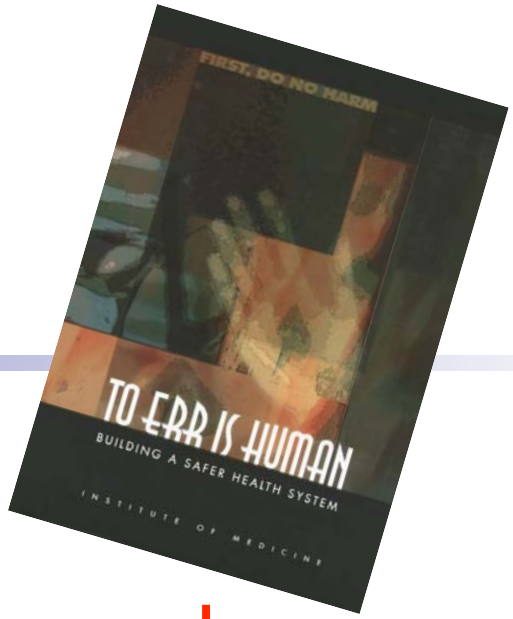
Answer?



- We are BP
- 10 years later.... Minimal to no change
  - Focus is STILL on the individual
  - Lack of automation where helpful
  - Focus is on local level
  - Poor response to near misses
  - Lots of faulty software

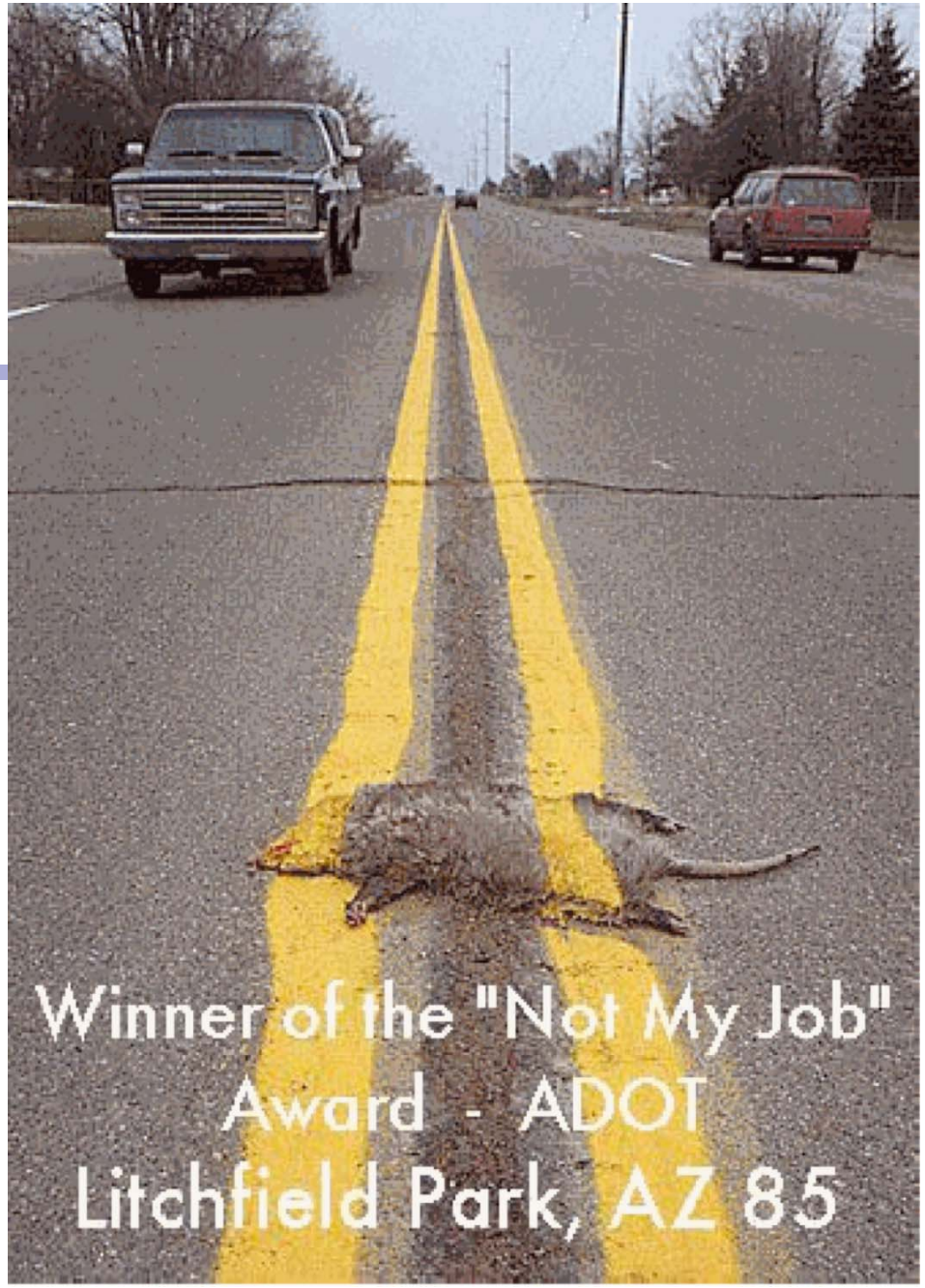
What US healthcare needs in order to be come Exxon

- Focus on contributing factors that can be changed
  - Non-punitive QA systems (educational)
  - Easy to use near miss reporting with feedback
  - System factor focus in RCAs & incident reviews
  - Study near misses
  - Ask staff about “accidents waiting to happen”
  - Culture change starting with leadership

Recommended Resources
[more at: www.MedicalHFE.org]

- Human Factors & Ergonomics Society www.hfes.org
  - resources and consultant directory
- Unique event reporting system
  - Helmet Fire www.HelmetFire.com
- Books:
  - Patient Safety in Emergency Medicine, Croskerry, Cosby, Schenkel, and Wears (2009) [link]
  - Handbook of Human Factors and Ergonomics in Health Care and Patient Safety, Pascale Carayon (2007) [link]
  - Set Phasers on Stun, Steve Casey (1998) [link]
  - Mistake-Proofing the Design of Health Care Processes, Grout (2007) [link]
  - Human Error, James Reason (1990) [link]
  - Normal Accidents, Charles Perrow (1984) [link]
  - Just Culture: Balancing Safety and Accountability, Dekker (2008) [link]
- Courses
  - Systems Engineering Initiative for Patient Safety (SEIPS) http://cqpi.engr.wisc.edu
  - Red Forrest Consulting (John Gosbee) www.redforestconsulting.com

Patient Safety is Everyone's Job



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