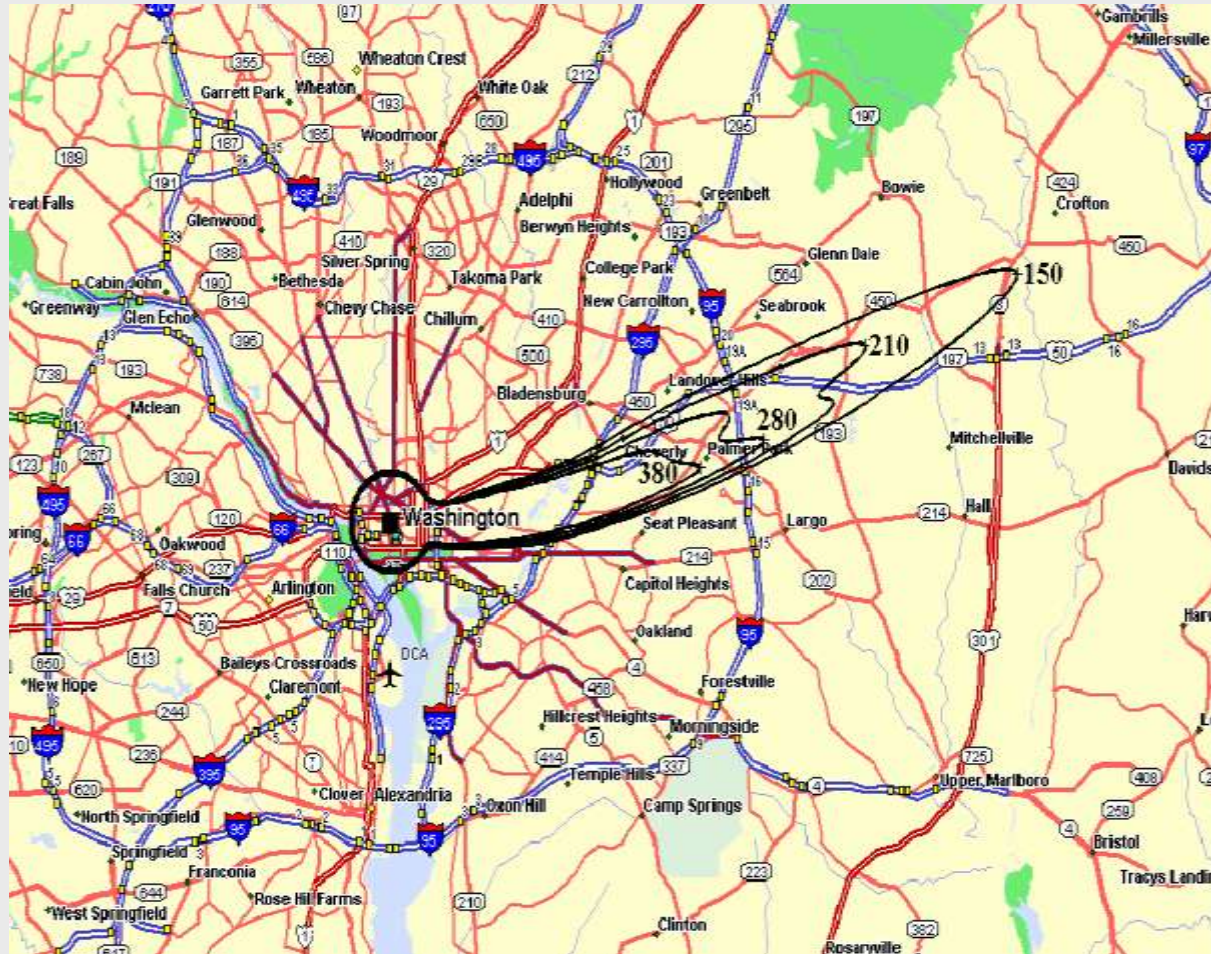


Addressing Nuclear Consequence Management Plan Shortfalls

Robert Housman

Projected Impacts

10KT device, Washington DC



Impacts (cont.)

- Primary Zone (2mi radius)
- 481K people w/in 3mi of blast (Oak Ridge 495K); 220K w/in 7 mi
- Expect 314K casualties & 215K fatalities—these expected levels are likely vastly under-stated
 - Based on unchallenged models
 - 70% of Hiroshima victims challenged
 - DoD studies challenged + sublethal = 90%+ death rates
- “Infrastructure Damage: Total within a radius of 0.5 to 3.0 miles”
- There will be no indigenous response/governance units larger than the family, street gangs
- Most of our national government is dead or dying/incapacitated—COG requires a government to continue

Response Manpower

(not including medical)

- Requirements:
 - Mgmt: 5,000 personnel
 - PAO: 7,000 personnel
 - Perimeter control: 25,000 personnel
 - Decon: 300 platoons; 200 stations; 7,200 personnel
- Vast majority will be DoD (non-in-situ resource)
- Time to deploy

Plan: Pullback military & first responder units to a safe perimeter – it won't work

- **Current – civilian agency – response plan will place the military in a no-win situation**
- No way to protect troops & first responders from radiation; plan is to pullback to safe perimeter
- Lack of LE/security will create chaos, hamper evacuation & incite looting/violence – Katrina lesson learned
- 24/7 media coverage of victims trapped, suffering, unable to get/reach/find help will cause public outcry
- No win: send in finite assets – lose them to radiation sickness – or sit back & be crucified
- HHS & DHS are creating the problem but military will get the blame – DoD will be lone face on the “battlefield”

Deployment/Pull Back First Responder & Military Units

- **Emergency Response (Pull Back Plan)**
 - NPS: “Emergency workers entering high-radiation areas in the first few days after the detonation are likely to receive lethal doses of radiation. Personal Protective Equipment (PPE) is used to control contamination but does not protect workers from external radiation doses.”
 - NPS: “Decision-makers have to weigh the benefit of [focusing on downwind rescue efforts] versus that of direct lifesaving in the blast area. It must be noted that all people, including emergency response workers, entering high radiation areas . . . have a high probability of receiving . . . likely fatal doses . . . radiation doses.”
 - NPS: “Victims will continue to absorb radiation doses while waiting on rescue, and this will result in an increased likelihood of fatality.”
 - NPS: “The location and removal of injured and disabled people will be a significant undertaking that will be greatly complicated by the need to keep the radiation dose of the individual workers as low as reasonably achievable (ALARA).”
 - JP 3-11: Whenever possible an MTF should be located such that it is maximally protected from an NBC attack.

Plan: Evacuate 450,000+ people from hot zone in 24 hours or less – it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- No infrastructure for .5 mi, severe damage up to 3 mi
- No electrical grid – likely across entire region
- Evacuation routes limited by damage, fallout/plume
- No responder presence in affected area (fire/police/mil)
- Most victims won't reach help – which will be miles out at a safe perimeter
- Similar evacuation – w/72 hrs advance notice, perfect intel, undamaged infrastructure, working comm's, & relative public calm – failed for Hurricane Katrina

Evacuation

- **Infrastructure Challenges**

- “Infrastructure Damage: Total within a radius of 0.5 to 3.0 miles.”
- “Damaged buildings, downed power and phone lines, leaking gas lines, broken water mains, and weakened bridges and tunnels are just some of the hazardous conditions that will need to be assessed.”
- “There likely will be significant damage to the general public support infrastructure with potentially cascading effects. These systems include transportation lines and nodes (e.g., air, water, rail, highway); power generation and distribution systems; communications systems; food distribution; and fuel storage and distribution.”

- **Communications Challenges**

- “[EMP] has the potential to disrupt the communication network, other electronic equipment, and associated systems within approximately a 5-kilometer (~ 3-mile) range from the 10-kiloton ground blast.”
- “The communication systems in the area will suffer similar damage and will likely be repaired in [several days to a couple of weeks].”

Evacuation (cont.)

- All infrastructure within .5 miles destroyed, all infrastructure within 3 miles significantly damaged:

Memorial Bridge

Rt. 66 Bridge

Independence Ave (+associated bridges)

Potomac River Freeway

North-South streets from river to 10th Street

East-West streets from river to T Street

Metro Rail lines

Connecticut Avenue

Massachusetts Avenue

Pennsylvania Avenue

New York Avenue

- Up to 160 car accidents on regional basis, majority on major arteries
 - NPS: 3,100 eye injuries, range up to 14.3mi
 - Assume 10% operating vehicle; of that 50% crash

Plan: Shelter in place – it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- Counter-intuitive & no way to get the word out
- Less than 10% of American families have a disaster kit
 - Level of preparedness is falling not rising
- Without water, food, baby formula, & information people will break shelter, venture into contaminated area
 - Sooner or later you have to come out
- DHS: delays in the actual physical evacuation of these people through the contaminated environment will cause further casualties

Shelter-In-Place

- Shelter-in-place (SIP) is counter intuitive.
- Lacking communications, most victims will flee:

“However, information distribution will be greatly hampered by power outages and damaged electronic equipment. Since information dissemination will be difficult, it is likely that self-evacuation will be the dominant protective action taken in the short term (~ 24 hours) after detonation. Authorities may resort to loudspeakers mounted on vehicles to help disseminate information.”

HSC, NPS

- Even those who do SIP, will need supplies to outlast the half life of dangerous radiation levels
- 2004 Red Cross survey: Less than 10% of American families had a disaster kit—*and this level of preparedness is falling not rising*
- SIP impractical for residents of apartment buildings
 - Power drives water supplies, sewage
 - Few apartments have space for adequate SIP supplies (family of 4 requires 56 gallons water for 7 days; 24 gallons for 3 days)

Impacts (cont.)

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- “Infrastructure Damage: Total within a radius of 0.5 to 3.0 miles.”
- There will be no indigenous response/governance units larger than the family, street gangs.
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ARS

- Vast majority of victims suffer from ARS
 - Opportunistic infection (Neutropenia)
 - Internal bleeding (Thrombocytopenia)
 - Higher doses GI impacts
 - Higher doses other internal organs
- Treatment window
 - Bone marrow transplants: Longest window; not feasible for mass casualties
 - Resource intensive treatments (requires intensive supportive care; antibiotics; platelets; hospitalization; costly): 12/24 hours post exposure
 - Mass casualty appropriate treatments: 4-12(?) hours post exposure
 - First responder prophylactics: pre-exposure



ARS

Management of ARS Injuries

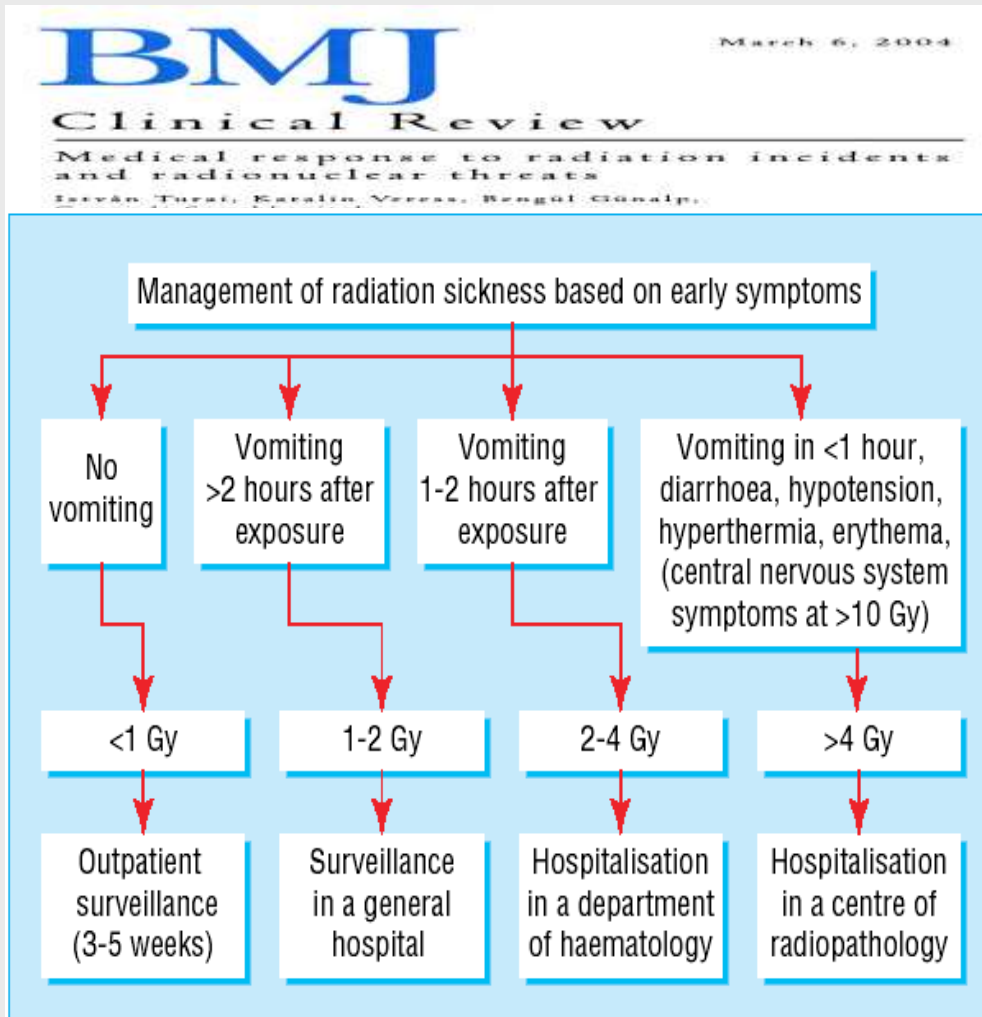


Fig 3 Management of radiation sickness at different levels of medical care depending on the appearance of early symptoms and the estimated radiation dose to the whole body

BMJ VOLUME 328 6
MARCH 2004

Numbers of patients with exposure >1Gy will be in hundreds of thousands

The Life/Death Stopwatch

The longer a victim is exposed to radiation, the greater the dose, the greater the injury.

From the moment of exposure, the longer any victim goes untreated, the higher likelihood of death—the golden hour amplified.

For hundreds of thousands of victims, clock starts running w/in minutes of blast.

The greater the delay, in touching/treating a victim, the harder it is to save that victim, and the higher the demands of intervention.

If you can't respond within the ARS treatment window, you will lose hundreds of thousands of people.

Plan: HHS plans are based on treating just numbers of actually injured and dying – it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- All treatment requirements are based on estimated numbers of casualties and a small number of expected fatalities
 - Plans provide “pastoral care” for most expected fatalities, which isn't medical care.
- However, we have no way to differentiate (triage) between those actually irradiated and those worried well, presenting as symptomatic
- Absent effective triage you must treat all who present—and even that under-counts.
 - Many real victims present as asymptomatic
- Using DHS estimates, *then reducing these assumptions substantially*, the number of people who survive the blast and will require treatment is approx. 700,000+.

ARS Triage

- **Triage will require 73,000+ trained personnel for first 48 hours; however, you still have no way to triage**
- **HSC, NPS**
 - “Triage will be a major issue for care providers. Among other things, this will require the determination of which victims may benefit from medical attention and which have received radiation doses that make it unlikely that they will survive. While there are post-exposure methods to measure dose levels, these methods are unlikely to be widely available during an incident of this nature. This is due to the extremely limited national capability for these tests and to the complexity of the laboratory procedures required.”
- **Clinical Guidelines Recommendations - SNS Radiation Working Group June 2004 (Federal Officials)**
 - Access rate of decline of nadir of the absolute lymphocyte count over the initial 12 hours to 7 days after exposure.
 - Complete blood cell count with leukocyte differential should be obtained immediately after exposure, 3times per day for the next 2 – 3 days and then twice per day for the following 3-6 days.
 - This will require deployable hematology laboratory capabilities be established and exercised for mass casualty scenarios.
 - May not be practical in large nuclear scenario

ARS Triage (Cont.)

- RDD/IND Preparedness Working Group Summary Report (HS-03-0007) assumes that capacity exists to test worst off victims (e.g., 215K dying)
 - “In cases where the number of victims significantly exceeds the available medical resources, patients reporting vomiting less than 4 hours post-exposure can be directed for immediate further testing while the treatment and evaluation of radiation exposure for other patients may be temporarily deferred.”
- However, NPS acknowledges we lack triage testing capacity for even a fraction of victims
 - HSC, NPS: “While there are post-exposure methods to measure dose levels, these methods are unlikely to be widely available during an incident of this nature.”
- Guidance calls for use of crude diagnostics (time to vomit), then acknowledges won't work
 - HS-03-0007: “In the [Goiania Accident] 8.3% of the first 600,000 people screened presented with signs and symptoms consistent with acute radiation sickness: e.g., skin reddening, vomiting, diarrhea, although they had not been exposed.”
- If attack occurs in flu season, indicators masked

Triage and Treatment Demands

- 470,000 victims survive blast
- DHS Emergency Radiation Dose Assessment Program: 100-400 worried well per victim will seek medical help;
- Assuming just 4-1 unexposed-exposed seeking care (typical medical setting) = 1.88M regionally + actual victims = 2.35M
- Each triage unit (3 people) handles 96 victims in 24 hours; triage 2.35M in 24 hours will take approx. 24,479 triage teams; approx. 73,437 trained personnel
- Of 2.35M WW, 10% (235,000) present w/ symptoms (require actual care); total population requiring treatment = 705,000
- Assume 4-1 patients to medical personnel (including tech and support), total medical personnel requirement of 176,250
- NB: IDA study calculates 48,000 but does not figure in worried well.

Plan: HHS deployment target 100K courses of ARS drug – it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- DHS: 314K casualties & 215K fatalities from 10KT nuclear bomb in a mid-sized US city
 - 429K or more treatment shortfall
 - Does not account for worried well and lack of triage
- Who decides who lives & dies? What happens when people hear there isn't enough to go around?
- Assumption that every dose procured can be deployed in a timely manner to a distant city – in the aftermath of a nuclear attack – is negligently optimistic
- Hundreds of thousands guaranteed to die – *needlessly*

Plan: HHS to deploy drug via Strategic National Stockpile (SNS) – it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- SNS guarantee of 24 hr delivery is to intermediate staging, not to victims
- Getting drugs to hospital impossible
- Getting people to hospitals within treatment window impossible
- Administering drugs to hundreds of thousands of victims in hospitals impossible
- Deployment times will exceed treatment window for all known counter-measures – people will die
- DoD rad/nuc experts favor forward deployment strategy for any ARS drugs

Plan: Treat victims in medical treatment facilities— it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- By most conservative estimates a modest nuclear attack will cause hundreds of thousands to seek treatment
- No region—let alone city—has such surge capacity on a good day
- Attack will seriously degrade regional capacities
- No medical facility has the security and other systems in place to manage such numbers
- No region has adequate numbers of trained medical personnel
- Plans relying on bringing massive numbers of trained personnel in will take far too long, eclipse treatment window

Medical Surge Capacity

- Per DHS, 10KT bomb used v. mid-size US city produces approx. 314K casualties; 215K fatalities
- No city has surge capacity to care for these numbers
 - New York State has just 20,000 open beds on a good day.
 - Most of these beds are not critical care beds.
 - Attack will destroy/contaminate thousands of currently available beds. *British Medical Journal 2002*: attack on NYC takes 9,700+ beds off line.
- Based on these numbers NY State would be short over half-million beds post-attack
- We lack the medical personnel and facilities to handle these numbers of victims:
- Post-attack medical personnel shortages will worsen situation
 - 2005 study NYC healthcare workers: 50% will abandon their posts in a nuclear attack
 - Approx. 60% of nurses in Richmond, VA are single moms – they have their own children to worry about
 - Hiroshima: Vast numbers of medical personnel will be among injured and dying

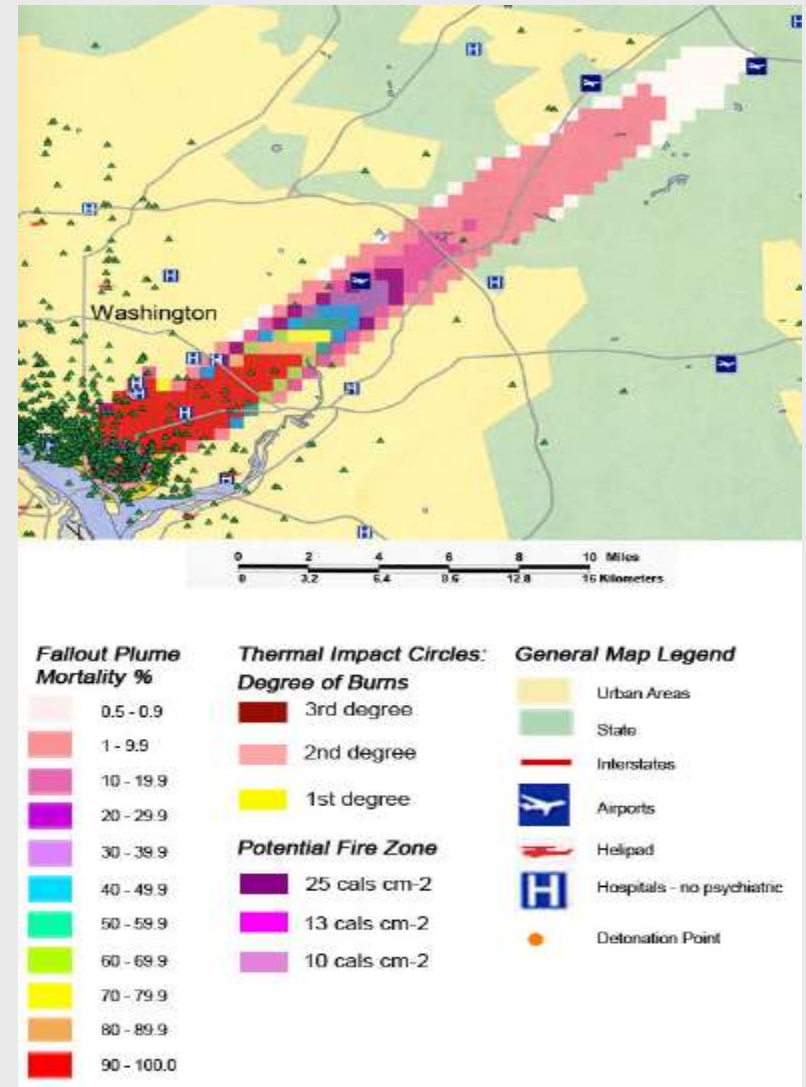
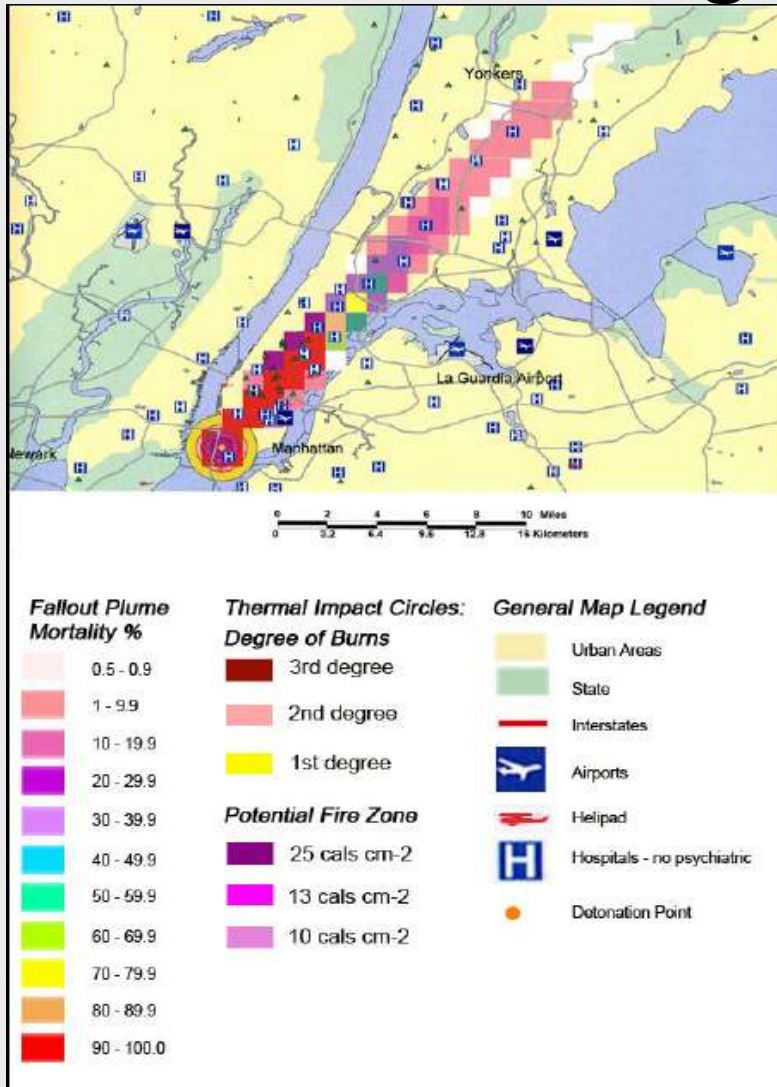
Medical Surge Capacity (Cont.)

Impact Blast NYC

- Number of beds: Approximately 57,200 (American Hospital Association)
- Average daily occupancy rate: 64.4% (AHA)
- Approximate available beds for NYS in mass casualty scenario: 20,000
- Number of beds eliminated by nuclear attack: 9,700 (*British Medical Journal* 2002)
 - 1,000 beds lost in blast
 - 8,700 beds in contaminated zone

Medical Surge Capacity (Cont.)

Degradation



Medical Surge Capacity

Hiroshima Example

- Number of hospitals functioning post-attack: 3 of 45 (6.7%)
- Number of physicians still working: 59 of 298; only 28 uninjured
- Casualty rate among nurses: 92.9%
- Who is going to be caring for victims when vast numbers of doctors and nurses are among the victims?

Standard of Care

- **Post attack capacity/standard of care**
 - “The level of care that can be expected may be significantly lower than would normally be expected. This may well contribute to a larger than expected number of casualties.”

HSC, NPS

- “We’d warehouse victims in hallways, cafeterias ... We’d turn away all but the worst off. We’d hand out morphine. If a victim was bad off and lucky they’d see a nurse every 8 hours. We’d try to change dressings, until supplies ran out. We expect riots at our doors.”

Marsh Cuttino,
Emergency Medicine Doctor,
VCU Health System;
Richmond Medical Response Steering
Committee & Homeland Security
Coordinating Council

“Pastoral Care” ≠ Medical Care

Plan: Ship victims to distant medical treatment facilities— it won't work

- **Current – civilian agency – response plan is fundamentally flawed & will cost lives**
- Assumes that even on a regional basis we have MTF capacities that we just don't.
- Before a victim gets shipped, they will first need to walk out of the contaminated zone, get processed, get decon'd, get loaded up—this will take significant amounts of time, eclipse window
- Decon process will take up entire treatment window for many/most victims
- Buses, rail, trucks, planes dependent upon infrastructure that will not support massive evacuations
- ARS victims suffer from immune-suppression; enclosed vehicles become incubators
- Where will you find the drivers? The buses? The trains?

Shipment of victims to distant care

- *JP 3-11*: “As a general principle, to limit contamination of evacuation assets, patients should be decontaminated before evacuation.”
 - Lack decontamination capacity for hundreds of thousands
 - Lack time to deploy decontamination assets to the affected area.
- Decon process will take up entire treatment window for many/most victims
 - 300 platoons, 7,200 personnel, required to decon 1.5M people and 400,000 vehicles in 24 hours
- Buses, rail, trucks, planes dependent upon infrastructure that will not support massive evacuations
 - All infrastructure within .5 miles destroyed, all infrastructure within 3 miles significantly damaged
 - Lack of power halts mass transit
 - Large numbers of car accidents snarl roads up to 14 miles out
 - For major cities that renders inoperable most mass transit systems, major thoroughfares
- No region has hundreds of thousands of beds
- Nearby areas will face their own surge issues (e.g., for DC, that will cut beds across MD, VA, PA, WV)—necessitating much longer distances and travel times

Existing Stockpile

- Potassium Iodide (KI)
 - Widely stockpiled
 - Can protect the thyroid against long-term cancer risk
 - *Does not treat ARS – main nuclear killer*
 - Most nuclear victims will die well before thyroid cancer becomes a risk
 - Chernobyl data: post-exposure risk of thyroid cancer in normal adults relatively low
 - Best if given *pre*-exposure; utility drops sharply if given post-exposure (less than 7% efficacy if given 24 hrs post-exposure)
- G-CSF
 - Stockpile in place
 - Effective only against Neutropenia – *does not treat Thrombocytopenia*
 - Must be given with platelets (IV, special handling, limited supply)
 - Cannot be given to many (e.g., open wounds; E. coli sensitive; sickle cell anemia), histories must be taken – will slow distribution
 - Requires hospitalization
 - Cost precludes use on mass scale (\$2,500 not incl. hospital costs)
 - Not appropriate for mass casualty scenario

Existing Stockpile (Cont.)

- Chelating Agents (Ca-DTPA; Zn-DTPA)
 - Being procured under Bioshield
 - Assists exposed individuals excrete certain radionuclides
 - Does *not* treat ARS – the main nuclear killer
 - No evidence chelation produces a survival benefit
 - Useful only for plutonium and americium – isotopes unlikely to be used in a nuclear bomb
 - Must be given by IV
 - Best if given within 6hrs of exposure
 - New England journal of Medicine: “. . . not very useful for the treatment of contamination with other radionuclides, and they are not useful after the detonation of a nuclear weapon.”
- Prussian Blue
 - Being procured under Bioshield
 - Traps cesium and thalium in the gut, prevents re-absorption, speeds excretion
 - Does *not* treat ARS – the main nuclear killer
 - Limited efficacy beyond cesium and thalium –no impact with more likely bomb radionuclides

“A nuclear attack is by far the most serious kind of terrorist attack. Yet it appears to have been given the least attention in planning and preparing for consequence management

The United States is unprepared to mitigate the consequences of a nuclear attack. We were unable to find any group or office with a coherent approach to this very important aspect of homeland security. . . .

This is a bad situation.”

Brinkerhoff, J., *Managing the Consequences of a Nuclear Attack*, Institute for Defense Analysis, 18 July 2005

Better Plan: Available ARS Counter-Measures

- The Armed Forces Radiobiology Research Institute (AFRRI) is the government's primary source of research on radiation injury.
- Since 1961 AFRRI had tested over 4500 drugs to protect people from radiation exposure.
- AFRRI has been co developing two ARS drugs
 - HE2100 selected by AFRRI as the lead compound to protect against acute radiation injury specifically bone marrow suppression
 - *CBLB502* newly emerging drug indications are it counters bone marrow suppression and GI impacts

Better Plan: Get counter-measures into hands of first responders and victims

- Widespread forward drug deployment:
 - Military/first responders
 - High risk areas (cities, around nuclear plants)
 - Community level – fire stations, police stations, schools, universities, population centers, malls
 - Along evacuation arteries
 - Air drop
- Encourage private sector stockpiling (e.g., large employers, stadiums)
- Public education campaign
- Triage worst cases to medical facilities – shrinking the surge frees up treatment capacity
- Protected military & first responders can enter hot zone for some period of time safely

Response Alternative

Available ARS Counter-Measure Status

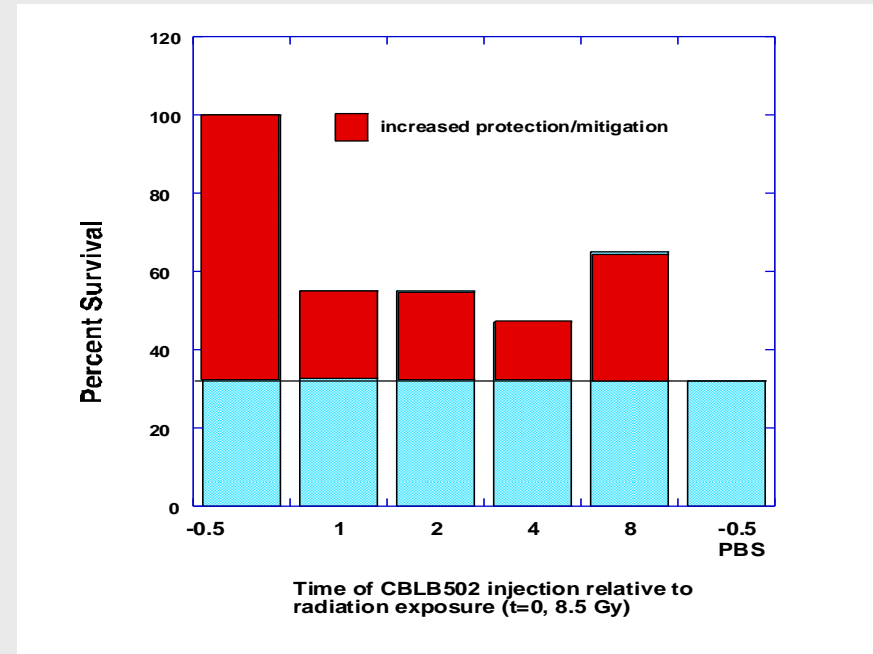
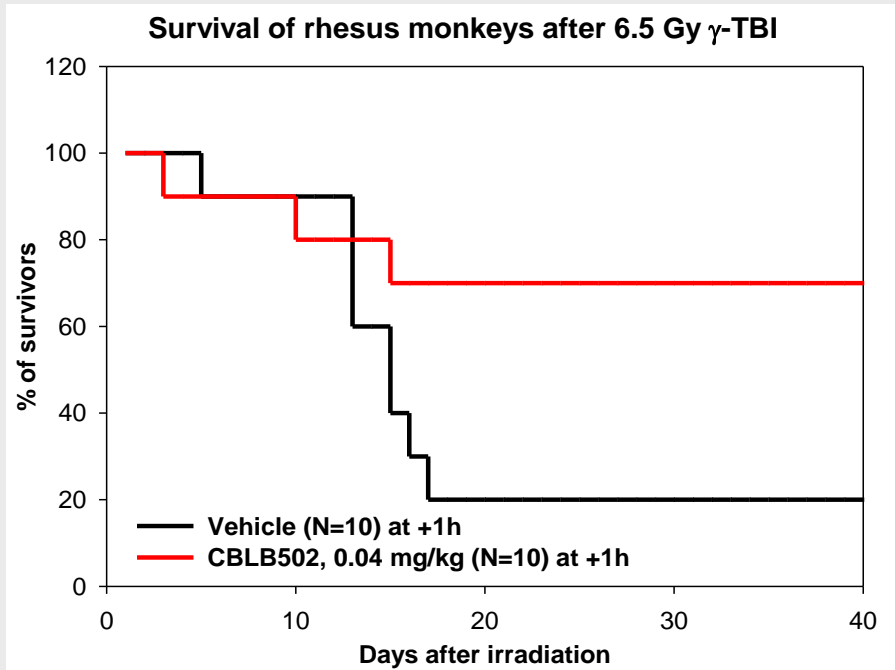
- HE2100 Drug in final stages of development; could be deployed under year—**Development Suspended**
- *CBLB502* now entering primate testing
 - A pilot study in which 20 non-human primates received lethal doses of radiation demonstrated a significant reduction in death rates (from 75% to 33%) and a 10-day delay of radiation-associated mortality in the group of animals treated with *Protectan CBLB502* without any associated signs of toxicity
- HHS issued ARS RFP over a year ago—cancelled it.
- DoD has developmental RFP out.

Effective Deployment Nuclear Counter-Measure

- No counter-measure's treatment window is greater than window to deploy via SNS
- Any counter-measure will require alternative deployments
 - Forward deployment (akin to Chempacks); schools, businesses, police/fire, post offices; evac routes
 - Air drops

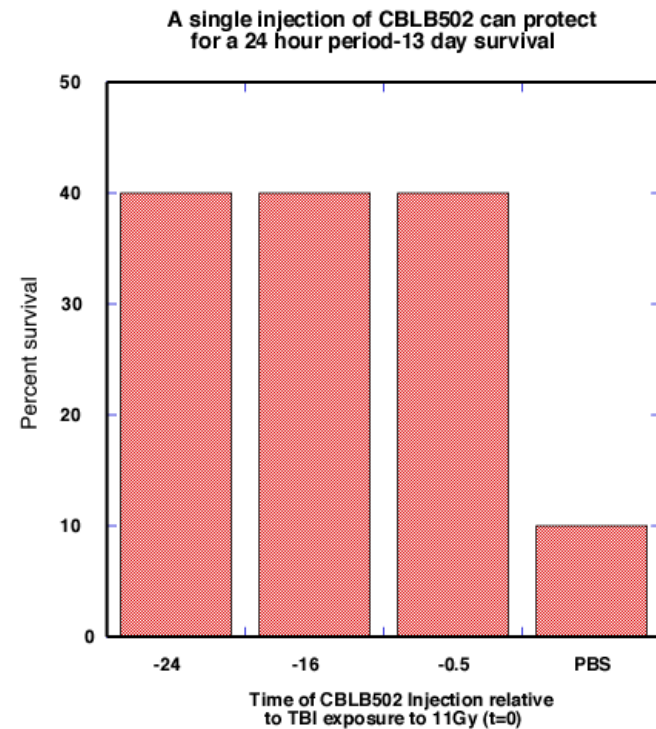
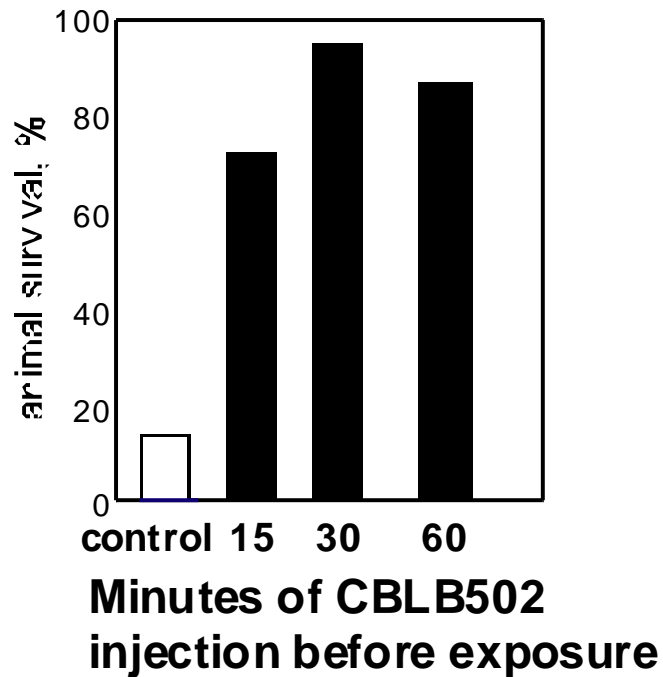
Response Alternative (Cont.)

CBLB502 can increase survival when administered after exposure



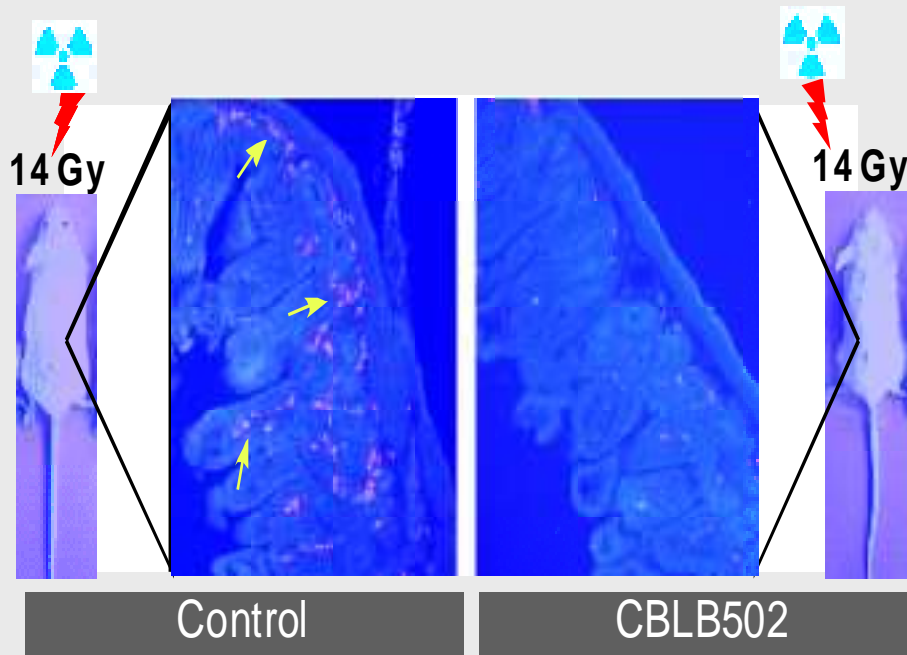
Response Alternative (Cont.)

CBLB502 provides rapid protection that lasts at least 24 hours

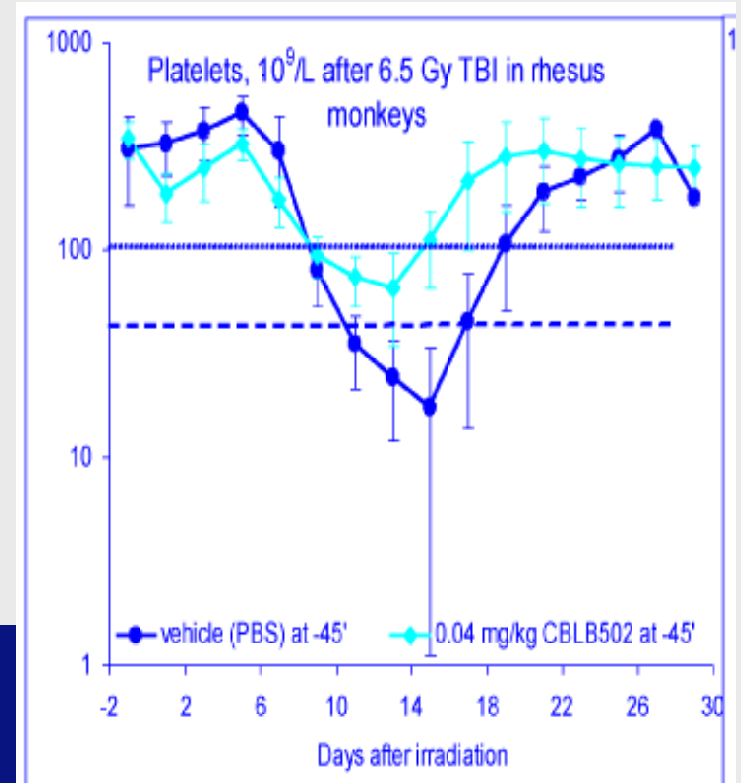


Response Alternative (Cont.)

CBLB502 protects both the
GI and HP systems from damage



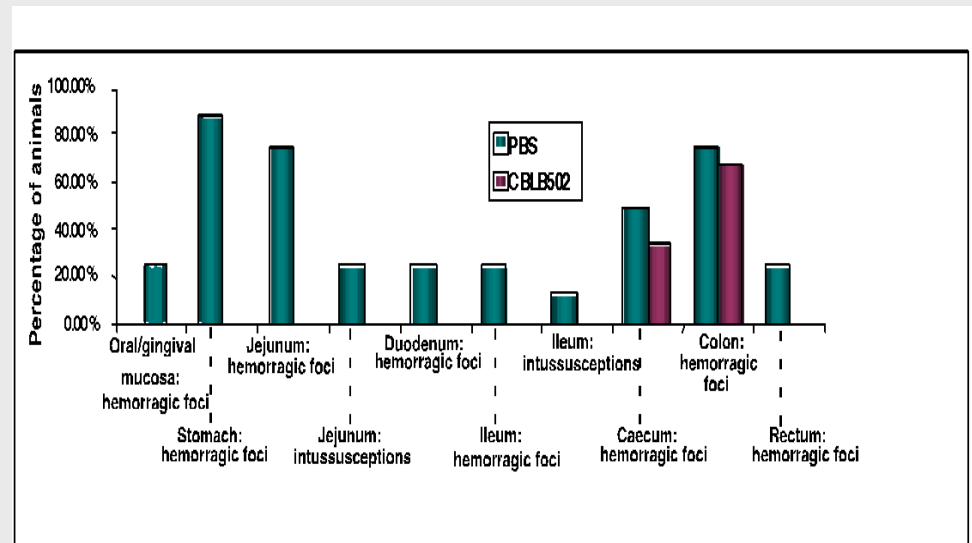
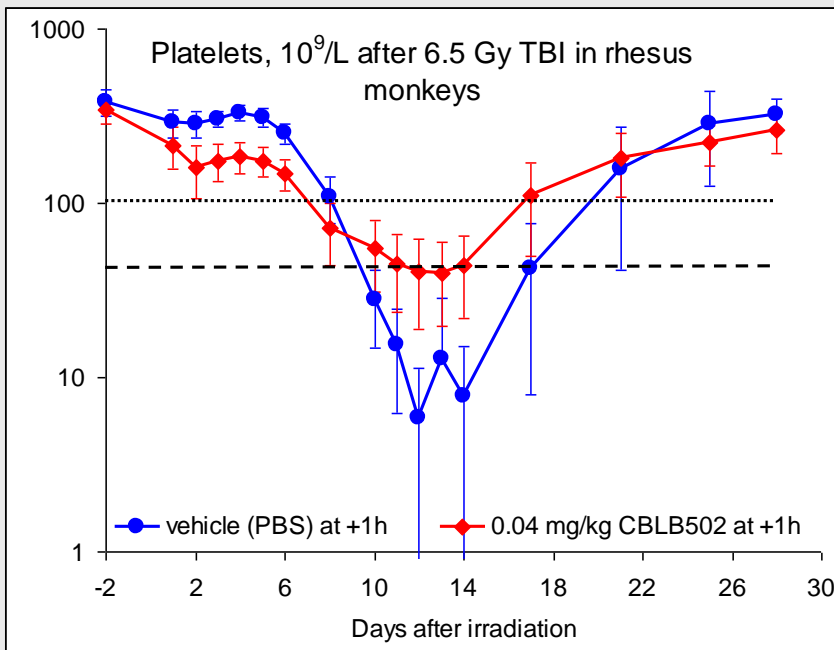
Green naïve BM cells use to identify damaged
(apoptotic) regions with the gut



Reduces thrombocytopenia

Response Alternative (Cont.)

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GI and HP systems from damage



Addendum on Threat

Al Qaeda's Nuclear Intentions

OBL's WMD Fatwa

"Nuclear Warfare is the Solution for Destroying America"
In the name of Allah the most merciful. Thus, you are not mistaken in reading this text. This is the only way to kill the greatest possible number of Americans. The Americans have never experienced a threat like this one. During World War II, America used this [nuclear] weapon twice in three days following the successful Japanese attack on Pearl Harbor. America has bombed Iraq with weaponry that will pollute the soil and underground water with radiation for thousands of years. It also enhances its bombs with depleted uranium to cause even greater harm to the people and the environment.

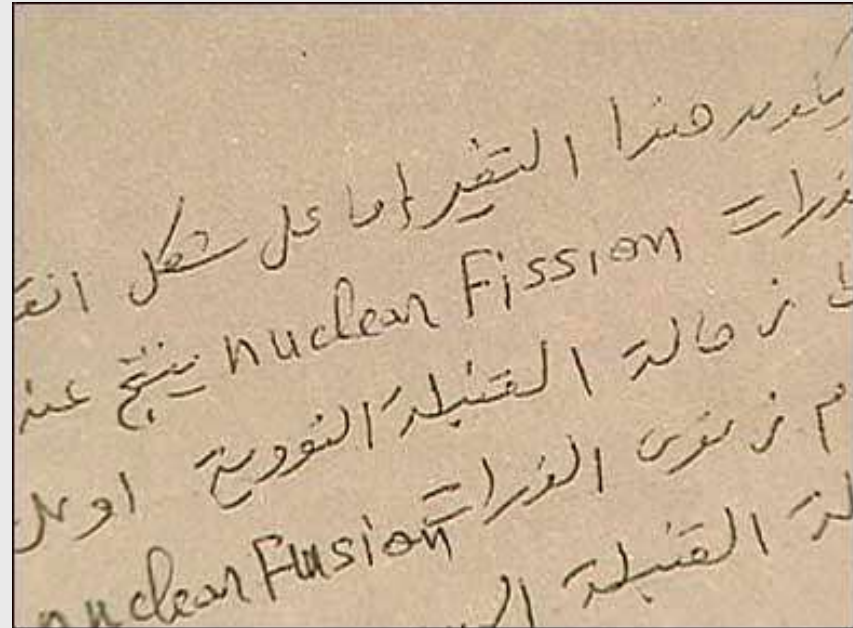
This, so that no one should think that after they leave the island of [the Prophet] Mohammed [the Arabian Peninsula], which they have transformed into a restricted area, just to return to the same place [because of the pollution perpetrated by them]. . . . Therefore, an eye for an eye, a tooth for a tooth. Even though the Americans have bombs possessing enormous power, Al-Qaeda is even more powerful than they, and it has in its possession bombs which are called "dirty bombs", and bombs with deadly viruses, which will spread fatal diseases throughout American cities.... The coming days will prove that [the Al-Qaeda organization] is capable of turning America into a sea of deadly radiation, and this will prove to the world that the end is at hand.... Yes, we will destroy America and its allies, because they have used their power for evil against the weak. And now, the end approaches at the hand of the enlightened [Islamic] youth astride their horses [fighting the war against the infidels]; they will dismount either as victors or vanquished [i.e. - fall in holy war for Allah].

Author: Abu Shihab El-Kandahari
26 December 2002



OBL, al Qaeda Nuclear Efforts

- OBL Embassy bombing trial, prosecution witness Jamal Ahmad al-Fadl detailed efforts to assist Bin Laden in an attempt to acquire uranium.
- 1998, *Al-Hayat* reported that OBL made a \$30M deal to purchase 20 nuclear warheads stolen in Russia by Chechnyan rebels.
- 1998, bin Laden's aide, Mamdough Mahmud Salim, arrested in Munich, Germany on charges of attempting to obtain highly enriched uranium (HEU).
- 2001, Arabic "Superbomb" document found in Abu Khabbab home—codename of senior al Qaeda. Document discussed types of nuclear weapons, physics of nuclear explosions, materials needed to make them, and effects on urban centers.
- 2001, US intel reports that at meeting of senior Al Qaeda leaders, member held up cylinder and stated it was "Dirty bomb" materials.
- 2002, US uncovered rudimentary diagrams of nuclear weapons in a suspected al Qaeda house in Kabul.
- Two Pakistani nuclear scientists, Sultan Bashiruddin Mahmood and Chaudiri Abdul Majeed, admitted that they had had long discussions with al Qaeda operatives in August 2001 about the development of nuclear weapons.



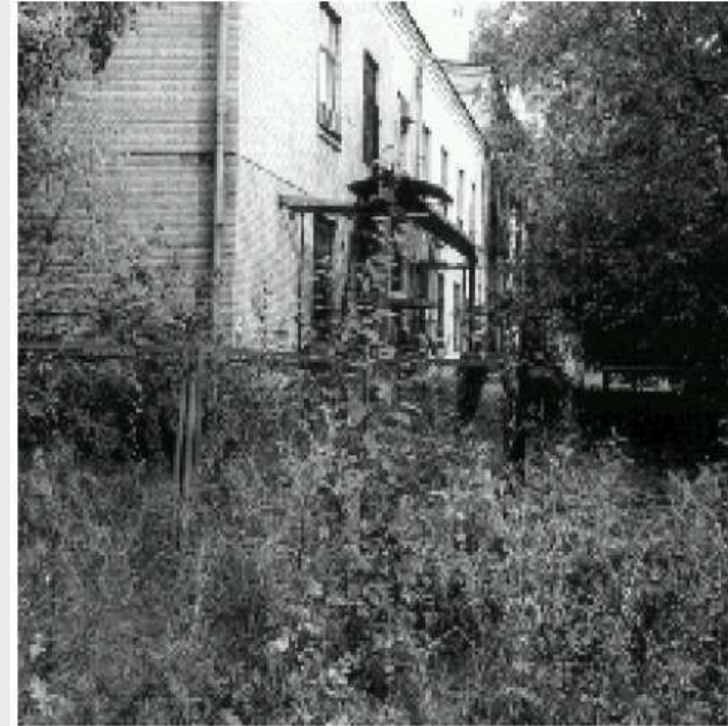
Nuclear Attack is Achievable and Cost-Effective

- 19-member team; ~1 year; total cost \$5.4M.*
- “[O]n a per murder basis, nuclear weapons are both cheap and can be used against high-profile targets.”
- A successful nuclear attack would cost approx. \$100 per murder; typical al Qaeda attack costs \$100-\$300/victim.
- This does not take into account the “ROI” in terms of injured and economic damages.
- PNL estimates that clean costs of a terrorist-size nuclear attack on NYC would equal/exceed US 2005 GDP.
- GAO reports that a series of dirty bomb attacks would cost the US economy \$58B.

*Zimmerman & Lewis, *The Bomb in the Backyard*, For. Pol’y, Nov/Dec. 2006.

Availability of Weapons Grade Material

- IAEA: Nuclear smuggling is up substantially since 2002; 149 confirmed instances in 2006 alone
- Radioisotope Thermoelectric generators (Chernobyl level radiation potential) remain unsecured/abandoned.
- Security upgrades at 16-of-20 major waste sites (Russia and Ukraine) not completed—DOE “most vulnerable in world.”
- 70 percent of upgrades within FSU have been at lower risk hospitals
- Funds may not support current contractual commitments.

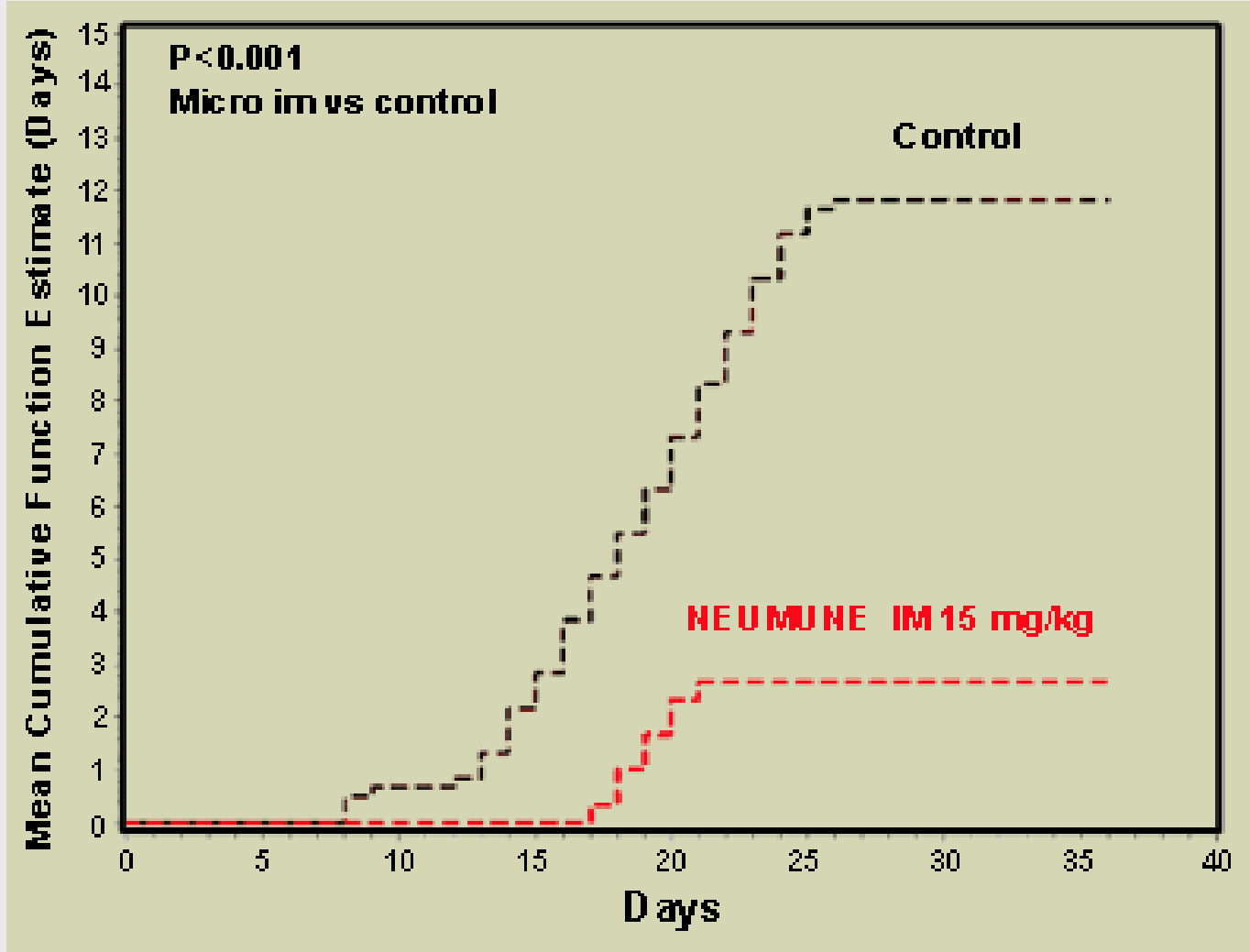


Kurchatov Institute (Moscow) building housing HEU (2004)

Addendum on HE2100

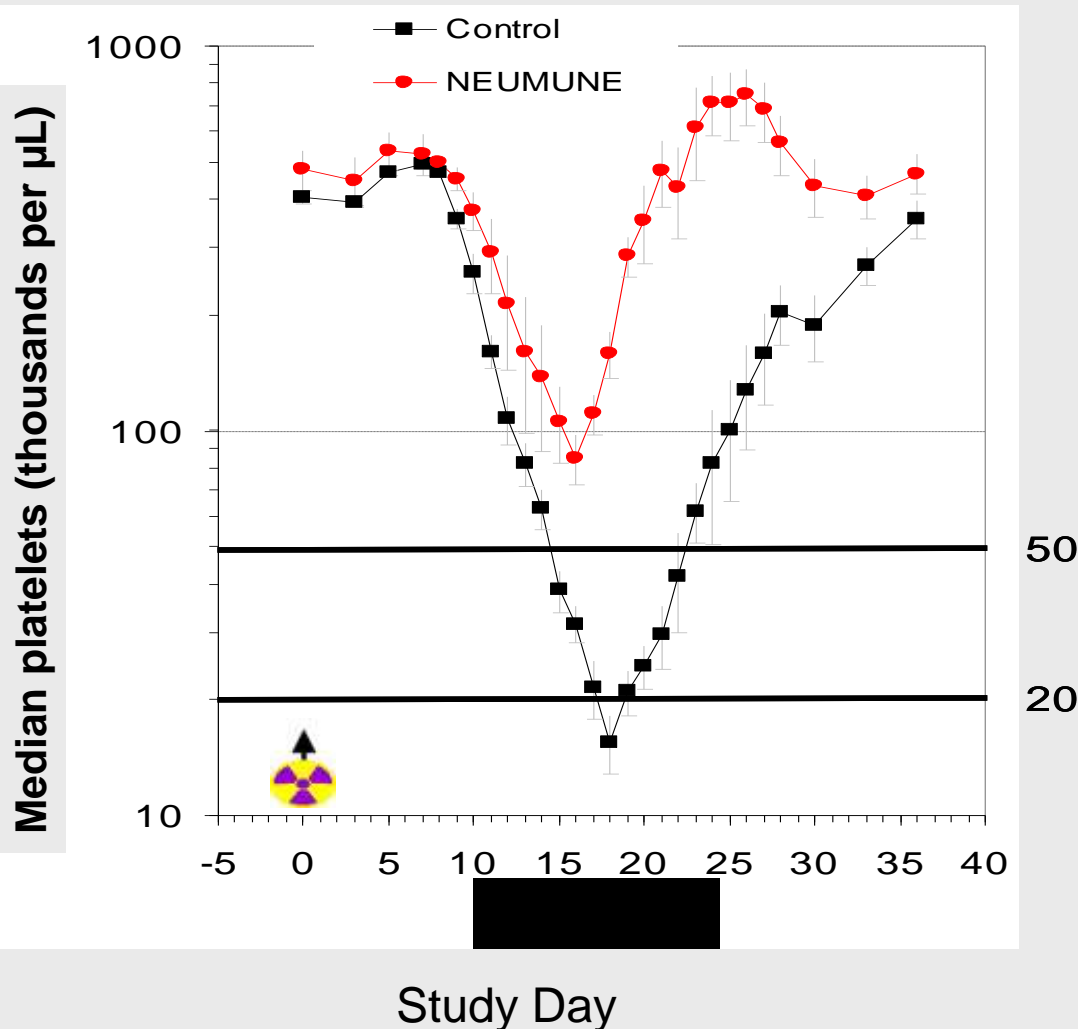
Response Alternative (Cont.)

HE2100 Days of Severe Neutropenia in Rhesus Monkeys Exposed to 400 cGy TBI



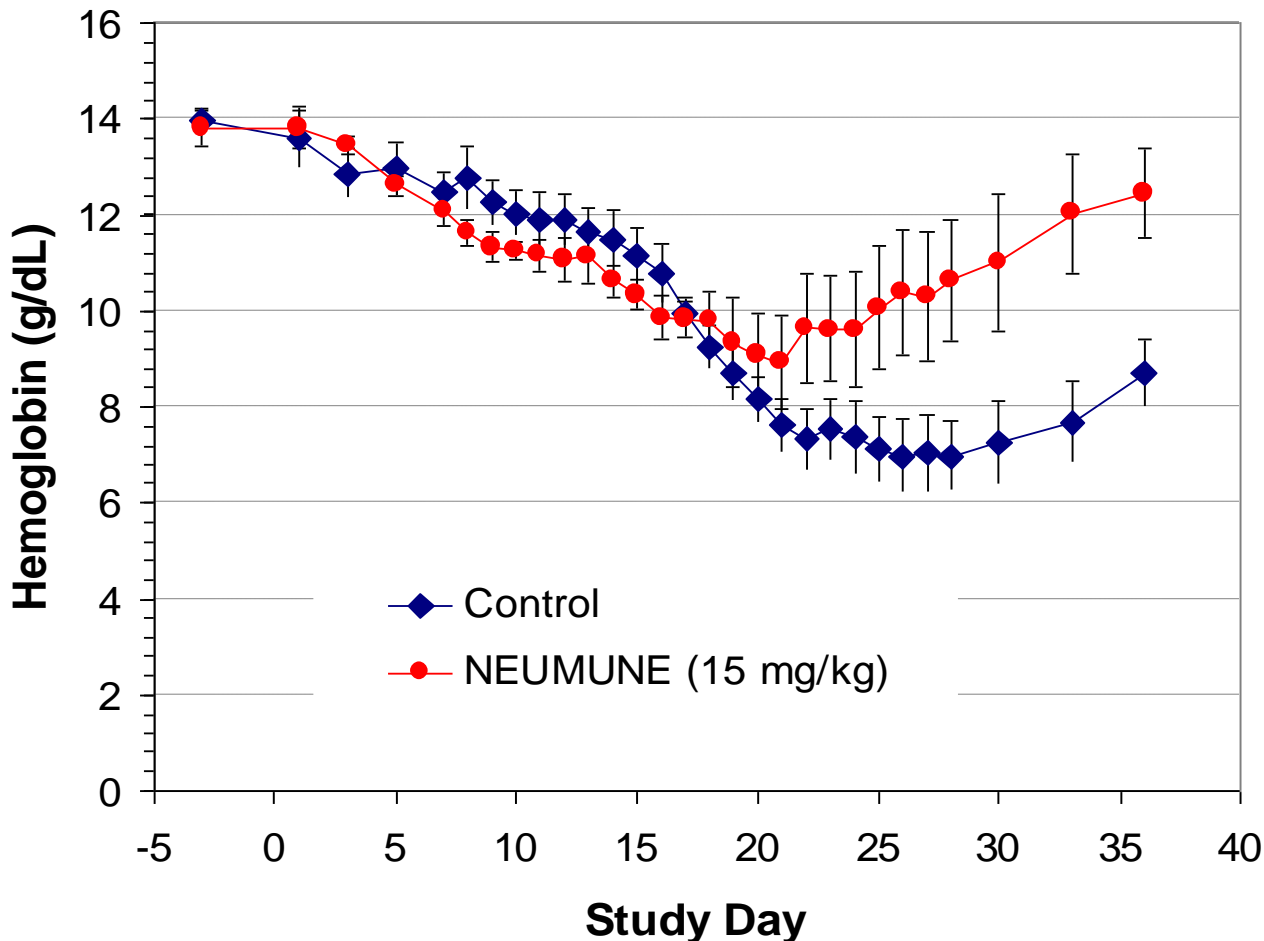
Response Alternative (Cont.)

HE2100 Impact on Severe Thrombocytopenia in Rhesus Monkeys Exposed to 400 cGy TBI



Response Alternative (Cont.)

Severe Anemia; Rhesus Monkeys
Exposed 400 cGy TBI w/ HE2100



Days of Severe Anemia
($<8\text{g/dL Hgb}$)

Placebo 7

NEUMUNE 0

$p < 0.0001$

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