EDGEWOOD CHEMICAL BIOLOGICAL CENTER

Homeland Security – *"Partnership with Industry"*

Chemical, Radiological and Biological Defense

NDIA 2006 Homeland Security Symposium

Jim Zarzycki
Director, Edgewood Chemical Biological Center

30 March 2006

Edgewood Chemical Biological Center

Mission

Provide integrated science, technology and engineering solutions to address chemical and biological vulnerabilities

Vision

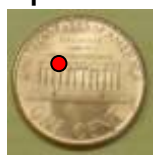
A premiere national resource for chemical and biological solutions

Core Competence

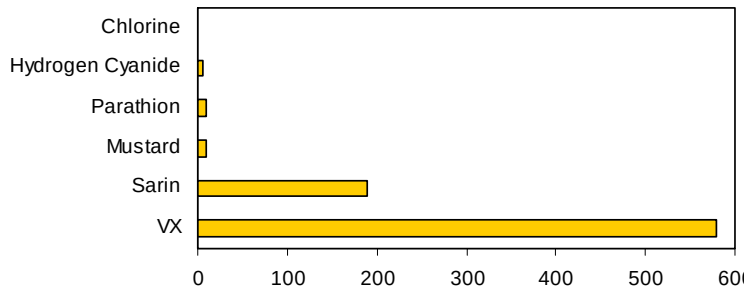
Working with chemical and biological agents at all stages of materiel lifecycle

Scientists working in ECBC's Biological Safety Level 3 Laboratory

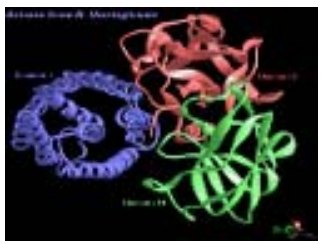
- Primary DoD technical organization for **non-medical CB defense**
- **Support over the entire lifecycle**: Basic research through technology development, engineering design, equipment evaluation, production support, sustainment, field operations, and disposal
  - **Detection**
  - **Protection**
  - **Decontamination**



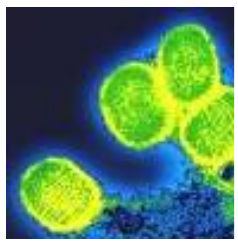
CW agents are on average 200-600 times more toxic than toxic industrial chemicals



Bacteria



Toxins



Viruses

Location and Organization Relationship/Reporting Chain

Aberdeen Proving Ground, Aberdeen Area

Aberdeen Proving Ground, Edgewood Area

Department of the Army

GEN Benjamin Griffin
Army Materiel Command
★★★★

MG Roger Nadeau
Research Development and Engineering Command
★★

Jim Zarzycki
Director
Edgewood Chemical Biological Center

Activities at ECBC enabling industry to better support CB Defense and Homeland Security

Enabling Activities at ECBC

Basic & Applied Research | Engineering | Field Services and Operations

Supporting Science: Answering the fundamental CB questions

Common reference point for all

New Developments in CB Technology

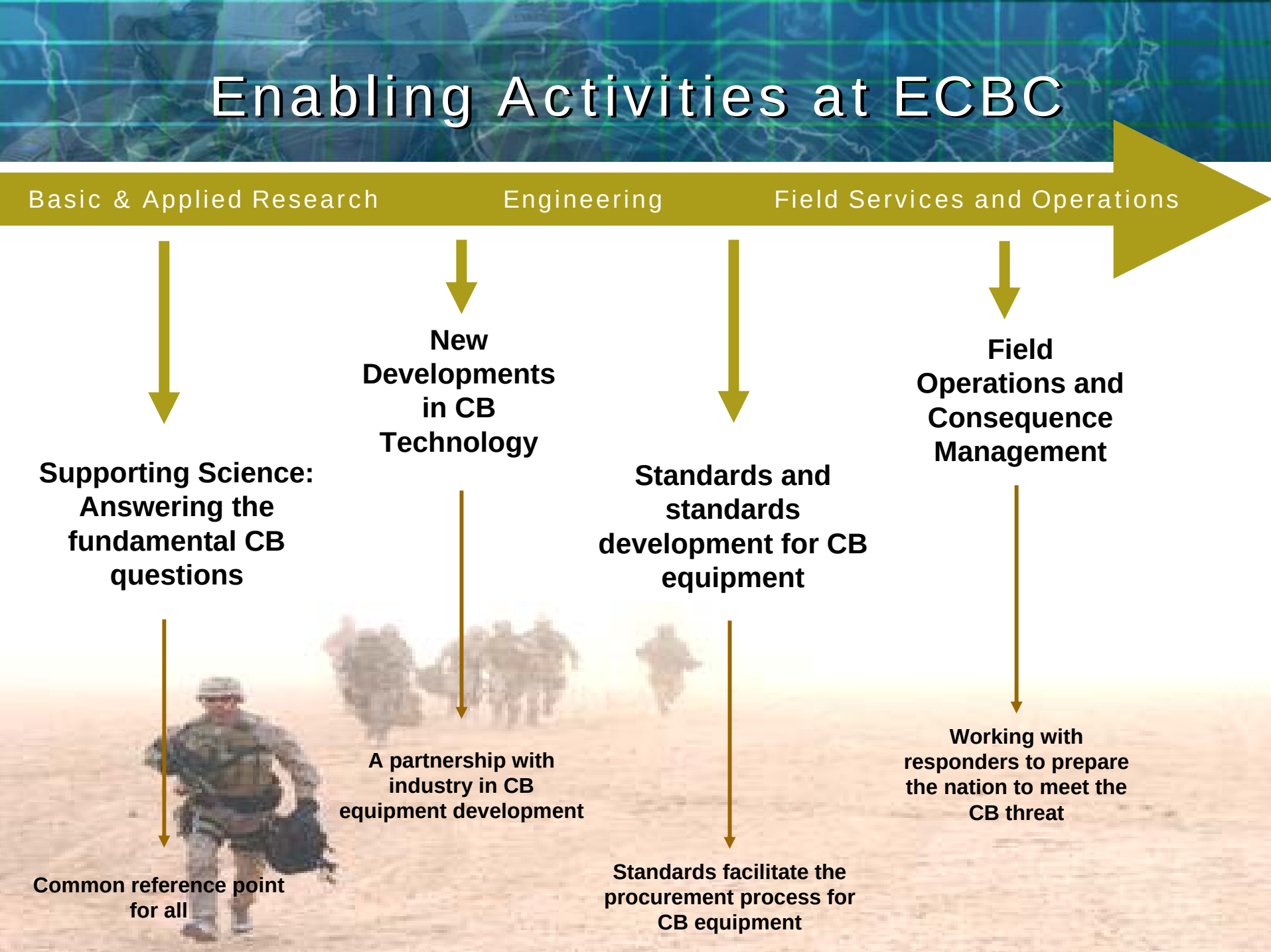
A partnership with industry in CB equipment development

Standards and standards development for CB equipment

Standards facilitate the procurement process for CB equipment

Field Operations and Consequence Management

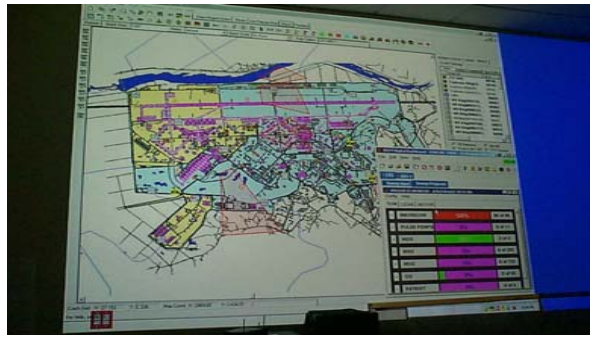
Working with responders to prepare the nation to meet the CB threat



Field Operations and Consequence Management

PortWARN

- Provides a commander with situational awareness: detector data, hazard prediction
- Incident management software
- Integrates nuclear, biological, chemical and meteorological sensors
- All port events included and tracked: medical emergencies, intruders, facility damage and road blocks
- Sends reports to higher headquarters
- Notifies port workers via visual and audible alarms
- Installed at PACAF bases in 2004-2005. Being installed in Kuwait
- Industry Partners: **SENTEL** (Hardware), **ITT Industries, NGI Systems, and Optimetrics** (Software)



Above: PortWARN "Electronic Data Wall"

Above and below: PortWarn installed at Port of Ash Shuaybah in Kuwait

Licensing of Technology in Support of Consequence Management

Enzymes

- Enzymes for destruction of nerve agents, sulfur mustard, BW agents and toxins developed at ECBC and patented
- Nerve agent enzymes licensed to **Genencor** for large-scale production and commercialization
- DEFENZ™ 120G marketed and produced for civilian emergency response

Above: Enzymes packaged and distributed in dry form

Biological Sampling Kit (BiSKit)

- Human engineered, efficient device that can collect biological contaminants from surfaces
- Licensed to **Quicksilver Analytics** for manufacture
- Allows multiple samples to be taken in quick succession, minimizes potential for operator exposure and cross-contamination

Above: BiSKit is easy to handle, even with protective gear

Automated Decision-Aid System for Hazardous Incidents (ADASHI)

- Portable, computer-based decision-aid for improving response to hazardous or CB incidents
- Patented by ECBC and licensed to **OptiMetrics**
- Designated by Department of Homeland Security as a qualified anti-terrorism technology and placed on the approved products list

Above: ADASHI provides emergency responders incident decision-making tool

Standards Development for CB Equipment

- Initiative underway to develop industry-wide standards for CB equipment
  - DHS oversight
  - Close collaboration among DHS, domestic agencies, DoD, and industry
  - Involvement of independent standards development organizations – ANSI, ASTM, NFPA
- DoD policy requires acquisition of equipment certified to these standards
- ECBC supporting interagency community in CB standards development

National Fire Protection Association
The authority on fire, electrical, and building safety

Assures users of suitability of equipment and levels the playing field for industry

Standards Development for CB Equipment

Respiratory Equipment

- Established: Self contained breathing apparatus (2001), air purifying respirators (gas masks) (2003), and escape hoods (2005)
- In Process: Powered air purifying respirators (Due 2006) and closed circuit SCBA (Due 2007)

Personnel Protective Ensemble

- Established: NFPA 1994: Standard on protective ensembles for CB terrorism incidents
- In Process: TIC performance requirements and material test methods; Update of NFPA 1994: Standard on protective ensembles for CB terrorism incidents (2006)

Chemical Detectors

- In Process: ASTM Committee E54.01 Homeland Security Applications CBRNE Sensors and Detectors continues to refine a Chemical Warfare Vapor Point Detector Performance Standard with support from **Battelle Memorial Institute** and ECBC
- In Process: Chemical agent detection methods and testing procedures being developed by ECBC

Decontamination

- Established: ASTM Three-step method to determine sporicidal efficacy of liquids and vapor or gases on contaminated surfaces
- In Process: Decontamination Support Equipment Standards have been submitted to ASTM E54.03 Homeland Security Applications

A Partnership with Industry in CB Equipment Development

- Redesign of USPS postal processing systems
  - ECBC responded to October 2001 anthrax incidents by evaluating postal processing equipment in test chambers
  - Determined where detection and risk mitigation systems could be built into process
  - **Northrop Grumman** built prototypes
  - ECBC and Northrop Grumman evaluated and refined technology
  - Systems now embedded in postal facilities nationwide

- DHS BioWatch Program
  - ECBC supporting DHS Homeland Security Advanced Research Projects Agency
  - Design and execute test and evaluation programs needed to validate future BioWatch technologies
  - ECBC is evaluating commercial approaches and has TSAs with **Northrop Grumman, General Electric, S3I, InnovaTek, Lockheed Martin, SESI, Hatch, Ultra Analytics, and Smiths Detection**

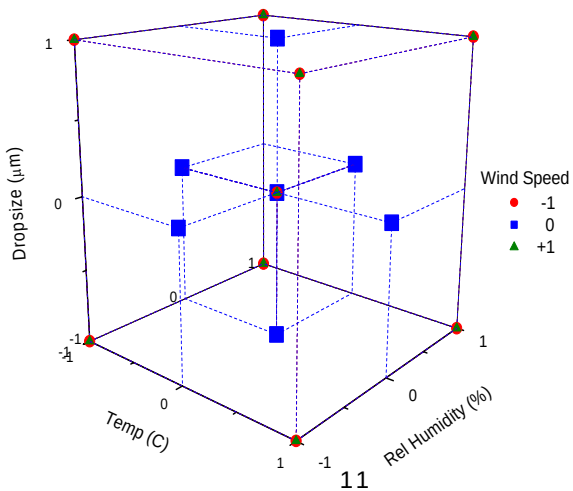
Answering the Fundamental Questions About CB Materials

How clean is safe?

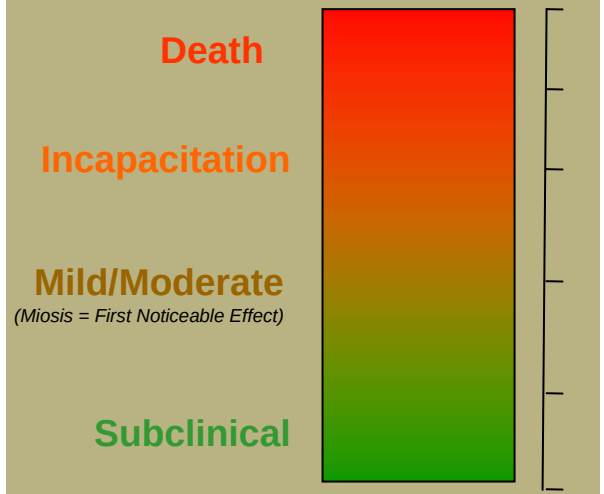
- Effects of low level exposure
- Persistence of agent over time on/in various surfaces
- How environmental factors affect contamination and clean-up

What should be requirements for detection, protection and decontamination equipment?

What materials can be utilized to simulate an agent property?



Potency and the problem of "less than lethal"

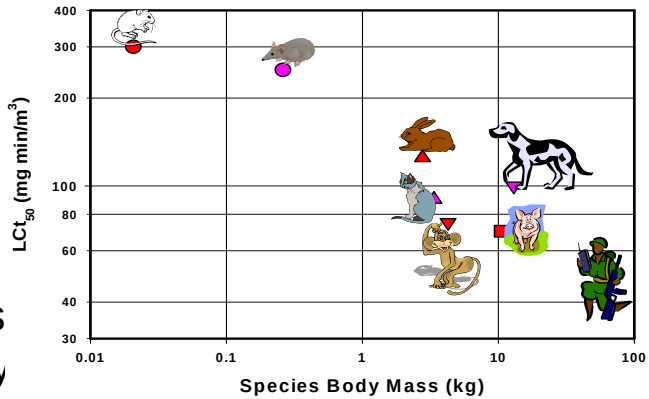


Valid and defendable toxicity data -- the foundation for detection, protection and decontamination requirements

Supporting Science: Low Level Operational Toxicology

Studies Conducted

- Dose-Response
- Conc-Time Profile
- Miosis and ChE
- Parenteral Studies
- Sublethal, Systemic
- Persistent/Delayed Effects
- Biomarkers/Physiologically Based Pharmacokinetics (PBPK)
- Route/Species Extrapolation

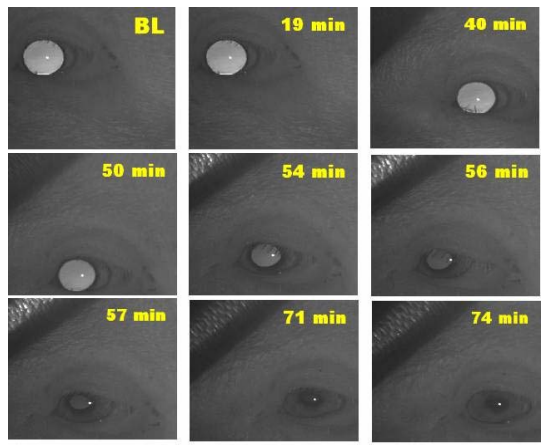


Agents Studied

- German Agent B, Cyclo-sarin, VX, Soman

Status

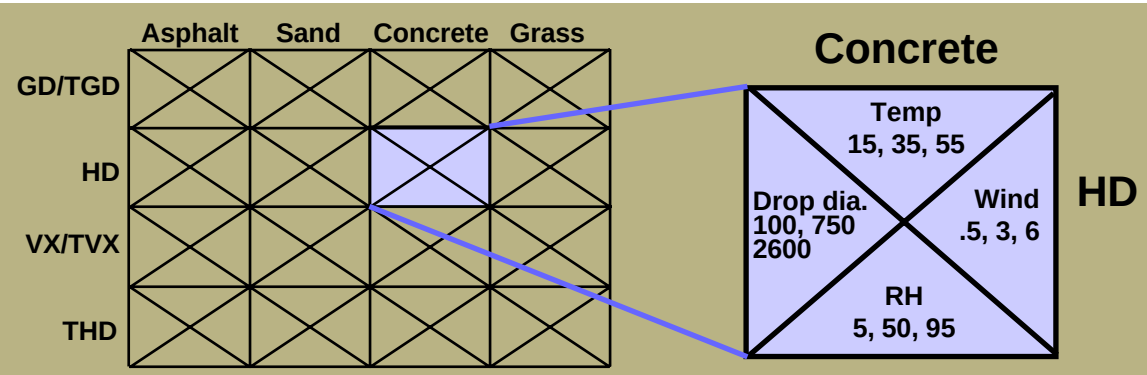
- Confirmed that miosis is the first noticeable effect of exposure
- Full understanding of the levels of exposure that mark the onset of miosis
- Refined human operational exposure standard for GB
- Refined human exposure standards for GF and VX



– **Salem, Harry. *Inhalation Toxicology, Second Edition*; CRC Press: Boca Raton, 2006.**

– **Abstracts from The Toxicologist, SOT 2006 Annual Meeting.**

Supporting Science: Environmental Fate of Agents



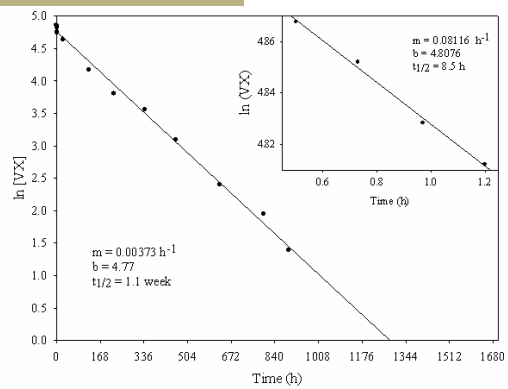
- **About 10,000 experiments for full factorial approach – not feasible**
- **Experimental design techniques brings us to conducting about 1300 experiments**
- **24 agent/substrate combinations (3 levels for each parameter (temp., drop dia., wind speed, humidity)**

Wind Tunnel Tests

- Primary source of model development data
- Controlled environment
- Factor effects on evaporation
- Limited scrutiny on agent/substrate interaction effects

Lab Experiments

- Agent/substrate interaction
- ID substrate parameters affecting evaporation
- Expands wind tunnel model to surfaces beyond those tested



– **Wagner, George. W.; *Degradation and Decontamination of VX in Concrete*, December 2004. NTIS AD-A433-144. Preliminary study published in Journal of American Chemical Society, June 2001.**

Inactivation of Threat Virus by Solar Radiation

- Ultraviolet radiation from the sun – primary germicide; few data points available regarding survival of viruses following exposure to solar UV radiation
- Discovered that viral agents remain infectious after release from the host for several days with continued risk for re-aerosolization and human infection, depending on the geographic location

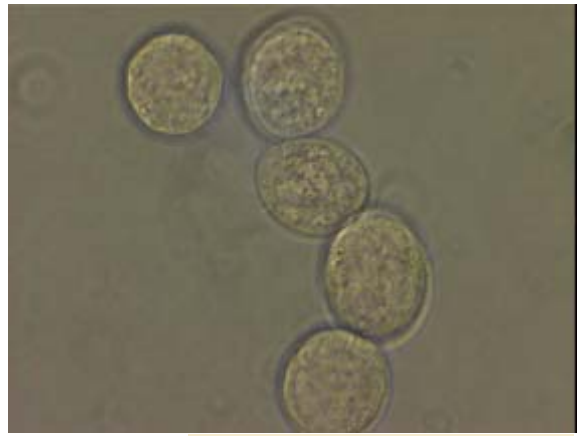
Virus	Virus Family	Data for related virus	Predicted sensitivity D37(J/m^2)	UV for 1 Log inactivation (J/m^2_{254})
Ebola Marburg	Filoviridae	None	7.4	17.0
Variola (Smallpox)	Poxviridae	Vaccinia	11	25.3
Hanta RiftValley	Bunya-viridae	None	12	27.6
Lassa Junin	Arena-viridae	None	13	29.9
WEE VEE	Toga-viridae	VEE	19	43.7
West Nile	Flavi-viridae	None	24	55.2

- Developed predictive model to estimate survival of a wide variety of viruses after their release at any location and time of the year

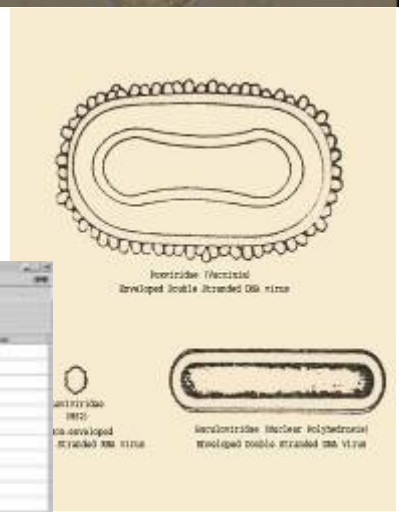
– **Sagripanti, Jose-Luis. "*Predicted Inactivation of Viruses of Relevance to Biodefense by Solar Radiation* ," Journal of Virology, November 2005, p. 14244-14252, Vol. 79, No. 22.**

Simulant Development

- Goals of Simulant Development Program
  - Mimic a specific chemical or physical property of the chemical or biological warfare agent
  - Easy and affordable to produce
  - Acceptable for release in the environment
  - Non-pathogenic, non-toxic, and non-allergenic
  - Detectable by both fielded and laboratory instruments



- **O'Connell, Kevin; *Native and Engineered Simulants for DNA Virus Threat Agent*, December 2004. Available from NTIS as AD-A433-121.**



- Agent Simulant Knowledge (ASK) Database
  - TICS, chemical agent, virus, toxins
  - Will be available through the Chemical and Biological Defense Information Analysis Center (CBIAC)