Subject: Re: Your visit Jemski and Larson
From: "Reid Kirby" <rkirby@eximdyne.com>
Date: Sat, 24 Jun 2006 23:26:50 +0000
To: "Matthew S. Meselson" <msm@wjh.harvard.edu>, "Reid Kirby" <rkirby@eximdyne.com>
CC: "Julian Robinson" <j.p.p.robinson@sussex.ac.uk>

Matthew,

Many thanks on the independent action dose-response relationship lead. I found an excellent source on the subject that applies an exponencial model to US Army figures, and now feel I have a good grasp on the subject.

Once I get the notes back from Bud and Joe, I will send HSP a copy of the notes and documents shared. Tom Collins' report sort of insulted Joe by stating repeatedly that his methods were not sound, but the author evidently had the benefit of regression analysis using MS Excel. I'm old enough to remember the days of using specialized graph paper or log tables and a ruler through a cloud of data points when one did not want to go through a reem of paper calculating least squares. I found an oral history from MORS that interviewed the first statistician to work for Fort Detrick. He didn't have an office and had to work from a desk next to the eight-ball for Ralph M Parsons company, and confirmed what I suspected on how they made their analysis. Also recall a munition expenditure calculation for the E61 that stopped at 500 bomblets per a cluster since their computer couldn't handle the anything more.

Funny to hear Bill Patrick "hooted" at your Sverdlovsk source strength estimate. If he was using "tables" for atmospheric diffusion analysis, then the debate ended before it started. I too have been skeptical that the release was only a few mg, but honestly had not made any attempts to validate your work until today. Atmpospheric diffusion is an area that I have spent some time studying, and after reading your ASA Newsletter article I made my own estimate (attached) changing the assumptions slightly, and now regret having any doubts.

I read a book review of War of Nerves by a former chemical soldier and as expected there was a considerable discourse on the Skull Valley incident. My personal belief is that a contemporary investigation is neededoin this for the health of the Chemical Corps. Anyways, what made the book review entertaining was an illustration by this chemical soldier showing a two-step sheared trapazoid leaving DPG towards the sheep with the notion that it was way to far to have made an impact. What caught my attention was the reviewers ignorance on the adjustment of source strength when a spray line is no longer perpendicular to the wind as he was illustrating.

I have a few more interviews to make, and a need to answer why anthrax was in the stockpile in 1969 even though it was not standardized and not accepted. Once that is complete, I have a full featured story on St. Jo with many historical lessons.

Sincerely,

Reid Kirby
2208 Autumn Trace Parkway
Wentzville, Missouri 63385
United Stated

Telephone: 01-314-324-0997

<ex>-----Original Message-----
<ex>From: Matthew S. Meselson [mailto:msm@wjh.harvard.edu]
<ex>Sent: Friday, June 23, 2006 09:43 AM
<ex>To: 'Reid Kirby'
<ex>Cc: 'Julian Robinson'
<ex>Subject: Re: Your visit Jemski and Larson
<ex>
<ex>
<ex>Dear Reid,
<ex>
<ex>Very good that you met with Joe and Bud. I would have liked to have been a
<ex>fly on the wall.
<ex>
<ex>Could you send me a copy of the Collins' paper you mention below.
<ex>
<ex>Do you have a copy of my 2001 note on source strength calculations wrt the
<ex>Sverdlovsk outbreak published in the ASA Newsletter volume 48 and the
<ex>recent paper by Dean Wilkening PNAS 103:7589-7594?
<ex>
<ex>Although probit models are often used and are appropriate in chemical
<ex>toxicology, I believe that for a homogenous host population the
<ex>independent action model is more appropriate for infective agents like
<ex>anthrax. The basic reason for expecting this difference is that pathogens
<ex>replicate within the body and chemicals do not.
<ex>
<ex>Of course there is no good primate (human or non-human) data to test any
<ex>model for an infective agent at low response levels and, if the population
<ex>is distributed smoothly within the cloud area, most casualties are likely
<ex>to be from correspondingly low doses.
<ex>
<ex>Wilkening, however, does produce a qualitative argument against there
<ex>having been a threshold in the dose-response relation at Sverdlovsk. This
<ex>also would rule out any probit model with probit slope greater than
<ex>approximately 1, as that would produce an apparent cut-off, looking like a
<ex>threshold.
<ex>
<ex>Note that Wilkening obtains estimates for Sverdlovsk source strength
<ex>essentially identical to the estimates I gave in Science and, later with
<ex>more detail, in the ASA Newsletter. In "Germs" Bill Patrick is quoted as
<ex>having "hooted" at my Science estimates. At the time of our Science paper,
<ex>Tom Dashiell sent me a note including some tables that he said Bill
<ex>Patrick had used in making his estimates of the Sverdlovsk Source
<ex>strength. But I found that when the tables were used correctly, the
<ex>estimates were virtually the same as mine.

<ex>
<ex>None of this means that we know the actual source strength. Rather it
<ex>means that some people apparently thought, without correctly doing the
<ex>rather simple math, that the models they favored would predict large
<ex>sources even though when the math is correctly done using those same
<ex>models, the results are as I had published.
<ex>
<ex>For an early application of the independent action (exponential) model to
<ex>anthrax data see Druett (1952) Nature 170:288.
<ex>
<ex>I look forward to seeing the notes from your visit to Fredrick.
<ex>
<ex>Best wishes,
<ex>
<ex>Matthew
<ex>
<ex>
<ex>
<ex>_____
<ex>_____
<ex>Matthew Meselson
<ex>Department of Molecular and Cellular Biology
<ex>Harvard University
<ex>7 Divinity Avenue
<ex>Cambridge, MA 02138 USA
<ex>email: <msm@wjh.harvard.edu>
<ex>telephone: (617) 495-2264
<ex>telefax: (617) 496-2444
<ex>
<ex>On Fri, 16 Jun 2006, Reid Kirby wrote:
<ex>
<ex>Date: Fri, 16 Jun 2006 16:24:13 +0000
<ex>From: Reid Kirby <rkirby@eximdyne.com>
<ex>To: Julian Robinson <j.p.p.robinson@sussex.ac.uk>,
<ex> Prof M S Meselson <msm@wjh.harvard.edu>, rkirby@eximdyne.com
<ex>Subject: St. Jo
<ex>
<ex>Matthew,
<ex>I interviewed Bud Larson and Joe Jemski yesterday. We spent a
<ex>couple hours in Frederick, Maryland and discussed their activities with
<ex>St. Jo and anthrax. Theyt are both in good health and mentally sharp. Joe
<ex>was unaware of the true aim of St. Jo, but provided a good account of the
<ex>effort to privatize Fort Detrick in 1952 (something that seems to have
<ex>excaped notice by contemporary scholars). We spent a good time discussing
<ex>posology. They gave me a copy of Tom Collins' report A Preliminary
<ex>Analysis of the Respiratory Infectivity of Bacillus Anthracis (Jaycor:
<ex>June 1996). Joe deffended his research on anthrax in light of this report
<ex>and discussions he had with you several years ago. Neither seemed aware of

<ex>the exponential model used for dose-response in U of PA's Project SUMMIT
<ex>for ACDA and FM 3-10 Chemical Biological Weapons Employment (1962), and
<ex>stated the probit model was throughout the life of the offensive program.
<ex>I'm still trying to locate why the dose-response model changed on the
<ex>operational side since that has a significant impact on the feasibility of
<ex>biologicals with questionable median infective doses. They made several
<ex>recommendations of other people to interview in the aerobiology community
<ex>on the history of St. Jo and anthrax research. I will send a copy of my
<ex>interview notes to HSP after giving Bud and Joe a draft for comment.
<ex>Sincerely, Reid Kirby 2208 Autumn Trace Parkway Wentzville, MO 63385
<ex>United States Telephone: 01-314-324-0997
<ex>
<ex>
<ex>

Sverdlovsk.pdf	**Content-Type:** application/octet-stream **Content-Encoding:** base64

Estimation of Source Strength

Sverdlovsk Incident

Reid Kirby
EXIMDYNE 2006

Diffusion Model

Using the following point source model and diffusion parameters defined by G. H. Milly[1] estimates were made for the source strength from the Sverdlovsk Incident:

$$D = \frac{Q \cdot \Lambda \cdot B}{\pi \cdot \bar{u} \cdot \sigma_y(x) \cdot \sigma_z(x)} \cdot \exp\left[\frac{y^2}{2\sigma_y^2(x)}\right] \cdot \frac{1}{2}\left\{\exp\left[-\frac{(z-h)^2}{2\sigma_z^2(x)}\right] + \exp\left[-\frac{(z+h)^2}{2\sigma_z^2(x)}\right]\right\} \cdot \exp\left(-\frac{k \cdot x}{\bar{u}}\right)$$

Where:

D = index dose received (spores/person);
Q = source strength (spores);
Λ = overall source strength correction factor (unitless);
B = rate of breathing (m^3/min);
ū = mean wind speed (300 m/min);

$\sigma_y(x) = 3.41\left(\frac{x}{100}\right)^{\alpha}$ (unitless cross-wind diffusion parameter);

$\sigma_z(x) = 1.35\left(\frac{x}{20}\right)^{\beta}$ (unitless altitude-wise diffusion parameter);

α = stability diffusion parameter (for Pasquill-Gifford D = 0.30);
β = stability diffusion parameter (for Pasquill-Gifford D = 0.88);
y = distance from center-line of windward travel (m);
z = sampling height (assumed 2 m);
h = release height (assumed 10 m);
k = agent decay rate (%/min); and,
x = distance downwind from source (m).

Ceramic Factory

There was a 2% incidence of anthrax at this location about 2,800 m downwind from the suspect release point. Assuming an exponential dose-response

[1] G. H. Milly, Atmospheric Diffusion and Generalized Munition Expenditure ORG-17, US Army Chemical Corps Operations Research Group (1958). [AD223841]

relationship[2], and an ID_{50} of 8,000 spores/person, then the index dose received inside this facility is 230 spores/man. Considering several other assumptions, the source strength estimates are as follows:

Q	B	k	Λ
7.1×10^{9}	0.03	None	None
2.1×10^{10}	0.01	None	None
1.4×10^{10}	0.03	None	Inside blding – 0.5
4.2×10^{10}	0.01	None	Inside Blding – 0.5
4.6×10^{10}	0.01	1% physical only	Inside Blding – 0.5

Veterinary Cases

There were also veterinary cases up to 50,000 m downwind from the suspected release point. The species and fraction of infections is unknown, but attempting to attain a minimal dose at this distance may also indicate potential source strength. Assuming a rate of breathing of 0.01 m^3/min, no physical decay rate, and in the open, then a source strength in the order of 5.5×10^{10} spores would render a dose of 2 spores/animal – probably a low figure, and thus the lowest acceptable figure. If an aerobiological decay rate of 1% is used for physical loss of aerosol during windward travel, then the figure jumps to the order of 10^{12} spores.

Source Strength

The real problem with estimating source strength is translating the number of spores released into a mass or volume figure. To illustrate, I will assume reconciled source strength of 3×10^{10} spores (range between 10^9 to 10^{12} spores). In the US biological program, dry-type anthrax had a strength of 3.0×10^{11} spores/g, putting this estimate at 100 mg (range 0.3 mg to 3.3 g). This represents what left the facility in a "puff."

The actual source may have been inside of a building, and thus air change rates would indicate a higher figure. Furthermore, if the release resulted from an industrial accident, the actual figure would require knowledge of the manufacturing process. Nonetheless, given the many uncertainties, it appears what left the facility was in the order of tens to hundreds of milligrams of dry-type anthrax.

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[2] George Shortley and Judd Wilkins, *Independent-Action and Birth-Death Models in Experimental Microbiology*, Bact Rev Vol. 29, No. 1 (March 1965): 102 – 141. The model used was –

$$P(\%) = 1 - \exp\left(-\frac{d_i}{d_0} \cdot \ln 2\right)$$