M. Hugh-Jones

19 December 1993

Dear Martin,

Here is a revised version of the MS I sent to you last month.

Your fax came as Julian Robinson and I were writing a huge grant proposal to enable us to continue our Harvard Sussex Program on CBW Armament and Arms Limitation, including publication of its *Chemical Weapons Convention Bulletin*. But now I can respond to your fax of the 13th.

Authorship. The rule I follow in these matters is that authors must have contributed a seminal idea or have contributed importantly to the organization, conduct, or analysis of the work reported or to the writing of the article. If a person does any one or more of these things, he or she should be included, and *vice versa*. Do you not agree with these criteria?

Alex Langmuir spent days at Woods Hole on the epidemiological analysis and wrote an early draft of the MS. Popova did a great deal of essential interview research in Ekaterinburg. And Yampolskaya made an essential contribution in helping to develop the interview procedure and then, with Jeanne, spent as much time doing interview research as she did assisting David, Abramova and Grinberg with the pathoanatomy.

David's contribution to the pathoanatomical part of the study, already published, is certainly excellent and important. Nevertheless, the present MS does not include his contributions. I said this in the letter I sent to him along with the draft MS and I do not believe that he would disagree.

Case list. The unnumbered male is the unknown man. The numbers 80-90 designate the survivors in alphabetical order: Danilov, Fedulov, Fedulova, Kazakov, Podgorbunskikh, Poleshaeva, Runev, Sterkhov, Talashmanov, Tolmacheva, and Yakovlev. Of these, so far as I know, only Danilov and Podgorbunskikh had cutaneous anthrax. My notes on Alexis' translation of the Nikiforov notes makes no mention of cutaneous lesions.

The second list from Mishustina gives the birth year of Tishenko, number 68 on the list, as 1947. I have no grave photo for her. I believe I have sent you photos of all the graves I photographed for which you had no photograph of your own.

Following the rule given in the MS, the tabulated death date of Kozlova is 411. The "list of 5" from Ilenko gives 410. The histogram would be the same with either value.

According to Lev, the diagnosis of anthrax in the case of Spirina is, on reexamination, "doubtful or negative".

Aerosol calculations. The value 1.06×10^5 comes from dividing QR by the term πu. The basis of the calculations of dosage and attack rate is as follows:

DOSAGE

Atmospheric stability "D"
Wind speed = u = 5 m/sec
Release height = 0
Breathing rate = R = 1.67×10^{-4} m^3/sec (= 10 l/min)
Source strength = Q = 10^{10} spores as aerosol
Deposition negligible
No mixing layer
Plume, not puff

$$\text{Dose} = [QR]\,[\pi u \sigma_y \sigma_z]^{-1} \exp[-(1/2)(y/\sigma_y)^2]$$

$$= [1.06 \times 10^5]\,[\sigma_y \sigma_z]^{-1} \exp[-(1/2)(y/\sigma_y)^2]$$

$$\sigma_y = [0.08]\,[x]\,[1+0.001x]^{-1/2}$$

$$\sigma_z = [0.06]\,[x]\,[1+0.0015x]^{-1/2}$$

According to Briggs for open terrain
(Hanna, Briggs & Hosker, 1982)

Downwind (x) and crosswind (y) distances are in meters.

DOSE-RESPONSE

LD_{50} = 4,000 spores,
Slope = 0.7 probits per log dose
The following tabulation is of the form [dose],[attack rate]

8000,.584
4000,.500
2000,.417
1000,.337
500,.274
250,.201
125,.146
60,.102
30,.070
15,.046
8,.029
4,.018
2,.011
1,.006
.5,.003
.25,.0017

While in the Hague last month, I discussed the epidemic with a friend at TNO, but did not mention what model or parameters I had used for calculating dosage and attack rate. A few day later, I was surprised to receive printouts of their own calculations, using the Glassman-Jemski dose-response relation and I don't know what model of atmospheric diffusion. TNO assumed various non-zero release heights. My calculation is for zero release height but will not be used in Figures 2 and 3 close to the source where it matters a lot. At distances beyond which release height matters much, the two sets of dosage and attack values are essentially the same. The agreement with TNO means that the values have been correctly calculated from the assumptions. Also, TNO and I independently made essentially the same assumptions regarding diffusion and dose-response. Of course the results are illustrative, not definitive.

After I get your remaining comments and those of a few reviewers and when the figures are done, I will send the completed MS to you and to *Nature*.

Sincerely,