MEMORANDUM TO FILES REGARDING SVERDLOVSK/mm
1980

1. The main technical question in my mind at this point concerns the diagnosis of respiratory anthrax. The reliable diagnosis of many cases of respiratory anthrax is a crucial point. .

2. Brachman was not convinced that the respiratory illness described was anthrax. On exactly what are the diagnoses based? How reliable is each source and item of evidence?

3. I understand that without bacteriological tests no diagnosis of respiratory anthrax is reliable. Physical examination of the patient is not enough, nor is autopsy unless it includes bacteriological testing. Gold, an authority on anthrax, failed to diagnose it in the one respiratory case he examined.

4. Can the possibility be excluded of a different respiratory disease (plague, Legionaire's, or several others) plus some cases of intestinal anthrax?

5. It is possible, I understand, for intestinal anthrax to become respiratory. One or a very few cases of respiratory anthrax could come about this way--though not many. How many of the diagnoses of respiratory anthrax meet high standards of reliability?

6. Related to the question of diagnosis is the claim that until mid-June, about ten weeks after the event, all presenting cases ended fatally. Drug therapy must have been instituted early and vigorously. This raises doubts about the diagnosis, since drug therapy is said to be able to reduce the case fatality rate of respiratory anthrax substantially.

7. The allegedly steady rate of new cases for several weeks raises questions. If the initial aerosol cloud plus trapped air plus re-suspension of spores all contributed to infection in the way I would expect, there should have been a rapid fall-off of new cases.

8. In any careful consideration of the evidence, one should make every effort to examine the most primary data: transcripts of interviews, not merely summaries, etc.

9. Some areas for detailed examination are listed in outline in Appendix A. Appendix B consists of source strength calculations.

APPENDIX A

Outline of Questions

Facility

- evidence of BW involvement before and after March 26, 1975 entry into force of BW Convention
- size and physical layout
- traffic in and out
- security provisions
- evidence of large-scale fermentation of pathogens and other operations with pathogens, such as incineration of effluent air
- nearby facilities, including possible tanneries, animal hair, wool factories,
- population density in vicinity--within several km
- What could the facility be if not a BW facility?

Time and Weather

- when did event occur: date, time?
- weather: cloud cover, precipitation, wind direction and wind speed?
- precipitation over subsequent ten week period

Cases

- How many cases presented during each week of the episode? How many died and how many recovered of those presenting in each week?
- How many fatalities and recoveries in total?
- Where did initial cases, those presenting in the first week, reside and/or work? How many cases from each place?
- How many in each of these residence or work places might have been exposed without becoming ill?
- How many persons might have been present within an elipse fitted to the facility and the various sites where early cases were presumably exposed? How many of these became ill? Where did later cases reside and/or work?
- Construct a detailed map showing facilities, population, and work places or residences of known cases, indicating time of their presentation and outcome.
- Age and sex distribution of cases.

Illness

. Diagnosis--on what does it rest, exactly and in detail?
. What could it have been if not anthrax?
. Could there have been intestinal and/or cutaneous anthrax plus some fatal respiratory disease other than anthrax?
. What other illnesses were prevalent in Sverdlovsk during episode and during preceding two months?
. What, specifically, was the course of influenza B during above period?
. What interactions with viral or other epidemics might occur? "Cloud babies," etc.
. Assemble summary of relevant information and areas of uncertainty regarding anthrax and diseases for which it could be mistaken.

Therapy

. What therapy/prophylaxis? Drug and/or vaccine, route of administration, dose and schedule, when instituted, outcomes.
. public health measures
. decontamination efforts

Source Strength

. estimated values
. assumptions in the calculations
. resuspension as particles in 1-10 micron range

Spore Detection

. Have we attempted it? Results?
. clothing of persons present; controls
. Could we detect if given access at this date?
. False negatives and false positives.

Anthrax and Soviet Public Health

- prevalence of cutaneous, intestinal and respiratory human anthrax
- prevalence among animals
- How much anthrax is produced for vaccine in USSR?
- Where is it produced?

Scenarios

- Construct some violation scenarios.
- Construct non-violation scenarios, trying to incorporate Soviet version of events in some of them.

APPENDIX B

Source Strength Calculations*

Assumed Conditions

Night
Cloud ≤ 3/8
Wind speed u = 2m/sec (7.2 km/hr)
Pasquill category F (Table II)
Breathing rate 0.01 m^3/min
See Appendix I of Pasquill for details of calculation.

d(Km)	h(m)	θ(deg)	udθh	$D = \frac{2.8\times10^{-3}}{ud\theta h}$ (equation 7)	Dose for source strength = 10^1
0.1	5	10	10	2.8×10^{-4}	2.8×10^{6}
0.3	12	9.5	68	4.1×10^{-5}	4.1×10^{5}
0.5	18	9	162	1.7×10^{-5} ←	1.7×10^{5}
1.0	30	8.5	510	5.5×10^{-6}	5.6×10^{4}
3.0	60	8	2900	1×10^{-6}	1×10^{4}
5.0	75	7.5	5600	5×10^{-7}	5×10^{3}

Notes:

1) If category D, u = 3m/sec are used instead of the above conditions, one obtains the following doses for a source strength of 10^{13}:

d	dose
0.1	4.7×10^{6}
0.3	6.7×10^{5}
0.5	2.6×10^{5}
1.0	7.8×10^{4}
3.0	1.6×10^{4}
5.0	6.2×10^{3}

2) If wind speed is < 2m/sec on a clear night, the vertical spread may be even less than for category F. See page 43. Higher doses could then result due to the lesser vertical spread and to the longer dwell-time.

3) Plume will wander due to variations in wind direction.

4) Source strength is expressed in effective particles.

* Pasquill, F. (1961), The estimation of the dispersion of windborne material, Meterolog. Mag 90: 33-49.

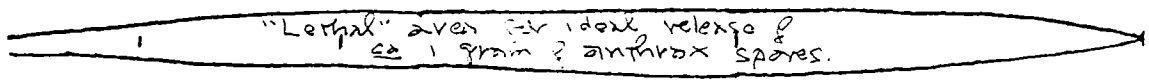
Approximation for Trapped Air

Assume that the along-wind dimension of the cloud, considered homogeneous, is about 1/2 km at 3 km downwind. Then for u = 2m/sec, the passage time would be $0.5/7.2 \approx 0.07$hr. If an airspace were equilibrated with the cloud and then sealed, a person remaining in the airspace for seven hours would receive 100 times the dose received in the open. Settling and surface deposition are considered negligible.

Isopleth for dose 10^4

Pasquill, p.48

F_2	deviation	axial dose	d	θ/2	α(deg)	isopleth width 2dtanα (km)
1.0	0	$1x10^4$	3	4.0	0	-
1.15	1/4	$1.15x10^4$	2.75	4.0	1	.10
1.8	1/2	$1.8x10^4$	2.05	4.0	2	.14
2.8	2/3	$2.8x10^4$	1.6	4.1	2.7	.15
4.4	4/5	$4.4x10^4$	1.2	4.1	3.3	.14
10	1	$10x10^5$	0.68	4.4	4.4	.10
37	5/4	$37x10^5$	0.31	4.4	5.5	.06



axial dose	$1.7x10^5$	$5.6x10^4$	$2x10^4$	10^4
downwind distance	0km	1km	2km	3km

Actual isopleth would show wandering due to variations in wind direction. The isopleth calculated here for dose 10^4 in the open would correspond to dose 10^6 under trapped air condition discussed above.

u = 2m/sec
Category F
Source Strength 10^{12}
Breathing rate $0.01 m^3/min$