

Appendix VIII

Packaging, Labelling and Documentation for Transport

(extracted from WHO 1997b)

Because of the distinction of risks between infectious substances and diagnostic specimens, there are variations to the packaging, labelling and documentation requirements. The packaging requirements are determined by the UN and are contained in ICAO and IATA regulations in the form of Packaging Instructions (PI) 602 and 650. The requirements are subject to change and upgrade by these organisations. The current packaging requirements are described below. UN-approved packaging systems are available commercially.

Basic triple packaging system

The system consists of three layers as follows.

1. Primary receptacle. A labelled primary watertight, leak-proof receptacle containing the specimen. The receptacle is wrapped in enough absorbent material to absorb all fluid in case of breakage.
2. Secondary receptacle. A second durable, watertight, leak-proof receptacle to enclose and protect the primary receptacle(s). Several wrapped primary receptacles may be placed in one secondary receptacle. Sufficient additional absorbent material must be used to cushion multiple primary receptacles.
3. Outer shipping package. The secondary receptacle is placed in an outer shipping package which protects it and its contents from outside influences such as physical damage and water while in transit.

Specimen data forms, letters and other types of information that identify or describe the specimen and also identify the shipper and receiver should be taped to the outside of the secondary receptacle.

Hand carriage of infectious substances is strictly prohibited by international air carriers, as is the use of diplomatic pouches for that purpose.

The maximum net quantity of infectious substances which can be contained in an outer shipping package is 50 mL or 50g if transport is by passenger aircraft. Otherwise, the limit per package is 4L-4Kg for transport by cargo aircraft or other carriers. Primary receptacles exceeding 50 mL in combination packing must be oriented so the closures are upward, and labels (arrows) indicating the "UP" direction must be placed on two opposite sides of the

package. The passenger aircraft quantify limits do not apply to blood or blood products for which there is no reason to believe they contain infectious substances, when in receptacles of not more than 500 mL each and with a total volume of not more than 4L in the outer package.

Hazard labels for dangerous goods

For all dangerous goods to be shipped by airfreight, specific hazard label(s) must be affixed to the outside of each package. The following hazards labels are of importance for culture collections or other institutions shipping biological substances.

Hazard labels for infectious substances and for genetically modified microorganisms which meet the IATA definition of an infectious substance:

Figure 1

Name:	Infectious Substance
Minimum dimensions:	100 x 100 mm
For small packages:	50 x 50 mm (black and white)

Labelling of the outer package for shipment of infectious substances must include the elements listed hereafter.

1. The International Infectious Substance Label.
2. An address label with the following information:
 - the receiver's (consignee) name, address and telephone number
 - the shipper's (consignor) name, address and telephone number
 - the UN shipping name (Infectious Substances Affecting Humans or Animals as the case may be) followed by the scientific name of the substance
 - the UN Number (Humans - UN2814, Animals UN2900)
 - temperature storage requirements (optional).

If the outer package is further packed in an overpack (with dry ice for instance) both outerpack and overpack must carry the above information, and the overpack must have a label stating "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS".

- 3. Required shipping documents – these are obtained from the carrier and are fixed to the outer package:
 - the shipper’s Declaration of Dangerous Goods (Figure 2 is one example)
 - a packing list/proforma invoice which includes the receiver’s address, the number of packages, detail of contents, weight, value (note: state that there is “no commercial value” as the items are supplied free of charge)
 - an airwaybill if shipping by air.
- 4. An import and/or export permit and/or declaration if required.
- 5. If the outer package contains primary receptacles exceeding 50 mL in combination at least two “Orientation Labels” (arrows) must be placed on opposite sides of the package showing correct orientation of the package.

Requirements for Air Mail

Infectious substances and diagnostic specimens may be shipped by registered air mail. The basic triple packaging system is used with the same requirements as for other means of conveyance.

The address label must display the word “LETTRE” and the green Customs Declaration Label for Postal Mail is required for international mailing. Diagnostic specimens are to be identified with the violet UPU “PERISHABLE BIOLOGICAL SUBSTANCES” label. Infectious substances are to be identified with the International Infectious Substance label (see Figure 1). Infectious substances must also be accompanied with a shipper’s Declaration of Dangerous Goods form (see Figures 2a and 2b).

Because of local/international restrictions, prior contact should be made with the local post office to ascertain whether the packaged material will be accepted by the postal service.

Figure 2b Shipment of infectious substances using dry ice

Shipper's Declaration for Dangerous Goods

Air Waybill No. 117-4312-9530
Page 1 of 1 Page
Shipper's Reference Number (optional)

Shipper:
World Health Organization
20, Avenue Appia
CH-1211 Geneva
Switzerland

Consignee:
Karolinska Hospital
Clinical Microbiology
Stockholm 17176, Sweden
Attn: Dr Olof Kronvall
Tel: +46 8 33 43022 Fax: +46 8 308 000

Transport details:
This shipment is within the Airport of Departure:
Geneva (Geneva-Macoy)
Passenger and Cargo Aircraft

Warning:
Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Shipment Type: **Non-Hazardous** **Dangerous**
See sub-Section 8.1 of IATA Dangerous Goods Regulations

Airport of Destination:
Geneva

Names and Quantity of Dangerous Goods

Proper Shipping Name	Class (Div. 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9)	Packing Group (I, II, III)	Quantity and type of packing	Net Weight (kg)	Gross Weight (kg)	Approximate
Infectious substance, affecting humans (Streptococcus Pasteurella)	6.2, DG 2814		1 fibreboard box x 2g	602		
Dry Ice	9	III	1.0 kg	904		
OVERSPACE USED						

Additional Handling Information:
Emergency contact: P. Hanger - Tel: 4122 791 2179
Prior arrangements as required by the IATA Dangerous Goods Regulations 1.3.3.1 have been made.

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled in accordance with the applicable IATA Dangerous Goods Regulations, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Two copies of original copies of this Declaration must be retained by the shipper.

Signature: P. Hanger, Shipper
Place and Date: Geneva, 3 July
See marking above

Declaration: One copy to be filed at airport of departure (IATA DGD 8007)

Figure 2a Standard shipment of infectious substances

Shipper's Declaration for Dangerous Goods

Air Waybill No. 117-4312-9530
Page 1 of 1 Page
Shipper's Reference Number (optional)

Shipper:
World Health Organization
20, Avenue Appia
CH-1211 Geneva
Switzerland

Consignee:
Karolinska Hospital
Clinical Microbiology
Stockholm 17176, Sweden
Attn: Dr Olof Kronvall
Tel: +46 8 33 43022 Fax: +46 8 308 000

Transport details:
This shipment is within the Airport of Departure:
Geneva (Geneva-Macoy)
Passenger and Cargo Aircraft

Warning:
Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Shipment Type: **Non-Hazardous** **Dangerous**
See sub-Section 8.1 of IATA Dangerous Goods Regulations

Airport of Destination:
Geneva

Names and Quantity of Dangerous Goods

Proper Shipping Name	Class (Div. 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9)	Packing Group (I, II, III)	Quantity and type of packing	Net Weight (kg)	Gross Weight (kg)	Approximate
Infectious substance, affecting humans (Streptococcus Pasteurella)	6.2, DG 2814		1 fibreboard box x 2g	602		

Additional Handling Information:
Emergency contact: P. Hanger - Tel: 4122 791 2179
Prior arrangements as required by the IATA Dangerous Goods Regulations 1.3.3.1 have been made.

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled in accordance with the applicable IATA Dangerous Goods Regulations, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Two copies of original copies of this Declaration must be retained by the shipper.

Signature: P. Hanger, Shipper
Place and Date: Geneva, 3 July
See marking above

Declaration: One copy to be filed at airport of departure (IATA DGD 8007)

Appendix IX – References

- Abramova FA, Grinberg LM, Yampolskaya OV, Walker DH. Pathology of inhalational anthrax in 42 cases from the Sverdlovsk outbreak of 1979. *Proc Natl Acad Sci* 1993; 90:2291-4.
- Anderson GL, Simchock JM, Wilson KH. Identification of a region of genetic variability among *Bacillus anthracis* strains and related species. *J Bacteriol* 1996; 178: 377-84.
- Anon (1918). Report of the Departmental Committee appointed to inquire as to precautions for preventing danger of infection from anthrax in the manipulation of wool, goat hair and camel hair. Vol 3, *Summary of Evidence and Appendices*, p.116, HMSO, London.
- Anon (1959). Report of the Committee of Inquiry on Anthrax 1959, Her Majesty's Stationery Office, London, cmd 846, pp. 43-47 and 90.
- Anon (1972). Deutsche Gesellschaft für Hygiene und Mikrobiologie: Richtlinien für Prüfung chemischer Desinfektionsmittel 3. Aufl Gustav Fischer Verlag, Stuttgart.
- Anon (1976). Deutsche Veterinärmedizinische Gesellschaft: Richtlinien für Prüfung chemischer Desinfektionsmittel für die Veterinärmedizin, in der Fassung von 1976.
- Anon (1996). "Bits and pieces (from the poster boards at the workshop)". *Salisbury Med Bull* 1996; No 87, special suppl:139.
- Ascoli A. Die Präzipitindiagnose bei Milzbrand. *Zbl Bact Parasit Infekt* 1911; 58:63.
- Beyer W, Glöckner P, Otto J, Böhm R. A nested PCR and DNA-amplification-fingerprinting method for detection and identification of *Bacillus anthracis* in soil samples from former tanneries. *Salisbury Med Bull* 1996; No 87, special suppl:47-9.
- Blenkharn JI, Oakland D. Emission of viable bacteria in the exhaust flue gases from a hospital incinerator. *J Hosp Infect* 1989; 14:73-8.
- Böhm R. Resistance, survival, sterilization and disinfection of spores of *Bacillus anthracis*. *Salisbury Med Bull* No 68, special suppl 1990; 99-101.
- Bowen JE, Turnbull PCB. The fate of *Bacillus anthracis* in unpasteurized and pasteurized milk. *Lett Appl Microbiol* 1992; 15:224-7
- Bowen JE, Manchee RJ, Watson S, Turnbull PCB. Inactivation of *Bacillus anthracis* vegetative cells and spores by gamma irradiation. *Salisbury Med Bull* 1996; No 87, special suppl:70-2.
- Brachman PS, Plotkin SA, Bumford FH, Atchison MM. An epidemic of inhalation anthrax: the first in the twentieth century. II. Epidemiology. *Am J Hyg* 1960; 72: 6-23.
- Brachman PS, Gold H, Plotkin SA *et al.* Field evaluation of a human anthrax vaccine. *Am J Publ Hlth* 1962; 52:632-45.
- Burans J, Keleher A, O'Brien T *et al.* Rapid method for the diagnosis of *Bacillus anthracis* infection in clinical samples using a hand-held assay. *Salisbury Med Bull* 1996; No 87, special suppl:36-7.
- Cartwright ME, McChesney AE, Jones RL. Vaccination-related anthrax in three llamas. *J Am Vet Med Assoc* 1987; 191:715-6.
- Cherkasskiy BL (Editor). *Abstract papers of the Inter-Regional WHO/FAO Workshop on Anthrax*, Almaty, Kazakhstan, October 5-6, 1997.
- Collins CH. *Laboratory Acquired Infections*, 2nd ed, 1988, Butterworths, London, p. 16.

- Coulson NM, Fulop M, Titball RW. *Bacillus anthracis* protective antigen, expressed in *Salmonella typhimurium* SL 3261, affords protection against anthrax spore challenge. *Vaccine* 1994; **12**:1395-401.
- Dahlgren CM, Buchanan LM, Decker HM *et al.* *Bacillus anthracis* aerosols in goat hair processing mills. *Am J Hyg* 1960; **72**:6-23.
- Davies JCA. A major epidemic of anthrax in Zimbabwe. *Central Afr J Med* 1982; **28**:291-8.
- Davies JCA. A major epidemic of anthrax in Zimbabwe. *Central Afr J Med* 1983; **29**:8-12.
- De Vos V, Scheepers GJ. Remote mass vaccination of large free-ranging wild animals for anthrax using Sterne spore vaccine. *Salisbury Med Bull* 1996; No 87, special suppl:116-21.
- Dietvorst DCE. Farmers' attitudes towards the control and prevention of anthrax in Western Province, Zambia. *Salisbury Med Bull* 1996a; No 87, special suppl:102-3.
- Dietvorst DCE. Educational material on anthrax for villages in western Zambia. *Salisbury Med Bull* 1996b; No 87, special suppl:104-6.
- Dietz P, Böhm R. Ergebnisse der experimentellen Desinfektionsmittelprüfung an Milzbrandsporen. *Hyg und Med* 1980; **5**:103-7.
- Doganay M., Almaç A, Hanagasi R. Primary throat anthrax. *Scand J Infect Dis* 1986; **18**:415-9.
- Dong SL. Progress in the control and research of anthrax in China. *Salisbury Med Bull* 1990; No 68, special suppl: 104-5.
- Dragon, D. Personal communication. Department of Clinical Microbiology, University of Alberta Hospitals, Walter C. Mackenzie Centre, Edmonton, Alberta, Canada.
- Duesbery NS, Webb CP, Leppla SH *et al.* Proteolytic inactivation of MAP-kinase-kinase by anthrax lethal factor. *Science* 1998; **280**:734-7.
- Fildes P. *Defensive aspects of biological warfare*. Unpublished Ministry of Supply report: BDP Report No 19, 1997.
- Friedlander *et al.* 1991 Abstracts of the Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), abstract no. 1194.
- George S, Mathai D, Balraj V *et al.* An outbreak of anthrax meningoencephalitis. *Trans Roy Soc Trop Med Hyg* 1994; **88**:206-7.
- Hammond SE, Hanna PC. Lethal factor active-site mutations affect catalytic activity in vitro. *Infect Immun* 1998; **66**:2374-8.
- Healing TD, Hoffman, PN, Young SEJ. The infection hazards of human cadavers. *Communicable Disease Report* 1995; **5**: R61-R68.
- Henderson DW, Peacock S, Belton FC. Observations on the prophylaxis of experimental pulmonary anthrax in the monkey. *J Hyg* 1956; **54**:28-36.
- Henderson I. Fingerprinting *Bacillus anthracis* strains. *Salisbury Med Bull* 1996; No 87, special suppl: 55-58.
- Heyworth B, Ropp ME, Voos UG *et al.* Anthrax in the Gambia: an epidemiological study. *J Hyg* 1975; **54**:79-82.
- Hutson RA, Duggleby CJ, Lowe JR *et al.* The development and assessment of DNA and oligonucleotide probes for the specific detection of *Bacillus anthracis*. *J Appl Bacteriol* 1993; **75**:463-472.
- Iacono-Connors LC, Welkos SL, Ivins BE, Dalrymple JM. Protection against anthrax with recombinant virus-expressed protective antigen in experimental animals. *Infect Immun* 1991; **59**:1961-5.

- Ivins BE, Welkos SL. Recent advances in the development of an improved anthrax vaccine. *Eur J Epidemiol* 1988; **4**:12-19.
- Ivins BE, Welkos SL, Knudson GB, Little SF. Immunization against anthrax with aromatic compound-dependent (Aro^r) mutants of *Bacillus anthracis* and with recombinant strains of *Bacillus subtilis* that produce anthrax protective antigen. *Infect Immun* 1990; **58**:303-8.
- Ivins BE, Welkos SL, Little SF, Knudson GB. Cloned protective activity and progress in development of improved anthrax vaccines. *Salisbury Med Bull* No 68, special suppl 1990; 86-88.
- Jackson PJ, Walthers EA, Kalif AS *et al.* Characterization of the variable-number tandem repeats in *vrrA* from different *Bacillus anthracis* isolates. *Appl Environ Microbiol* 1997; **63**:1400-5.
- Jones MN, Turnbull PCB. Disinfection against spores of *Bacillus anthracis*. *Salisbury Med Bull* 1996; No 87, special suppl:74-8.
- Joshi, DD (Editor). Proceedings of the Inter-Regional Workshop on Anthrax, Kathmandu, Nepal, March 9-11, 1997.
- Keim P, Kalif A, Schupp J, *et al.* Molecular evolution and diversity in *Bacillus anthracis* as detected by amplified fragment length polymorphism markers. *J Bacteriol* 1997; **179**: 818-24.
- Kelsey JC, Sykes G. A new test for the assessment of disinfectants with particular reference to their use in hospitals. *Pharm J* 1969; **202**:607-9.
- Keppie J, Smith A, Harris-Smith PW. The chemical basis of the virulence of *Bacillus anthracis*. III: The role of the terminal bacteraemia in death of guinea-pigs from anthrax. *Brit J Exp Pathol* 1955; **36**:315-22.
- Khanne N, Gokul BN, Ravikumar R. Successfully treated primary anthrax meningitis. *Indian J Pathol Microbiol* 1989; **32**:315-7.
- Knisely RF. Selective medium for *Bacillus anthracis*. *J Bacteriol* 1966; **92**:78-6.
- Knisely RF. Selective medium for *Bacillus anthracis*. *J Bacteriol* 1966; **92**:784-6.
- Kobuch E, Davis J, Fleischer K *et al.* A clinical and epidemiological study of 621 patients with anthrax in western Zimbabwe. *Salisbury Med Bull* 1990; No 68, special suppl:34-8.
- Koshi G, Lalitha MK, Danial J *et al.* Anthrax meningitis: a rare clinical entity. *J Assoc Physicians of India* 1981; **29**:59-62.
- Lalitha MK, Anandi V, Walter N *et al.* Primary anthrax presenting as an injection "abscess". *Indian J Pathol Microbiol* 1988; **31**:254-6.
- Lalitha MK, Anandi V, Walter NM *et al.* Unusual forms of anthrax - a clinical problem. *Salisbury Med Bull* 1990; No 68, special suppl:38-40.
- Lalitha MK, Mathai D, Thomas K *et al.* Anthrax - a continuing problem in Southern India. *Salisbury Med Bull* 1996; No 87, special suppl:14-15.
- Leppla SH. The anthrax toxin complex. In: Alouf JE, Freer JH (eds) *Sourcebook of Bacterial Protein Toxins* 1992; Academic Press, New York, pp. 277-302.
- Levy LM, Baker N, Meyer MP *et al.* Anthrax meningitis in Zimbabwe. *Central Afr J Med* 1981; **27**:101-4.
- Lightfoot NF, Scott RJD, Turnbull PCB. Antimicrobial susceptibility of *Bacillus anthracis*. *Salisbury Med Bull* 1990; No 68, special suppl: 95-98.
- Lindeque PM, Turnbull PCB. Ecology and epidemiology of anthrax in the Etosha National Park, Namibia. *Onderstepoort J Vet Res* 1994; **61**:71-83.

- Lindner F, Böhm R. Effect of lime on spores of *Bac. anthracis* in the sludge of a treatment plant connected with some tanneries. In: Strauch D, Havelaar AH, Hermite PL (eds) *Inactivation of Microorganisms in Sewage Sludge by Stabilisation Processes*, Elsevier Applied Science Publications, London, 1985; 113-117.
- Lindner F, Böhm R, Strauch D. Chemische Verfahren zur Abtötung von Milzbrandsporen im Klärshclamm. *Forum Stadte-Hyg* 1987; **38**:306-12.
- MAFF (1992). Anthrax (Appendix 2 of Chapter 2). Instruction to the Ministry of Agriculture, Fisheries and Food veterinary staff (UK). (Unpublished document).
- M'Fadyean J. A further note with regard to the staining reaction of anthrax blood with methylene blue. *J Comp Pathol* 1903; **16**:360-1.
- Manchee RJ, Broster MG, Melling J *et al.* *Bacillus anthracis* on Gruinard Island. *Nature* 1981; **294**:254-5.
- Martin GHB. Cutaneous anthrax in rural Ethiopia. A study of one hundred consecutive cases; their clinical features and epidemiology. MD Thesis 1975, University of Dundee, Scotland.
- Meselson M, Guillemin J, Hugh-Jones M *et al.* The Sverdlovsk anthrax outbreak of 1979. *Science* 1994; **266**: 1202-8.
- Norman PS, Ray JG, Brachman PS *et al.* Serologic testing for anthrax antibodies in workers in a goat hair processing mill. *Am J Hyg* 1960; **72**: 32-7.
- OIE (1996). Chapter 3.1.1. ANTHRAX . In: Manual of Standards for Diagnostic Tests and Vaccines: List A and B diseases of mammals, birds and bees. Office International des Épizooties, Paris.
- OIE (1997a). OIE Animal Health and Disease Control Report 1997. Office International des Epizooties, Paris, France.
- OIE (1997b). Chapter 3.1.1. ANTHRAX. In: *International Animal Health Code: mammals, birds and bees (Special edition 1997)*. Office International des Épizooties, Paris.
- Parry JM, Turnbull PCB, Gibson JR. *A Colour Atlas of Bacillus Species*. Wolfe Medical Atlases, Series no 19, 1983; Wolfe Publishing Ltd, London.
- Patra G, Sylvestre P, Ramisse V *et al.* Specific oligonucleotide primers for rapid identification of *Bacillus anthracis* strains. *Salisbury Med Bull* 1996; No 87, special suppl:445-6.
- Pfisterer RM. Retrospective verification of the diagnosis of anthrax by means of the intracutaneous skin test with the Russian allergen "Anthraxin" in a recent epidemic in Switzerland. *Salisbury Med Bull*, 1990, No. 68, Special suppl., 80.
- Plotkin SA, Brachman PS, Utell M *et al.* An epidemic of inhalation anthrax, the first in the twentieth century. *Am J Med* 1960; **29**:992-1001.
- Pomerantsev AP, Mockov YV, Marinin LI *et al.* Anthrax prophylaxis by antibiotic resistant STI-AR in combination with urgent antibiotic therapy. *Salisbury Med Bull* 1996; No 87, special suppl:131-2.
- Quinn CP, Turnbull PCB. Anthrax. In: Collier L, Balows A, Sussman M, Hausler WJ (eds) *Topley and Wilson's Microbiology and Microbial Infections*, 9th ed, Vol 3. Arnold, London 1998, pp. 799-818.
- Rao NSK, Mohiyudeen S. Tabanus flies as transmitters of anthrax - a field experience. *Indian Vet J* 1958; **35**:348-53.
- Redmond C, Henderson I, Turnbull PCB, Bowen J. Phage from different strains of *Bacillus anthracis*. *Salisbury Med Bull* 1996; No 87, special suppl:60-3.

- Redmond C, Hall GA, Turnbull PCB, Gillgan JS. Experimentally assessed public health risks associated with pigs from farms experiencing anthrax. *Vet Rec* 1997; **141**:244-7.
- Riedinger O, Strauch D, Böhm R. Die Abtötung von pathogenen und nichtpathogenen Sporenbildnern bei der Hitzesterilisation von Schlachtabfällen (the destruction of pathogenic and non-pathogenic spore-formers by heat sterilization of slaughterhouse waste). *Zbl Vet Med B* 1975; **22**: 860-5 (German, English summary).
- Riedinger O. Berechnung des Sterilisationsprozesses in Tierkörperbeseitigungsanstalten (computation for the sterilisation process in rendering plants). *Zbl Bakt Hyg I Abt Orig B* 1980; **170**: 287-96 (German, English summary).
- Robertson ME. Micro-organisms infective to workers in tanneries. In: *Progress in Leather Science 1920-1945*, British Leather Manufacturer's Research Association, London, 1948; 117-121.
- Schumacher CL, Meslin F-X. *Guidelines for research on oral rabies vaccines and field application of oral vaccination of dogs against rabies*. Working document for the WHO Consultation of Field Application of Oral Vaccines for Dogs, Geneva, July 20-22 1998. World Health Organization, Geneva, 1998. (in press).
- Sen SK, Minett FC. Experiments on the transmission of anthrax through flies. *Indian J Vet Sci* 1944; **14**:149-59.
- Shlyakhov E, Rubenstein E, Ovikov I. Anthrax post-vaccinal cell-mediated immunity in humans: kinetics pattern. *Vaccine* 1997; **15**: 631-6.
- Singh Y, Chaudhary VK, Leppla SH. A deleted variant of *Bacillus anthracis* protective antigen is non-toxic and blocks anthrax toxin. *J Biol Chem* 1989; **264**:19103-7.
- Sirisanthana T, Nelson KE, Ezzell JW, Abshire TG. Serological studies of patients with cutaneous and oral-oropharyngeal anthrax from northern Thailand. *Am J Trop Med Hyg* 1988; **39**:575-81.
- Sjöstedt A, Eriksson U, Ramisse V, Garrigue H. Detection of the vegetative form of *Bacillus anthracis* in soil by PCR. *Salisbury Med Bull* 1996; No 87, special suppl:50.
- Sjöstedt A, Eriksson U, Ramisse V, Garrigue H. Detection of *Bacillus anthracis* spores in soil by PCR. *FEMS Microbiol Ecol* 1997; **23**:159-68.
- Stepanov AV, Marinin LI, Pomerantsev AP, Staritsin NA. Development of novel vaccines against anthrax in man. *J Biotechnol* 1996; **44**:155-60.
- Sterne M. The effects of different carbon dioxide concentrations on the growth of virulent anthrax strains. Pathogenicity and immunity tests on guinea-pigs and sheep with anthrax variants derived from virulent strains. *Onderstepoort J. Vet Sci An Ind* 1937; **9**:49-67.
- Sterne M. The use of anthrax vaccines prepared from avirulent (uncapsulated) variants of *Bacillus anthracis*. *Onderstepoort J Vet Sci An Ind* 1939; **13**:307-12.
- Sterne M, Robinson EM, Nicol J. The use of saponin spore vaccine for inoculation against anthrax in South Africa. *Onderstepoort J Vet Sci An Ind* 1939; **12**:279-302.
- Sterne M. Anthrax. In: Stableforth AW, Galloway IA (eds) *Infectious Diseases of Animals*. Vol 1. *Diseases due to Bacteria*, 1959; Butterworths, London, pp. 16-52.
- Strauch von D. Tierkörperbeseitigung - eine ständige hygienische Herausforderung. *Wien Tierärztl Mschr* 1991; **78**:217-33.
- Taylor R. All fall down. *New Scientist* 1996; **150** (2029):32-7.

- Turell MJ, Knudson GB. Mechanical transmission of *Bacillus anthracis* by stable flies (*Stomoxys calcitrans*) and mosquitoes (*Aedes aegypti* and *Aedes taeniorhynchus*). *Infect Immun* 1987; **55**:1859-61.
- Turnbull PCB, Leppla SH, Broster MG *et al.* Antibodies to anthrax toxin in humans and guinea pigs and their relevance to protective immunity. *Med Microbiol Immunol* 1988; **177**:293-303.
- Turnbull PCB, Quinn CP, Hewson R *et al.* Protection conferred by microbially-supplemented UK and purified PA vaccines. *Salisbury Med Bull* No 68, special suppl 1990; 89-91.
- Turnbull PCB. Anthrax vaccines: past, present and future. *Vaccine* 1991; **9**:533-9.
- Turnbull PCB, Bell RHV, Saigawa K *et al.* Anthrax in wildlife in the Luangwa Valley, Zambia. *Vet Rec* 1991; **128**:399-403.
- Turnbull PCB, Bohm R, Chizyuka HGB *et al.* *Guidelines for the Surveillance and Control of Anthrax in Humans and Animals*. World Health Organization, Geneva, 1993 (unpublished document: WHO/Zoon./93.170).
- Turnbull PCB, Doganay M, Lindeque PM *et al.* Serology and anthrax in humans, livestock and Etosha National Park wildlife. *Epidemiol Infect* 1992; **108**:299-313.
- Turnbull PCB. Guidance on environments known to be or suspected of being contaminated with anthrax spores. *Land Contamination & Reclamation* 1996; **4**:37-45.
- Turnbull P, Bowen J, Mann J. Stubborn contamination with anthrax spores. *Environmental Health* 1996; **104**:171-3.
- Turnbull PCB, Lindeque PM, Le Roux J *et al.* Airborne movement of anthrax spores from carcass sites in the Etosha National Park, Namibia. *J Appl Microbiol* 1998; **84**:667-76.
- Turner M. Anthrax in humans in Zimbabwe. *Central Afr J Med* 1980; **26**:160-1.
- Van den Bosch C. Recalling an outbreak of gastrointestinal anthrax in northern Kenya, 1966. *Salisbury Med Bull* 1996; No 87, special suppl:139.
- Watson A, Keir D. Information on which to base assessments of risk from environments contaminated with anthrax spores. *Epidemiol Infect* 1994; **113**:479-90.
- Welkos SL, Keener TJ, Gibbs PH. Differences in susceptibility of inbred mice to *Bacillus anthracis*. *Infect Immun* 1986; **51**:795-800.
- Whitford HW. *A Guide to the Diagnosis, Treatment, and Prevention of Anthrax*. World Health Organization, Geneva, 1987 (unpublished document: WHO/Zoon./87.163).
- WHO (1967). Requirements for Anthrax Spore Vaccine (Live - for Veterinary Use) (Requirements for Biological Substances No. 13). World Health Organization Technical Report Series 1967; No 361.
- WHO (1970). *Health aspects of chemical and biological weapons*. World Health Organization, Geneva.
- WHO (1991). *Report of a WHO consultation on anthrax control and research*. Geneva, 13-15 November 1990. World Health Organization, Geneva (unpublished document: WHO/CDS/VPH/91.98).
- WHO (1994). Anthrax control and research, with special reference to national programme development in Africa: Memorandum from a WHO meeting. *Bull WHO* 1994; **72**:13-22. (French version *Bull WHO* 1994; **72**:353-63).
- WHO (1997a). *Disease outbreak in Kenya: WHO does not recommend travel restrictions*. Press Release No. WHO/101, 30 December 1997. World Health Organization, Geneva.

WHO (1997b). *Guidelines for the Safe Transport of Infectious Substances and Diagnostic Specimens*. World Health Organization, Geneva (unpublished document: WHO/EMC/97.3).

WHO (1997c). *WHO Recommended Surveillance Standards*. World Health Organization, Geneva (unpublished document: WHO/EMC/DIS/97.1).

Young SEJ, Healing TD. Infection in the deceased: a survey of management. *Communicable Disease Report* 1995; 5: R69-R73.