

# A foot and mouth disease simulation exercise involving the five Nordic countries

J.M. Westergaard<sup>(1)</sup>, C.B. Andersen<sup>(2)</sup> & S. Mortensen<sup>(2)</sup>

(1) ADC-Consult, Mikkelpborg Alle 7, DK 2970 Hørsholm, Denmark

(2) Danish Veterinary and Food Administration, Mørkhøj Bygade 19, DK 2860 Søborg, Denmark

Submitted for publication: 10 October 2006

Accepted for publication: 20 May 2008

## Summary

Simulation exercises are considered a very valuable tool for testing contingency plans established for the control and eradication of rapid spreading animal diseases such as foot and mouth disease, classical swine fever and avian influenza. An inter-Nordic simulation exercise was conducted in 2005 with the objective of testing the national foot and mouth disease contingency plans adopted respectively by Denmark, Finland, Iceland, Norway and Sweden. The Central Veterinary Administrations of the five countries jointly prepared a scenario which involved about 40 livestock holdings, 4 reindeer flocks, 6 slaughterhouses and approximately 500 people. An Excel spreadsheet with information on the events to take place and the timetable to follow during the exercise was a valuable tool for ensuring that the exercise was kept on track. The evaluation of the exercise dealt both with inter-Nordic activities and the activities of individual countries.

## Keywords

Animal health – Cross-border collaboration – Foot and mouth disease – Inter-Nordic activities – Simulation exercise.

## Introduction

Foot and mouth disease (FMD) has been absent from the Nordic countries for a number of years (Iceland: never recorded; Norway: 1952; Finland: 1959; Sweden: 1966 and Denmark: 1983). The great economic losses caused by FMD outbreaks in 2001 in Europe, the constant threat to food-producing animals in FMD-free countries and the potential for rapid spread of disease between countries having close links in the agricultural sector, encouraged the Nordic Council (the forum for parliamentary cooperation between Nordic countries) to give financial support for an inter-Nordic FMD simulation exercise in 2005. The decision to carry out such an exercise was further stimulated by the European Union (EU) FMD Directive (3), which foresees that countries shall test National FMD contingency plans by simulation exercises.

## Preparation of the scenario

A simulation exercise working group with representatives of the National Veterinary Administrations of the five Nordic countries was established in 2004. The initial meeting of the group dealt in particular with:

- a) the aim of the exercise
- b) the formulation of objectives relating to:
  - inter-Nordic activities
  - activities of individual countries in the light of the prevailing animal production systems and training requirements
- c) the timetable for the preparation and conduct of the exercise.

It was agreed at the meeting that the aim of the exercise was: 'to test the Contingency Plan established by each country for the control of foot and mouth disease' and that the timing of the exercise should only be known in advance to the Chief Veterinary Officers (CVO) of each country and the members of the working group. During the implementation of the exercise most of the Members of the working group were acting as 'game masters', i.e. persons designated to ensure that the exercise was running on schedule.

The working group met for preparatory work on five occasions between October 2004 and September 2005; each country was represented by two to three veterinarians who all were engaged in contingency planning at the national level. A consultant assisting the working group was responsible for preparing the agenda for meetings and for preparing working documents and meeting reports. It was noted by the group that although simulation exercises are widely recommended for improving the preparedness for the occurrence of rapid spreading animal diseases (the former List A diseases of the World Organisation for Animal Health [OIE]), a definition of a simulation exercise has not been agreed at International level. For the purpose of the inter-Nordic simulation exercise it was agreed that a simulation exercise should mean: 'an organised and controlled scenario-driven event carried out with the aim of:

- training personnel designated to be involved in an emergency situation related to the control of potentially rapid spreading animal diseases
- testing, reviewing and up-dating contingency plans, disease eradication strategies and capabilities at local, regional and/or national level'.

The definition adopted took into account experiences gained from simulation exercises conducted in the spring of 2004 in Denmark and in Iceland (7) and it was agreed that the exercise should include field conditions (i.e. farms, slaughterhouses) and that participants should work in their normal working facilities and environment.

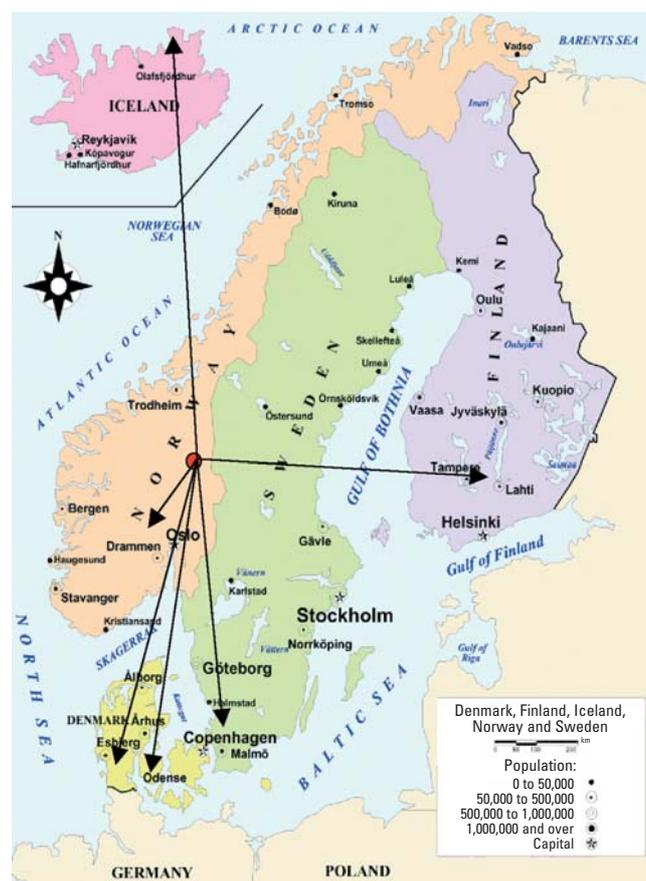
The scenario was based on a simulated spread of FMD virus between the Nordic countries as shown in Figure 1. The individual countries then developed additional detailed national scenarios within the framework of the inter-Nordic scenario.

The scenario included elements that required cross-border collaboration between individual countries within different areas relevant for disease eradication, including:

- information exchange at the level of the CVO
- epidemiological investigations
- use of an FMD model for airborne spread

- transport of diagnostic samples
- development of a policy for the transport of non-susceptible animals such as horses and hunting dogs
- recruitment of foreign veterinarians
- administration of cross-border surveillance zones
- administration and surveillance of reindeer populations migrating between countries.

The background documentation for the exercise was generated in an Excel spreadsheet. The spreadsheet was found to be an excellent tool for the preparation of a scenario and for the game masters to coordinate the proposed activities in the five countries whilst the exercise was being conducted. The spreadsheet contained



**Fig. 1**  
**Scenario of the inter-Nordic transmission of foot and mouth disease virus**

A Norwegian sheep farmer organised a workshop on specialised production of cheese, wool and meat on his farm. Many other farmers from the Nordic countries participated in the workshop and returned home to their own farms with cheese products or fresh meat. At the time of the workshop, the animals on the farm were incubating foot and mouth disease, because five sheep of a special genetic breed with a high milk production had been illegally imported from a country with endemic FMD

12 columns for placing information relating to: date, hour, country/countries involved, event, initiator of activity, responder, anticipated response, the element tested, name of the file containing details about the event and the author responsible for the text in a given row. At the time of the start of the simulation exercise information had been entered into 48 rows. Only the game masters were allowed to enter data into the spreadsheet. A part of the spreadsheet is shown in Figure 2.

Information on the conduct of the simulation exercise was submitted to the OIE for further distribution to OIE Member States (7).

## Implementation

The simulation exercise was carried out from 19 to 23 September 2005 and it was possible for the game

master team in each country to adhere to the established timetable given in the Excel spreadsheet (Fig. 2). A liaison officer was appointed in each team to coordinate the activities performed in the different countries.

The scheduled cross-border collaboration between the Nordic countries took place at both the level of the CVO and on the sub-CVO level by use of phone calls, faxes, emails and telephone conferences. In addition to the inter-Nordic activities, the individual countries had the opportunity to carry out activities which paid particular attention to issues of national interest. Information on the use of livestock holdings and persons involved in the exercise is given in Table I, which also contains information on issues tested by different countries.

The tasks performed in the field when FMD was suspected involved the owners of farms, private veterinarians and the official veterinarian. The measures applied or simulated were those outlined in Section 2: 'Measures in case of

	Date (yyyy-mm-dd)	Time (hhmm)	Country	Event	Initiator	Responder	Anticipated response	Tested element	Annex name - filename	Author
1	<b>Manuscript - Nordic FMD simulation exercise 2005</b>									
2	2005-09-15	1200	All	Press release to the public about the exercise					<a href="#">A 50915-1200 Press release - draft.doc</a>	
30	2005-09-19	0730	N	Clinical signs seen on several pigs, alarms practitioner who drives to farm	Farmer	Private vet	The Private vet should drive to the farm	The duty for notification of clinical signs of FMD		
31	2005-09-19	0800	N	Private veterinarian arrives on farm	Farmer	Private vet	The private vet should examine pigs, take anamnestic information and notify the vet authorities	clinical investigation, census of herd, place herd under official restrictions, sampling for diagnostics,	<a href="#">N 50919-0800 The farmers story to the private vet.doc</a>	
32	2005-09-19	0800	SF	Suspicion of FMD in pig herd	Farmer	MVO (municipal veterinary officer)	MVO contacts PVO (provincial veterinary officer) announcing a suspicion of FMD and PVO and/or MVO visits herd for sampling	Notification, clinical investigation, census of herd, place herd under official restrictions, sampling for diagnostics, epidemiological inquiry	<a href="#">SF 50919-0800 suspicion fattening pigs.doc</a>	Staff
33	2005-09-19	1200	DK	Suspicion of FMD in pig herd	Private vet	RVA	Private vet contacts the regional veterinary authority (RVA) announcing a suspicion of FMD and local official veterinarian visit herd - sampling	Clinical investigation, census of herd, place herd under official restrictions, sampling for diagnostics, epidemiological inquiry	<a href="#">DK50919-1200 Suspicion of FMD in swine herd in North Zealand</a>	Staff
34	2005-09-20	0800	DK	PCR indicate FMD +	DK game master	RVA and CVA	Regional and central vet authority establish crisis centres and prepare culling	Crisis centers, declaration of an outbreak, contingency plan on culling, training of staff for culling		
35	2005-09-20	0800	S	Suspicion of FMD at slaughterhouse	S game master	Vet autho at slaughterplant	Veterinary inspector makes all necessary contacts etc	Alarm system at slaughterhouse		
36	2005-09-20	0800	N	PCR indicate FMD +	N game master		Regional and central parts of Mattilsynet establish crisis centres and prepare	Crisis centers, declaration of an outbreak, contingency plan on culling		Staff

**Fig. 2** Inter-Nordic foot and mouth disease simulation exercise 2005: a spreadsheet was developed to describe the scenario and the timing of the introduction of each new element during the simulation exercise

Each row represents a significant event. Columns A and B specify the date and hour at which an activity should to be initiated, column C specifies in which country, column D provides information on the event, columns E and F describe who will initiate the event and who should respond. Columns G and H describe which section of the contingency plan is being tested and column I links to the documents handed out to the participants in the exercise, e.g. a made-up laboratory test result

**Table I**  
**Inter-Nordic foot and mouth disease simulation exercise 2005: information on the scope of the exercise with regard to livestock holdings and persons involved and issues given special attention by individual countries**

Countries	Number of livestock holdings and industries involved	Persons involved	Issues given special attention at national level
Denmark	Pigs (14) Sheep and goats (5) Cattle (3) Livestock markets (1) Slaughterhouses (3)	>200	<ul style="list-style-type: none"> <li>– disease suspicion and confirmation</li> <li>– stamping out</li> <li>– cooperation between Central Veterinary Administration and external institutions and organisations</li> <li>– trade issues</li> <li>– air-borne spread</li> <li>– emergency vaccination</li> </ul>
Finland	Cattle (8) Pigs (2) Reindeer flocks (3) Slaughterhouses (1)	>80	<ul style="list-style-type: none"> <li>– operation of national disease control and local disease control centres</li> <li>– disease suspicion and confirmation</li> <li>– milk collection</li> <li>– contact with the media</li> </ul>
Iceland	Sheep (1) Slaughterhouses (1)	>15	<ul style="list-style-type: none"> <li>– operation of national disease control centre</li> <li>– disease suspicion</li> <li>– transport of infectious material by air</li> <li>– review of legislation and contingency plan</li> </ul>
Norway	Sheep (1) Cattle (1) Pigs (1) Reindeer flocks (1) Slaughterhouses (1)	>150	<ul style="list-style-type: none"> <li>– operation of national disease control and local disease control centres</li> <li>– disease suspicion</li> <li>– disease confirmation</li> <li>– contact with the media</li> </ul>
Sweden	Cattle (2) Pigs (1) Slaughterhouses (1)	>50	<ul style="list-style-type: none"> <li>– operation of national disease control centre</li> <li>– disease suspicion</li> <li>– disease confirmation</li> </ul>

suspicion of an outbreak of foot-and-mouth disease' in Council Directive 2003/85/EC (3). The owners of herds in which disease was suspected, and the private veterinarians who would normally provide veterinary assistance to the herds, had been contacted two to three months prior to the exercise to ensure their:

- willingness to participate in the simulation exercise
- promise of secrecy with regard to date of disease suspicion
- agreement on remuneration.

On the day of the visit by the practicing veterinarian, the owner of an FMD suspected herd handed over to the veterinarian a letter which contained information on the signs of FMD and photos of lesions. The information received in the letter was used by the practicing veterinarian at the moment a call was made to the official veterinarian concerning the suspicion.

The specimens (blood and/or milk) collected at the time of suspicion were submitted to the national FMD reference laboratories for examination and the outcome of the examinations (time of reply and result) was given in the scenario. Two countries, Finland and Iceland, took the opportunity to test transport of samples by air to the

national FMD reference laboratory in Denmark. The samples from Iceland were initially refused by the airline due to the labelling of the parcel, in spite of the fact that the Central Veterinary Administration of Iceland had obtained assistance from a recognised transport company, which operates worldwide. In general, the involvement of the laboratories was limited to receiving samples from the field, as outlined in the scenario, and no attempt was made in this exercise to determine the capacities of the national reference laboratories.

In-depth epidemiological investigation is of paramount importance for controlling FMD, so epidemiological investigations were carried out at all farms when disease was suspected. The investigations took the form of a questionnaire, the lay-out of which varied slightly from country to country; but all questionnaires dealt with:

- potential source of infection
- duration of infection in the herd
- the movement of animals, persons, vehicles and substances (milk, meat, wool, slurry, manure, animal feed, etc.) likely to have carried the FMD virus to or from the herd in question.

When the disease was confirmed in Denmark work was initiated concerning the determination of the potential airborne spread of the FMD virus. Data collected at the infected farm (estimated virus release) and meteorological data obtained from the Danish Meteorological Institute were used in established FMD virus airborne spread models. The results obtained from the models (an atmospheric long-range dispersion model and an atmospheric short-range dispersion model) were communicated to the CVOs and game masters in Finland, Norway and Sweden.

It is important to ensure that documents produced and circulated during a simulation exercise are not mixed up with normal documents. In order to prevent this problem a printed watermark with the written text 'EXERCISE' was inserted in all exercise documents. In connection with telephone conversations the caller would start the conversation with the words 'This is an exercise' to avoid misunderstandings. In two countries the central veterinary administrations established a special 'simulation exercise mail-box' by using a log system that is part of the Microsoft Outlook programme.

None of the five countries carried out culling of animals; but cleaning and disinfection facilities were established for persons entering and leaving farms. Furthermore, killing teams were called to some of the farms where outbreaks were confirmed.

Two countries – Denmark and Finland – prepared a plan for emergency vaccination against FMD during the exercise. The plan took into account the criteria listed in Council Directive 2001/85/EC (3), which include:

- population density of susceptible animals
- predominant species clinically affected
- movement of potentially infected animals and products out of the established protection zone(s)
- predicted airborne spread of virus from infected holdings
- suitable vaccine
- origin of the outbreak with regard to traceability
- distribution of outbreaks
- public reaction to stamping out
- economic assessment of competing control strategies.

Furthermore, the logistic aspects of vaccination were simulated by desk top exercises.

## Evaluation of simulation exercise

The evaluation of the FMD simulation exercise looked at both inter-Nordic events and national events. The main topics included in the evaluation process were:

- management, particularly decision making and policy development
- technical aspects covering disease surveillance, diagnostic capabilities and capacities, use of FMD airborne spread models, culling and disposal of animals
- communication between countries and media communication
- information transfer with regard to epidemiological data and use of Geographical Information Systems (GIS)
- resources in relation to personnel and equipment
- lessons learnt during the exercise, i.e. what went well and what went wrong.

An external evaluator carried out the evaluation of the inter-Nordic events. An evaluation questionnaire containing 82 questions covering the main topics listed above was developed and used by all countries during the evaluation process. Furthermore, the individual countries evaluated the national events by use of 'wash-up meetings' with stakeholders and observers who had participated in the exercise and also by use of specially designed questionnaires.

The outcome of the evaluation was that the FMD simulation exercise from 19 to 23 September 2005 was considered to have been a very valuable exercise. Feedback from participants indicated that the objectives of the exercise had been met; the scenario had been considered realistic and had taken into account the characteristics of the different livestock production systems in the five Nordic countries and contained good challenges for the participants. Furthermore, a high level of commitment was noted during both the preparation and the conduct of the simulation exercise.

With regard to the elements of the exercise calling for cross-border collaboration between the five countries, the following observations and conclusions were made:

- bi-weekly telephone conferences between the CVOs were useful for ensuring good information exchange. At an early stage of an actual crisis these conferences should be scheduled at fixed time-points;
- during epidemiological investigations all five countries made use of the epidemiological questionnaires available in the contingency plans. When required, the results from the investigations were rapidly transmitted to neighbouring countries by phone, fax and email;

- there was good use of FMD virus airborne spread models. Maps detailing potential airborne spread after confirmation of the first FMD outbreak were available in the four countries using the models (Denmark, Finland, Norway and Sweden) within a period of 2 h to 12 h;
- good and on-going collaboration with air carriers is necessary for ensuring quick and efficient international transport of samples containing contagious material for diagnostic examination;
- the planned adoption of a common Nordic policy with regard to transport of horses and hunting dogs was more time consuming than anticipated. It proved impossible to include this activity in the scenario and no common policy was adopted during the exercise;
- the exercise revealed that two out of the five countries had arrangements in place (draft contracts, insurance policy) for recruitment of veterinarians from other Nordic countries;
- GIS was used during the exercise to delineate protection and surveillance zones. Three countries were able to transfer maps of the zones to all countries. The application of GIS ensured that information on established zones could be communicated to neighbouring countries easily. If a zone included parts of the territory of two countries maps could be consulted easily and the system enhanced the administration of such cross-border zones;
- the handling of the FMD suspicion in a flock of reindeer in Finland demonstrated that there was good cooperation between the veterinary administrations responsible for the health of reindeer in the Nordic countries and gave an opportunity to apply the FMD contingency plan in reindeer husbandry areas.

## Discussion

Simulation exercises have been used for a number of years by public institutions and certain private companies. With regard to public institutions, the exercises may simulate very different situations, such as airport disasters, biological terrorism, hurricanes and train fires; simulation exercises, however, may also be an integrated part of a university training programme (1, 5). Whatever the topic covered by the exercise, the ultimate goal of conducting simulation exercises is basically the same: to ensure an adequate level of preparedness, in terms of procedures and staff, to manage a real crisis. Within the area of animal health, simulation exercises have in recent years particularly focused on the OIE former List A diseases such as FMD, classical swine fever (CSF) and avian influenza.

A record of simulation exercises conducted since 2001 by European Countries has been published by T. Murray (4)

and since 2002 the OIE has systematically published information on simulation exercises conducted by OIE Member Countries (7). In 2005 and 2006 the OIE provided information on the implementation of 13 and 23 simulation exercises, respectively. The Central Veterinary Administration responsible for the preparation of documents related to a simulation exercise may make the documents available on their website; an example is documents related to Exercise Hawthorn, an exercise conducted in 2006 in the United Kingdom to test the government's avian influenza emergency preparedness (6).

The importance the EU gives to implementation of simulation exercises in the area of animal health has been highlighted in several acts of legislation (2, 3), but also by the fact that disease simulation exercises are now a requirement for candidate countries. Prior to the EU enlargements in 2004 and 2007, when the number of countries joining the Community was ten and two, respectively, all 12 candidate countries performed at least one simulation exercise involving large livestock (an FMD or CSF exercise) and one exercise involving poultry (a Newcastle disease or avian influenza exercise).

## Conclusions

The inter-Nordic FMD simulation exercise has, during the different stages of preparation, implementation and evaluation, created an important and valuable network between the veterinary administrations of the Nordic countries. It tested the established contingency plan of each country and showed that in principle their plans were satisfactory, although some minor adjustments should be incorporated. It has shown that the structure of the competent authorities of the five countries allows for proper functioning of simulation exercises over several days, with steadily rising pressure on staff with regard to challenges, functions and duties and to the numerous links to stakeholders and the outside society. An exercise can be organised by a small group of game masters with simple but highly effective measures.

## Acknowledgements

The authors would like to express sincere thanks to the Chief Veterinary Officers of Denmark, Finland, Iceland, Norway and Sweden and staff members of their National Veterinary Services for the excellent cooperation during the preparation, implementation and evaluation of the inter-Nordic FMD simulation exercise and in addition for their valuable contributions in the preparation of this article. The authors are particularly grateful to the Nordic Council for its financial support for the preparation and implementation of the exercise.



## Exercice de simulation de la fièvre aphteuse dans cinq pays d'Europe du Nord

J.M. Westergaard, C.B. Andersen & S. Mortensen

### Résumé

Les exercices de simulation sont un outil fort apprécié pour tester les plans d'urgence visant l'éradication et la lutte contre la propagation rapide de maladies telles que la fièvre aphteuse, la peste porcine classique et l'influenza aviaire. Un exercice de simulation a été conduit en 2005 par cinq pays d'Europe du Nord afin de tester les plans d'urgence contre la fièvre aphteuse élaborés respectivement au Danemark, en Finlande, en Islande, en Norvège et en Suède. Les Administrations vétérinaires centrales de ces cinq pays ont préparé conjointement un scénario faisant intervenir près de 40 élevages, 4 troupeaux de rennes, 6 abattoirs et environ 500 personnes. Un tableur Excel décrivant le déroulement des opérations ainsi que le calendrier à suivre durant l'exercice a permis d'en suivre la progression. L'évaluation de l'exercice visait autant les activités inter-nordiques que celles conduites par chaque pays individuellement.

### Mots-clés

Activité inter-nordique – Collaboration transfrontalière – Exercice de simulation – Fièvre aphteuse – Santé animale.



## Simulación de un episodio de fiebre aftosa con participación de los cinco países nórdicos

J.M. Westergaard, C.B. Andersen & S. Mortensen

### Resumen

En general se considera que los ejercicios de simulación constituyen un instrumento muy útil para ensayar los planes de contingencia destinados a contener y erradicar enfermedades animales que se extiendan con rapidez, como por ejemplo la fiebre aftosa, la peste porcina clásica o la influenza aviar. En 2005 se llevó a cabo en los cinco países nórdicos uno de tales ejercicios, con el objetivo de poner a prueba los planes nacionales de contingencia contra la fiebre aftosa de Dinamarca, Finlandia, Islandia, Noruega y Suecia. Los organismos veterinarios centrales de los cinco países prepararon conjuntamente una hipótesis de trabajo en la que de un modo u otro resultaban afectadas 40 explotaciones ganaderas, 4 rebaños de renos, 6 mataderos y aproximadamente 500 personas. Para asegurar el seguimiento del proceso resultó muy útil contar con una hoja de cálculo Excel que contenía información sobre todos los acontecimientos que debían producirse, junto con el calendario que convenía seguir durante el ejercicio. Al evaluar la simulación se tuvieron en cuenta tanto las actividades conjuntas como las de cada país por separado.

### Palabras clave

Actividad conjunta entre países nórdicos – Colaboración transfronteriza – Fiebre aftosa – Sanidad animal – Simulación.



## References

1. European Commission (2007). – 2007 Call for Proposals: Civil Protection Simulation Exercises. *Off. J. Eur. Communities*, **C 94**, 28.4.2007, 116.
  2. European Union (2001). – Council Directive 2001/89/EC on Community measures for the control of classical swine fever. *Off. J. Eur. Communities*, **L 316**, 1.12.2001, 5-35.
  3. European Union (2003). – Council Directive 2003/85/EC on Community measures for the control of foot-and-mouth disease repealing Directive 85/511/EEC and Decisions 89/531/EEC and amending Directive 92/46/EEC. *Off. J. Eur. Communities*, **L 306**, 22.11.2003, 1-77.
  4. Murray T. (2007). – Inventory of web accessible recent FMD real-time alert exercises carried out by European and other countries. FAO Report of the Open Session of the Standing Technical Committee of the European Commission for the Control of Foot-and-Mouth Diseases, Paphos, Cyprus. Appendix 7. Food and Agriculture Organization, Rome.
  5. Perry G.A. & Smith M.F. (2004). – A simulation exercise to teach principles of bovine reproductive management. *J. Anim. Sci.*, **82**, 1543-1549.
  6. State Veterinary Service (United Kingdom) (2006). – A report on Exercise Hawthorn: a series of linked exercises testing Government's avian influenza disease emergency preparedness. Available at: <http://www.defra.gov.uk/animalh/diseases/control/contingency/hawthorn/hawthorn-report.pdf> (accessed on 14 October 2007).
  7. World Organisation for Animal Health (OIE) (2007). – World Animal Health Situation. Disease Emergency Preparedness. Available at: [http://www.oie.int/eng/info/en\\_prepaurgence.htm?eld5](http://www.oie.int/eng/info/en_prepaurgence.htm?eld5) (accessed on 14 October 2007).
-