Aflatoxin B1 in rice bran as feed material and following contamination of consumer milk in Sweden: case study

Alexey Solyakov, Tech Dr, PhD
Dept of Chemistry, Environment & Feed Hygiene
National Veterinary Institute (SVA)
Uppsala, Sweden
E-mail: Alexey.Solyakov@sva.se

Mycotoxin Forum, 5-6 September 2013, Brussels

The National Veterinary Institute (SVA)

- An authority within Sweden's Ministry for Rural Affairs
- A specialist veterinary body and expert agency serving public and private sector
- Not a control authority – some control functions can though be delegated (in some rare cases)

Short reminder

Aflatoxin M1 is a metabolic product of aflatoxin B1 which is produced primarily by some strains of *Aspergillus flavus* and by most, if not all, strains of *A. parasiticus* , plus related species, *A. nomius* and *A. niger*.

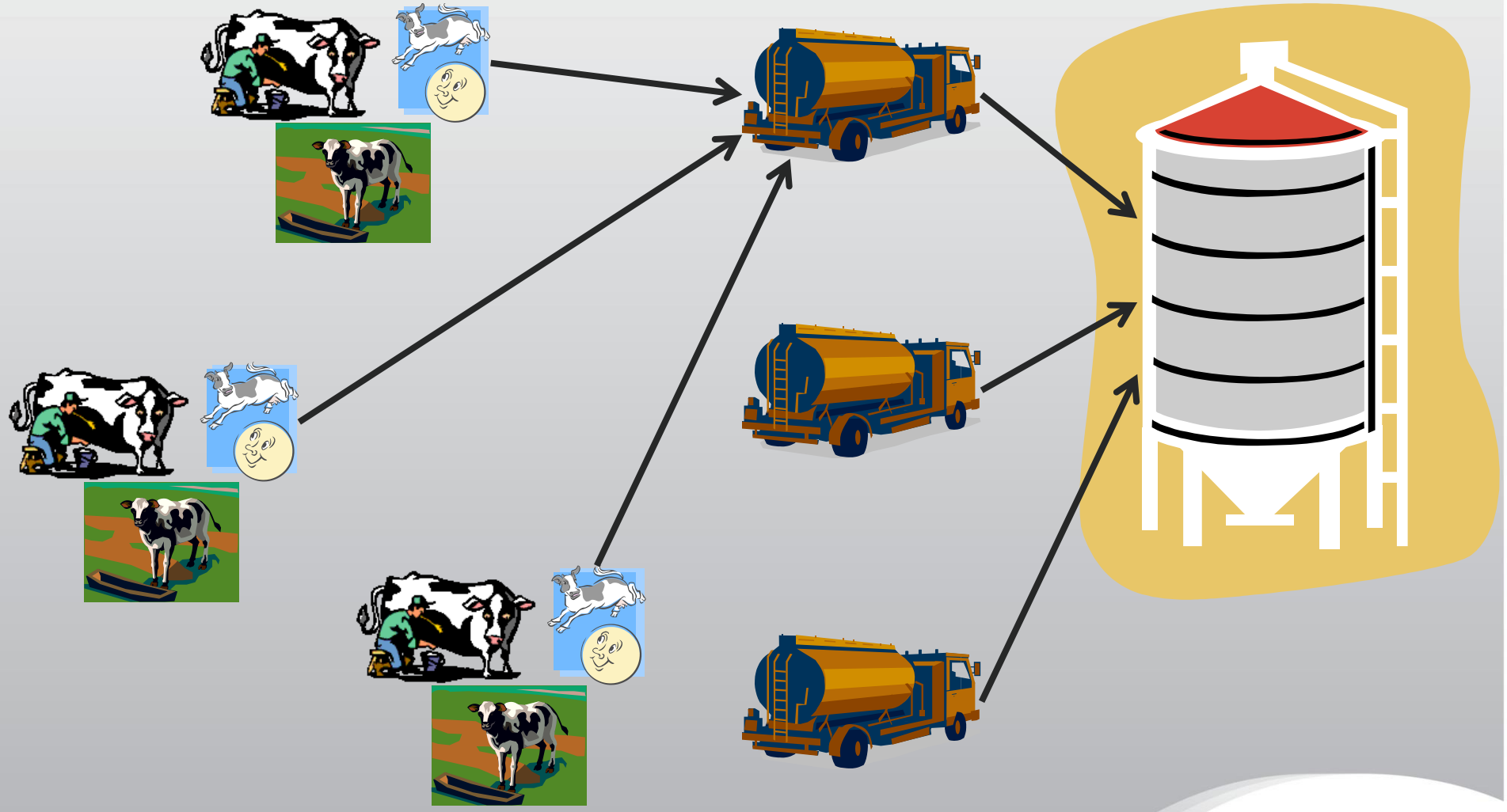
April 8th, 2013

- Routine sampling of raw milk at 20 major Swedish dairies within National Dairy Association monitoring programme. The target analyte was aflatoxin M1 (AFM1).

April 9th, 2013

- The samples arrived to SVA and analysed the same day.
- AFM1 in one sample was **24 ng/l** (the maximum permitted level is 50 ng/l according to Regulation 1881/2006).
- The dairy was immediately informed. The silo was quarantined.
- The result indicated occurrence of Aflatoxin B1 (AFB1) in the dairy cattle feed.

Collecting raw milk and deliverance to dairies



< LOQ

< LOQ

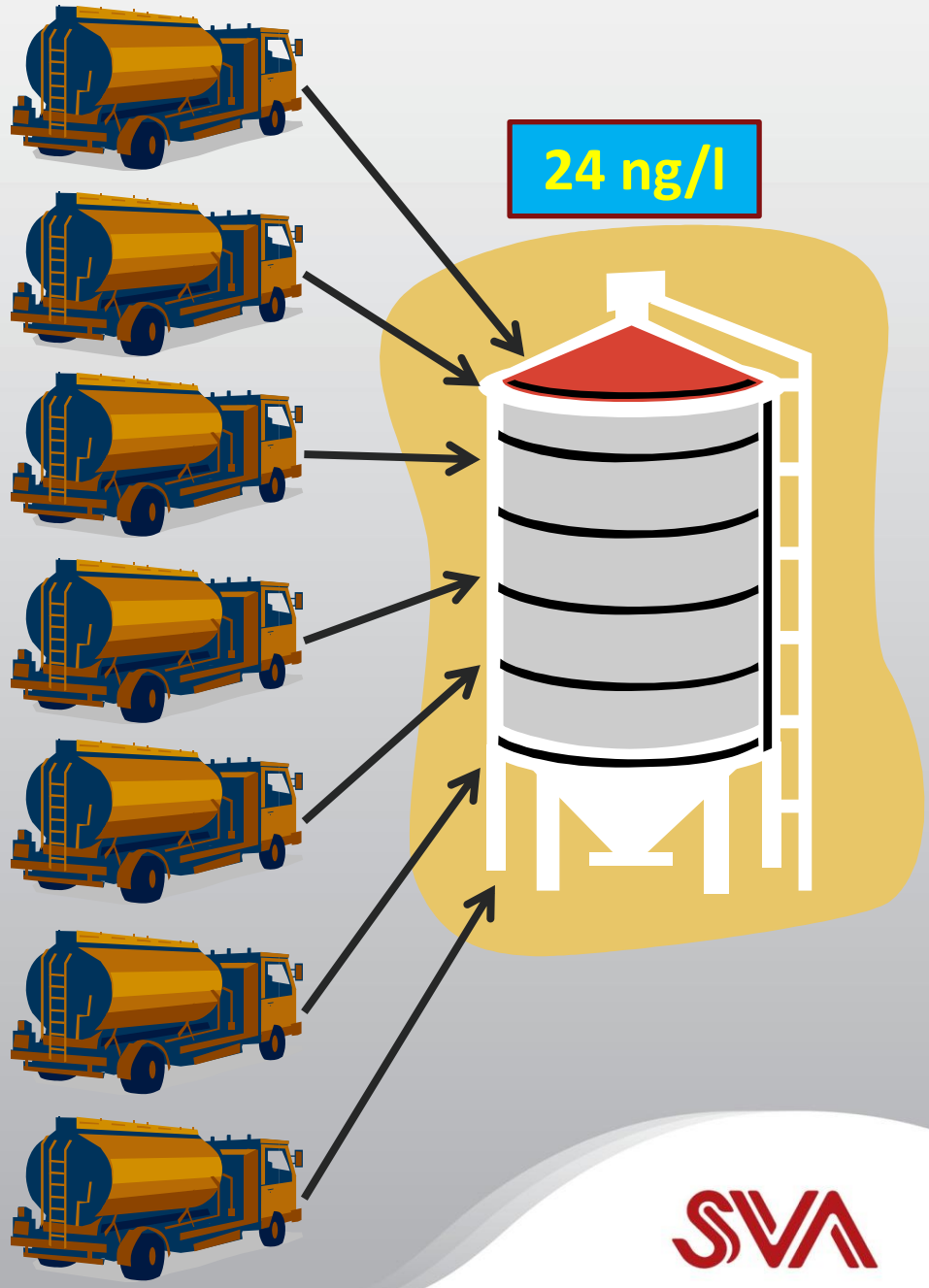
< LOQ

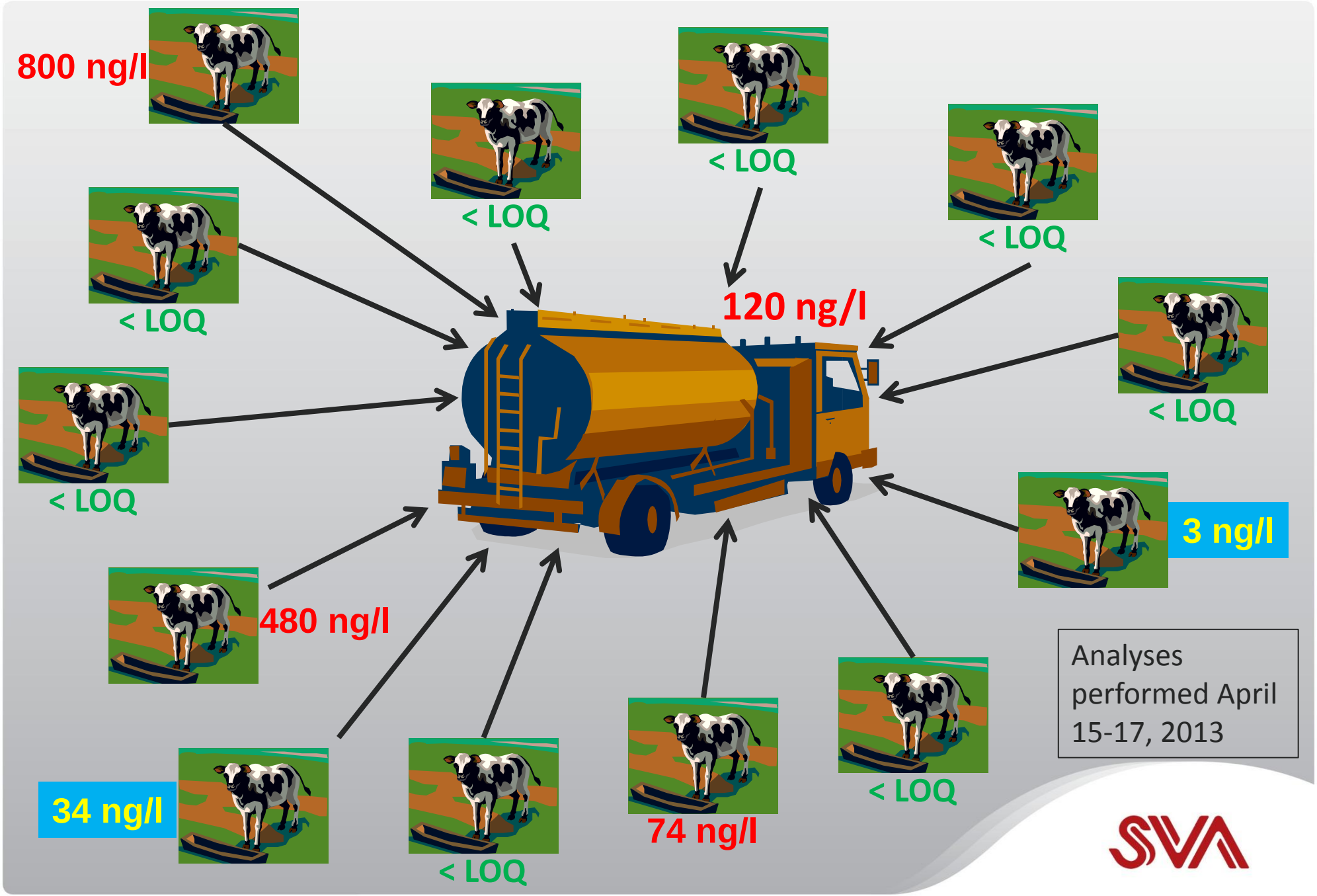
120 ng/l (April 12th, 2013)

< LOQ

< LOQ

< LOQ




800 ng/l
< LOQ
< LOQ
< LOQ
< LOQ
120 ng/l
< LOQ
< LOQ
3 ng/l
480 ng/l
34 ng/l
< LOQ
74 ng/l
< LOQ
Analyses performed April 15-17, 2013
SVA

- One common thing for the 5 farms: feed supplier
- The feed at the 5 farms was immediately replaced – one week stop for milk delivery was imposed. The feed samples were taken for AFB1-analysis.

	AFM1 in milk, ng/l	AFB1 in feed, µg/kg
Farm 1	**800** (50)	**89** (5)
Farm 2	**3** (50)	< LOQ
Farm 3	**480** (50)	**51** (5)
Farm 4	**34** (50)	< LOQ
Farm 5	**74** (50)	**10** (5)

Maximum permitted levels in brackets

- The dairy tog contact with the feed mill and requested information regarding feed materials used and recipes
- The feed mill reported the following feed materials and presented those for AFB1-analysis:
    - Rice bran
    - Betfor (by-product from the processing of sugar beet)
    - Alfalfa (lucerne)
    - Oat
    - Wheat
    - Wheat DDGS
    - Wheat meal
    - Rape seed meal
- The only high risk product for AFB1 is rice bran

Analysis results of the feed materials from the feed mill

Feed material	AFB1, µg/kg
Rice bran (from rice importer A)	**140-230** (20)
Rice bran (from rice importer B)	**1,4-5,9** (20)
Rice bran (from rice importer C)	**2,1-8,6** (20)
Betfor	**< LOQ**
Lucerne	**< LOQ**
Oat	**< LOQ**
Wheat	**< LOQ**
Wheat DDGS	**< LOQ**
Wheat meal	**< LOQ**
Rape meal	**< LOQ**

Maximum permitted levels in brackets

- According to documentation provided, the feed mill started with rice bran for dairy cattle feed since February 2013
- Only 5 reference samples could however be sourced (ca 50 batches were produced and released on the market)
- No information about sampling procedure (as regards reference samples) was available

Batch, production date	AFB1 in dairy cattle feed (reference samples), µg/kg
February 18, 2013	**1,6** (5)
March 12, 2013	**60** (5)
April 5, 2013 (I)	**4,7** (5)
April 5, 2013 (II)	**49,6** (5)
April 9, 2013	**11,1** (5)

Maximum permitted levels in brackets

- New information was that the rice bran was used even for production of mineral feed for horses (at least from Autumn 2012)
- Only recent reference samples could though be found. 2 samples were sourced from the market.
- All samples tested were AFB1-positive: 0,43-**49** µg/kg (maximum permitted level 10 µg/kg)
- Due to low dosage of the mineral feed, it was unlikely that the AFB1-amounts detected could be harmful for horses (there is though weak scientific basis regarding AFB1 and horses)
- The producer decided about voluntary recall from the market

- There were 3 suppliers of rice bran to the feed mill
- None of those rice importers was registered as feed business operator → no control from the Competent Authorities
- Supplier A delivered about 80% of rice bran total volume and therefore the supplier A was controlled first

Rice bran Supplier A

- First attempt to perform unannounced official control was unsuccessful: the premises were locked, no answer on known telephone numbers
- The second visit was announced around 2 weeks before it (i.e. the premises were inspected ca 1 month after the AFB1-kontamination source was traced to the rice bran)
- The company representative was unsure about their status as feed business operator (“not our business to ask what the buyer is doing with our bran”)

Rice bran Supplier A

- The company is ISO22000 certified – by-products are not in the scope though
- No rice bran reference samples at all
- The production line looked to be recently cleaned – but some material could be sourced from inner part of the line: AFB1 **310 µg/kg** (max permitted level 20 µg/kg)
- The company is currently contesting basically all results and conclusions and suggests that it was either rice bran from other suppliers (B or C) or that AFB1 was formed due to faulty storage conditions at the feed mill

Rice bran Suppliers B & C

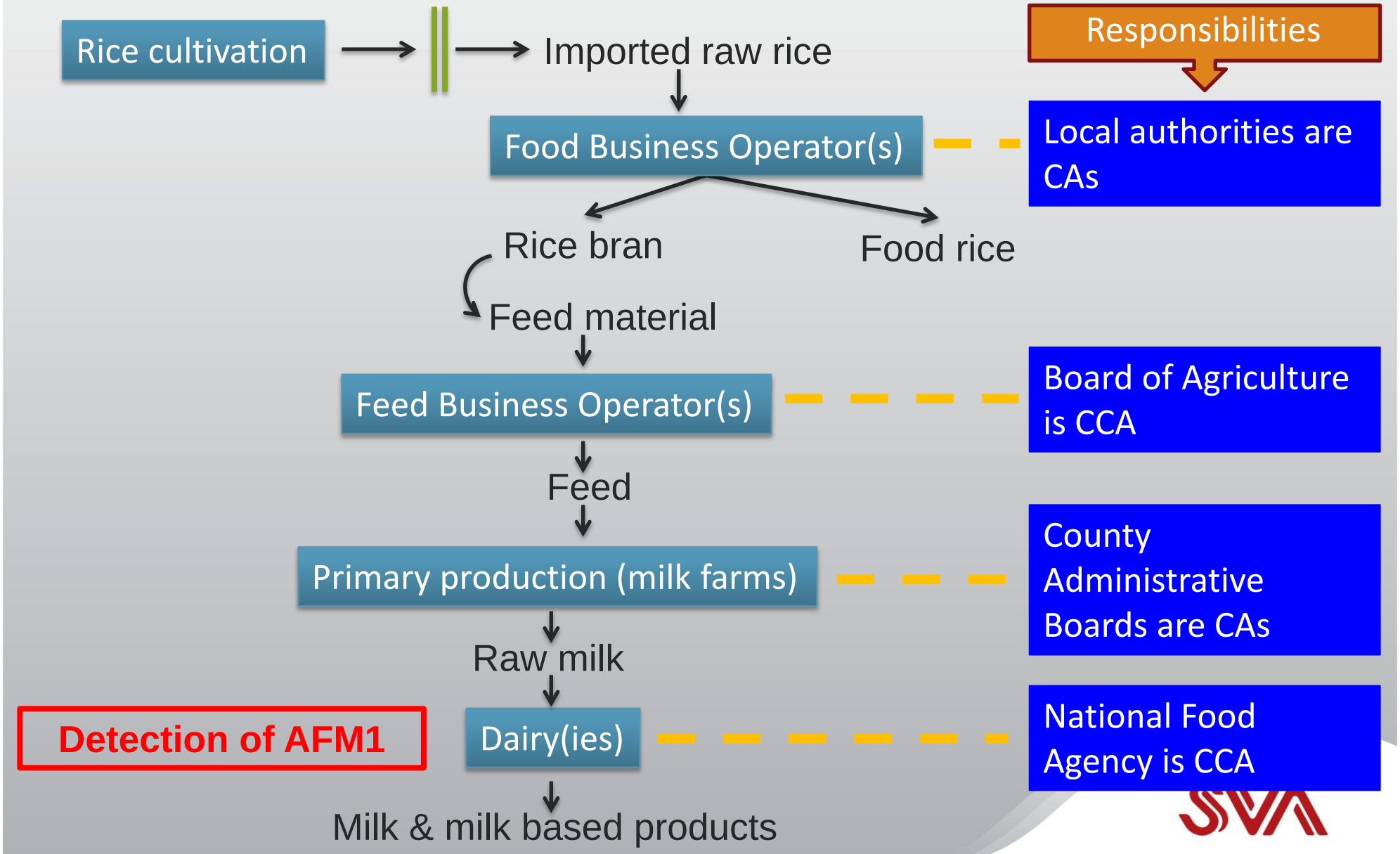
	Rice bran sample	AFB1, µg/kg
Rice bran supplier B	1	24
	2	7,3
	3	22
	4	2
Rice bran supplier C	1	13
	2	0,76
	3	0,84

Maximum permitted level is 20 µg/kg

Can AFB1 be formed under typical Scandinavian climate?

- AFB1 is produced by *Aspergillus flavus* etc which are thermophile moulds (require 30-36 °C under at least 2 days to produce significant amounts of AFB1)
- Another prerequisite is high water activity (Aw) level (>0,8). Around 10 samples (from the feed mill and all the rice bran suppliers) were tested for Aw and all the results were <0,7.
- The conclusion is that it is unlikely that AFB1 can be produced under typical Scandinavian climate. Which means that AFB1 in high levels occurred in raw rice before import to Sweden.

Short excursion into the national feed & food legislation (I)



Short excursion into the national feed & food legislation (II)

- Some imported risk feed materials shall be controlled regarding AFB1 at import to SE, for example:
  - copra (coconut by-product)
  - corn gluten meal
  - palm kernel meal
  - rape seed meal
  - rice/rice bran
  - shea nut meal
  - soya/soya by-products
- There is though a loophole: if one import raw rice for food purposes (practice) there is no obligation to control AFB1 at every delivery – but relevant HACCP-plan shall be in place and shall be followed

Lessons – or feed & food for thought (I)

- Communication between central competent authority and local competent authorities shall be attuned for unforeseen events
- Competent authorities shall have clear picture regarding analytical capacity of official analytical laboratories and level of their preparedness in case of unforeseen events
- Official control of Feed Business Operators shall focus on HACCP plan and its implementation
- Taking and keeping reference samples shall be in accordance with requirements of Regulation 183/2005 – and shall be controlled during official controls

Lessons – or feed & food for thought (II)

- Sampling within official control shall be in accordance with requirements of Regulation 152/2009 (video recording is advisable in case of juridical disputes)
- ISO22000 certification by itself is not a guarantee that the feed materials are safe
- Feed Business Operators are not always aware about basic requirements of the Regulation 183/2005
- High AFB1-levels in rice bran can normally indicate rather high AFB1-level in the respective food rice. FDA estimation is that AFB1-concentration in rice bran can be up to 6 times higher than in respective food rice.

Lessons – or feed & food for thought (III)

- Almost similar event in 2006 – even the same rice importer involved (but with new owners). Has one done homework?..
- The monitoring program for AFB1 in raw milk predisposes testing frequency as 1 analysis every 10 weeks from every diary within National Dairy Association. Is this frequency sufficient to see possible trends and, if necessary, to be able to act in reasonable time? Permanent scanning of the surrounding world is an important factor in the preparedness in general.

Many thanks for your kind attention!