

5.2. Milk: contamination risk analysis

Contamination capacity

The MRL are very different from one antibiotic to another. Thus, for milk, the rate is of 1 to 25 between two antibiotics very often used in veterinary medicine: penicillin and tetracycline (respectively 4 ppb and 100 ppb). This means that the same quantity of penicillin is able to contaminate, at the MRL threshold, 25 times more milk than tetracycline. Thus 1g of penicillin can contaminate up to 250 tons of milk whilst the same dose of tetracycline cannot contaminate more than 10 tons. Yet the doses used for either intramammary or general route treatment are often similar among the different antibiotics.

In other words, **antibiotics with a very low MRL, such as penicillin, are able to contaminate much higher volumes than those with a higher MRL** (see tables below).

The most used antibiotics

As previously mentioned, the main antibiotic residue risks in milk are due to intramammary treatments but also to general route treatments (penethamate). **Yet they are mainly betalactam-antibiotics**, particularly as regards to dry off treatments.

In certain countries, like France, the part of mastitis treatments related to “non-betalactam” drugs is very high. This means the risk of non-betalactam molecule residues is high and consequently, restricting the detection strategy only to betalactam-antibiotics could be dangerous (the most used antibiotics would not be detected). **However, in light of the elements presented above (“non-betalactam” treatments have few chances of contaminating important volumes of milk), searching in priority betalactam-antibiotics on bulk milk could be justified.**

table n°5 - Comparison of the quantity of milk “contaminable” at a risk threshold for the dairy industry for different antibiotics used by intramammary route.

Antibiotic	Maximum antibiotic concentration in milk	Concentration limit disturbing the lactic ferments used for yoghurt manufacturing	Number of litres of milk made improper for processing by contamination of a 10 litre milking
Penicillin	86 UI /ml	0,01 UI/ml	86 000 l
Tetracycline	57 ppm	0,1ppm	5 700 l
Dihydrostreptomycin	52 ppm	1 ppm	520 l

table n°6 - Theoretical contamination capacity for different intramammary antibiotic treatments.

Antibiotic	Treatment taken into account	MRL	Number of milk litres that can be contaminated at the MRL threshold with one treatment unit
Product 1	4 syringes of 200 mg of tetracycline (1 syringe every 12 hours, 4 times in the quarter affected by mastitis)	100 ppb	8 000 l
Product 2	3 syringes of 200 mg of amoxicillin (1 syringe every 12 hours, 3 times in the quarter affected by mastitis)	4 ppb	150 000 l
Product 3	4 syringes of 570 mg of penicillin (1 syringe every 12 hours, 4 times in the quarter affected by mastitis)	4 ppb	427 500 l

Main problems at the origin of residues on dairy farms

Antibiotic residue problems in milk have been undergoing studies for decades due to the consequences on lactic ferments and processing. Their causes have therefore been studied through many surveys (Ref. 22, Ref. 32)

Accidents or non-respect of the rules

Schematically, it is possible to distinguish problems due to accidents from those due to non respect of known rules.

“**Accidents**” are when the milk from a cow in treatment or in withdrawal time is mistakenly transferred to the farm’s milk storage tank. These accidents raise the question of the identification and management of “risky” animals whose milk possibly contains antibiotics superior to the MRL.

The **non respect of rules** corresponds either to a bad knowledge of the latter (lack of information) or to bad practices (farmers often underestimate their consequences).

Major risks with intramammary treatments

All the studies carried out have demonstrated that the most antibiotic residue cases in milk are related to intramammary treatments. In this case, the antibiotic is placed directly in the udder at a high concentration level.

Clinical mastitis intramammary treatments in lactation are therefore the risk number 1 (more than 50% of the cases according to most surveys). The concentration in antibiotics is high and the probability of an accident is strong because the animal is among those who usually undergo milking.

Dry off treatments also appear as hazardous. The doses used are very high because the 4 teats are treated at the same time with high doses of antibiotics in order to remain in the udder. **Accidentally milking in the evening a cow dried in the morning can lead to the contamination of hundreds of thousands of litres!** Also, the farmers sometimes forget that certain antibiotics remain during the whole dry period (generally 8 weeks) and are transferred to the colostrums, then to the milk during a period variable according to the medicines. This is even more the case when the dry period is short. For certain antibiotics, it has been proved that in case of a shortened dry period (under 4 weeks), the milk content in antibiotics was superior to the MRL for 10 and even 15 days after calving.

Any antibiotic treatment, whatever the administration route can be at the origin of a contamination

The surveys, then the scientific studies carried out demonstrated that whatever the route used to administer antibiotic treatments, they could be transferred to milk (see the transfer mechanisms of antibiotics to milk). Thus treatments administered by general route (subcutaneous, intramuscular and intravenous) are an important cause of milk contamination. A prevention policy should therefore take into consideration all kinds of treatments. Note that a simple subconjunctival treatment can be at the origin of residues in milk (Ref. 40).

Results of a survey carried out on more than 1000 farms having delivered milk positive in inhibitors (Virbac Info, 2003)

Several surveys have been carried out around the world to study the main causes of antibiotic residues in milk. The results presented here are from a study made in France in 2001 on more than 1500 cases of farms found positive in inhibitors.

The most often incriminated treatments are intramammary (47% of known cases) and dry off treatments (32%). The errors at the origin of the problem are mainly due to the accidental milking of a “residue” cow, 63% (mastitis, dry cow...) corresponding to an insufficient identification of the animals or to a lack of instructions.

All antibiotic families seem detected correctly by the method used (Delvotest® MCS). The number of different products incriminated is high (21 lactation products, 13 dry off treatments, 35 general route treatments) but the 5 most prescribed products in each category alone represent respectively 81%, 94% and 56% of the positive tank cases.

