Le Cemagref

New Challenges for environmental protection in terms of intensive animal production

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eau - territoires - développement durable

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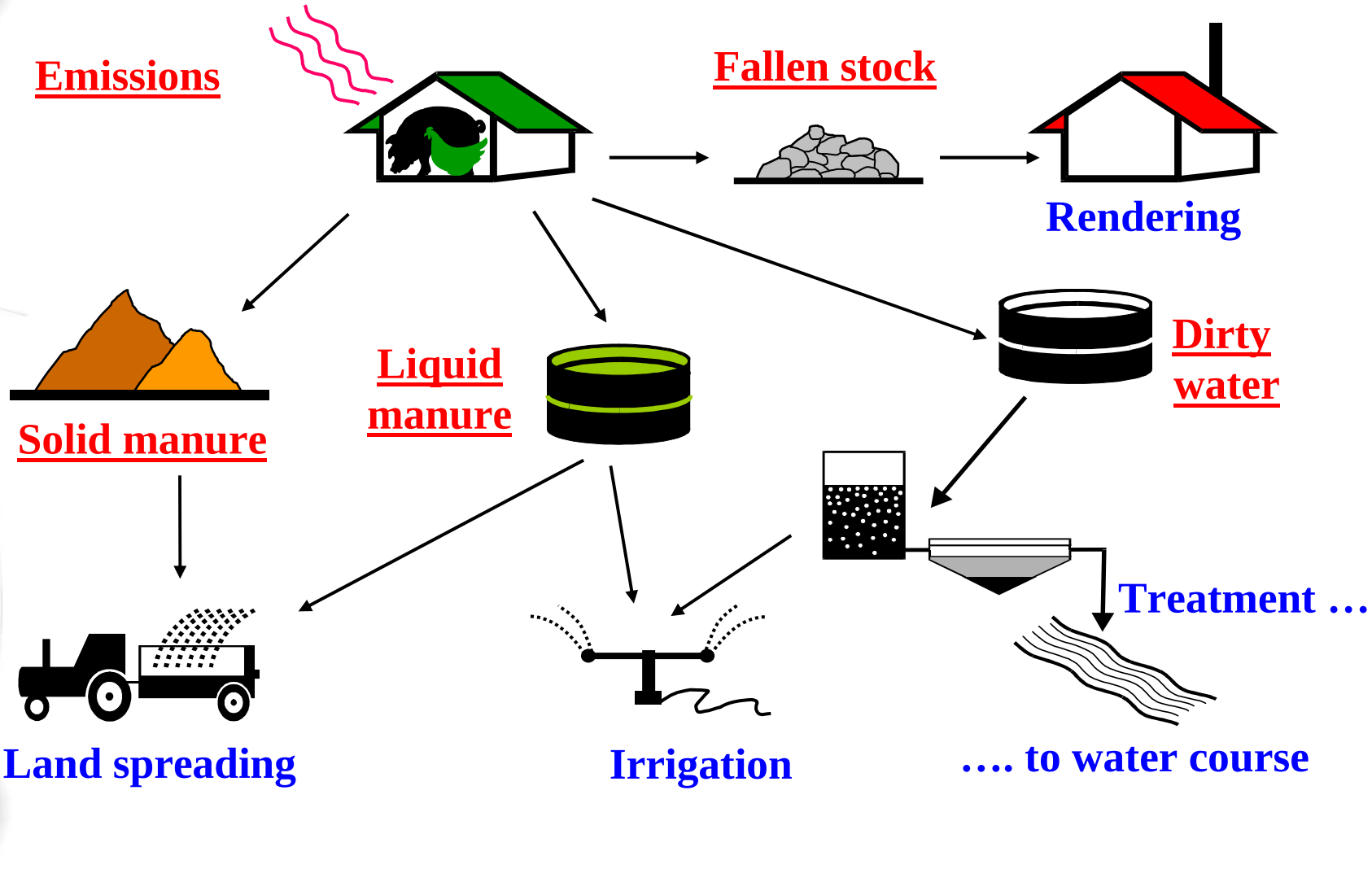
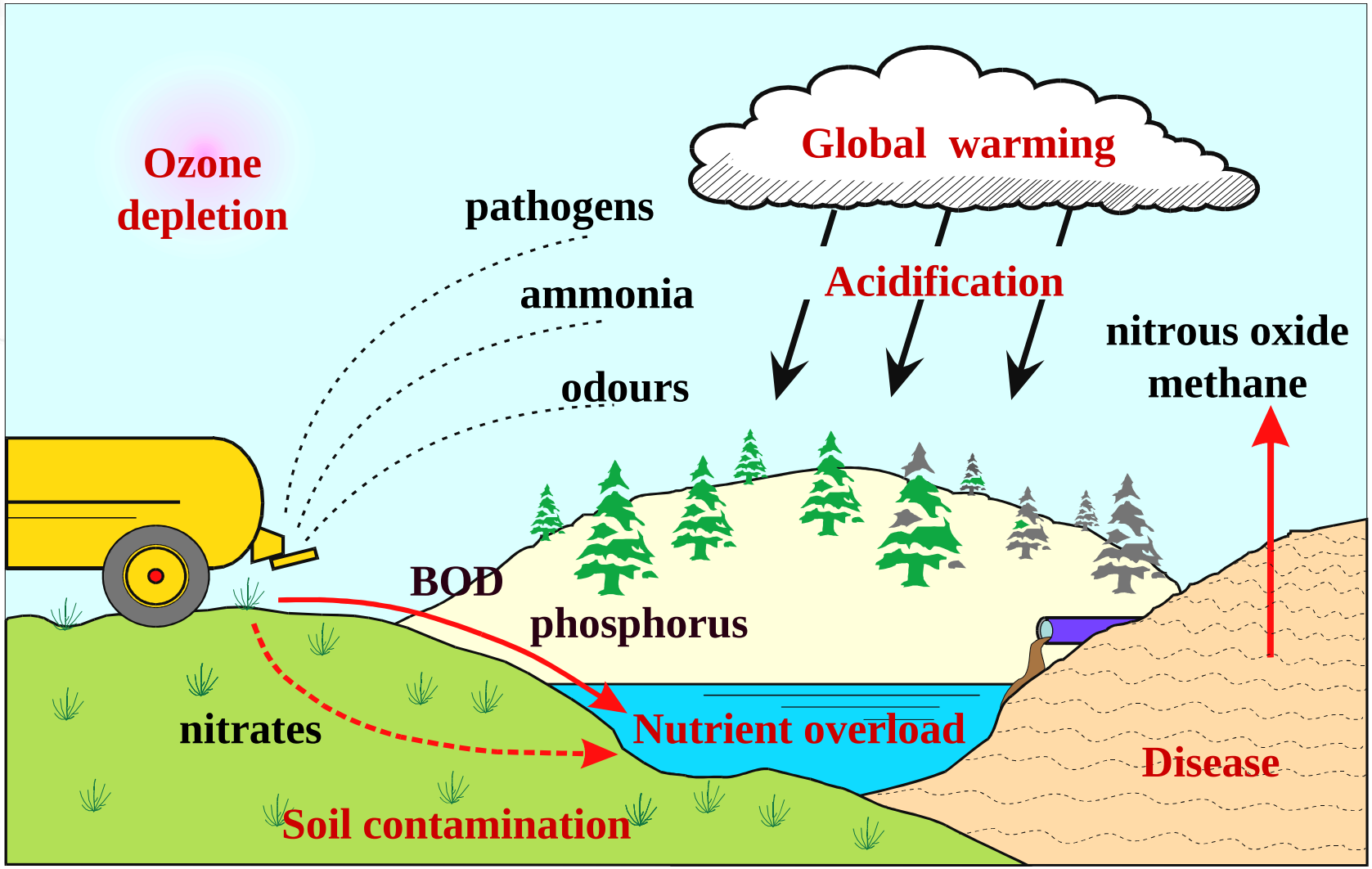
Structure

- **What are the problems ?**
- Strategies and regulations
- Manure management technologies
- Conclusions

The main waste streams

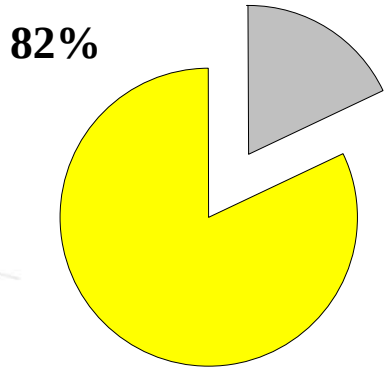


Potential environmental impact

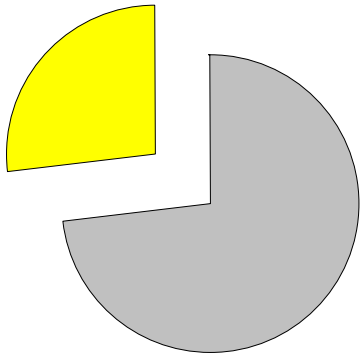


Impact of agriculture*

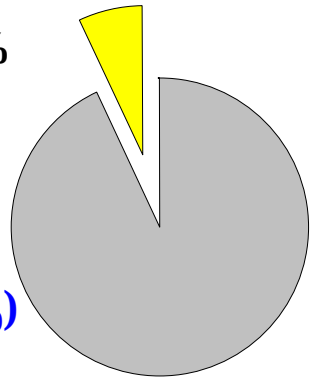
*** Figures for the UK between 1996 and 1999**



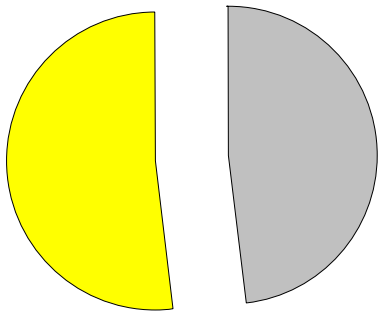
Ammonia



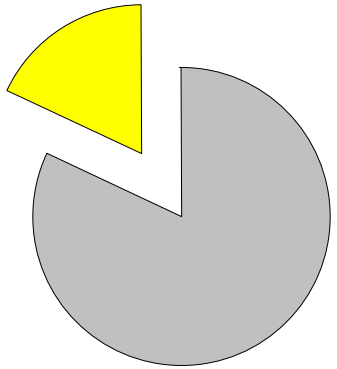
Methane



Dust (PM_{10})

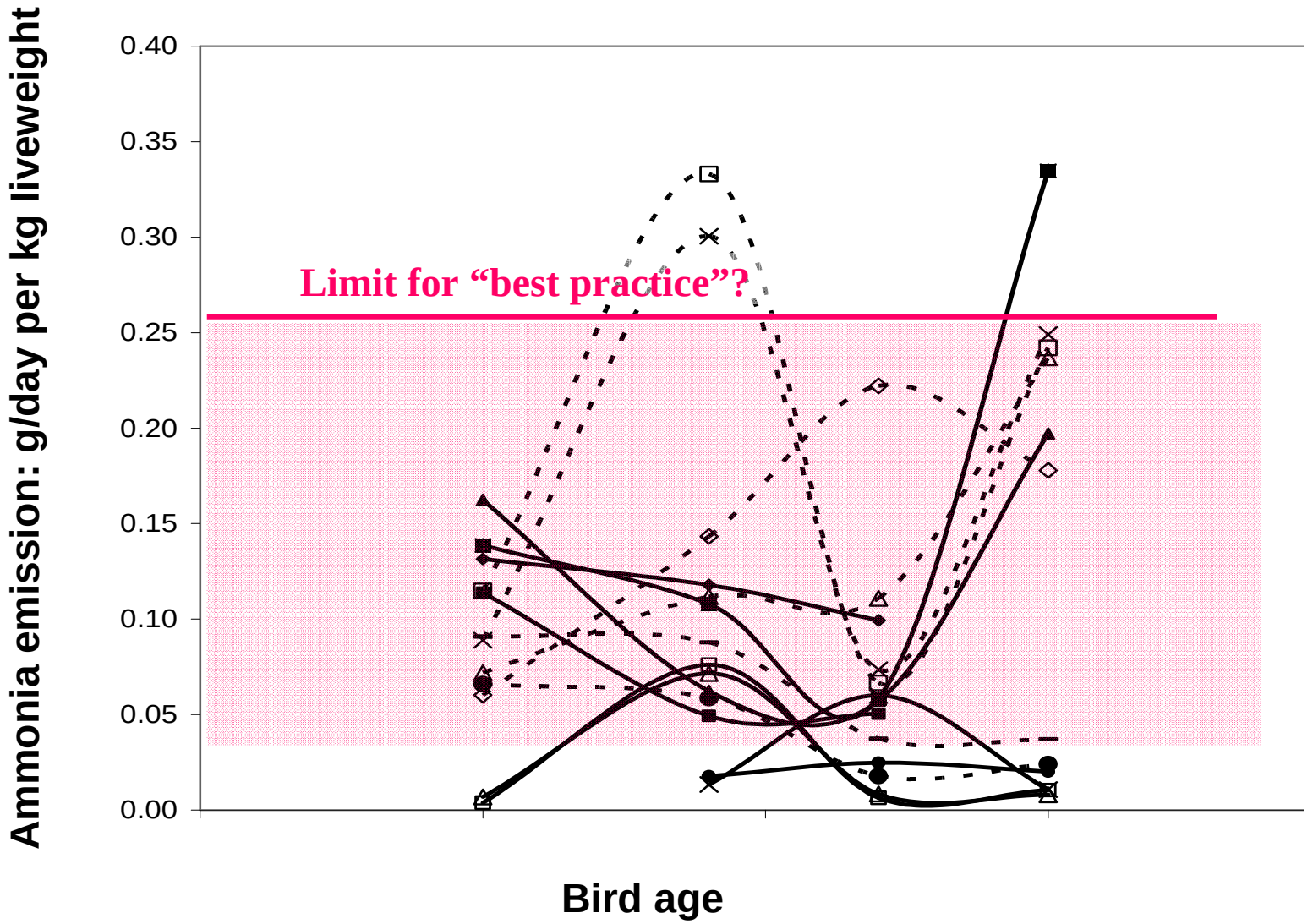


Nitrous oxide

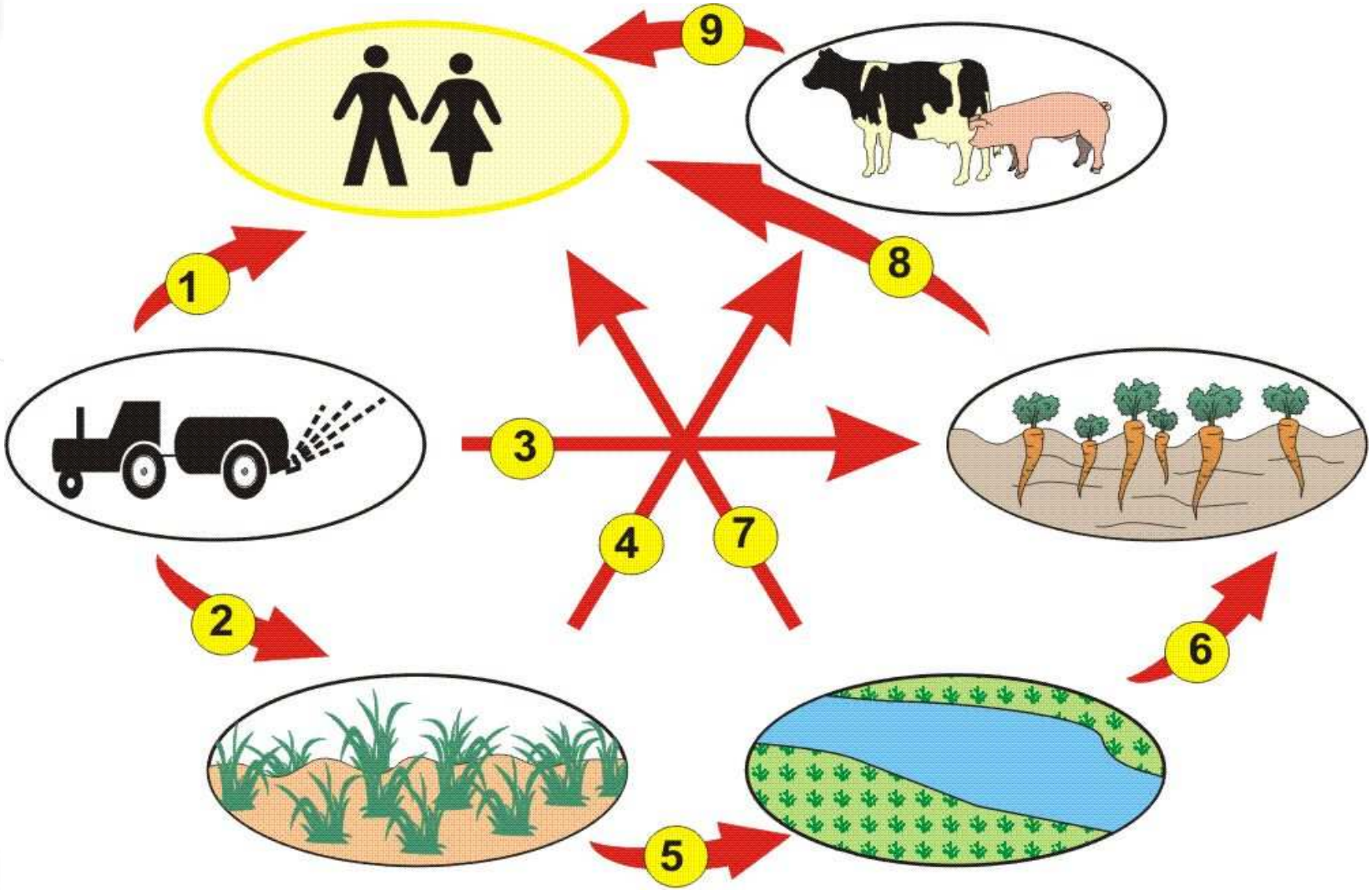


Water pollution

Ammonia emissions from poultry houses



Pathogen risks in agricultural and food



Impact areas of the livstock industry

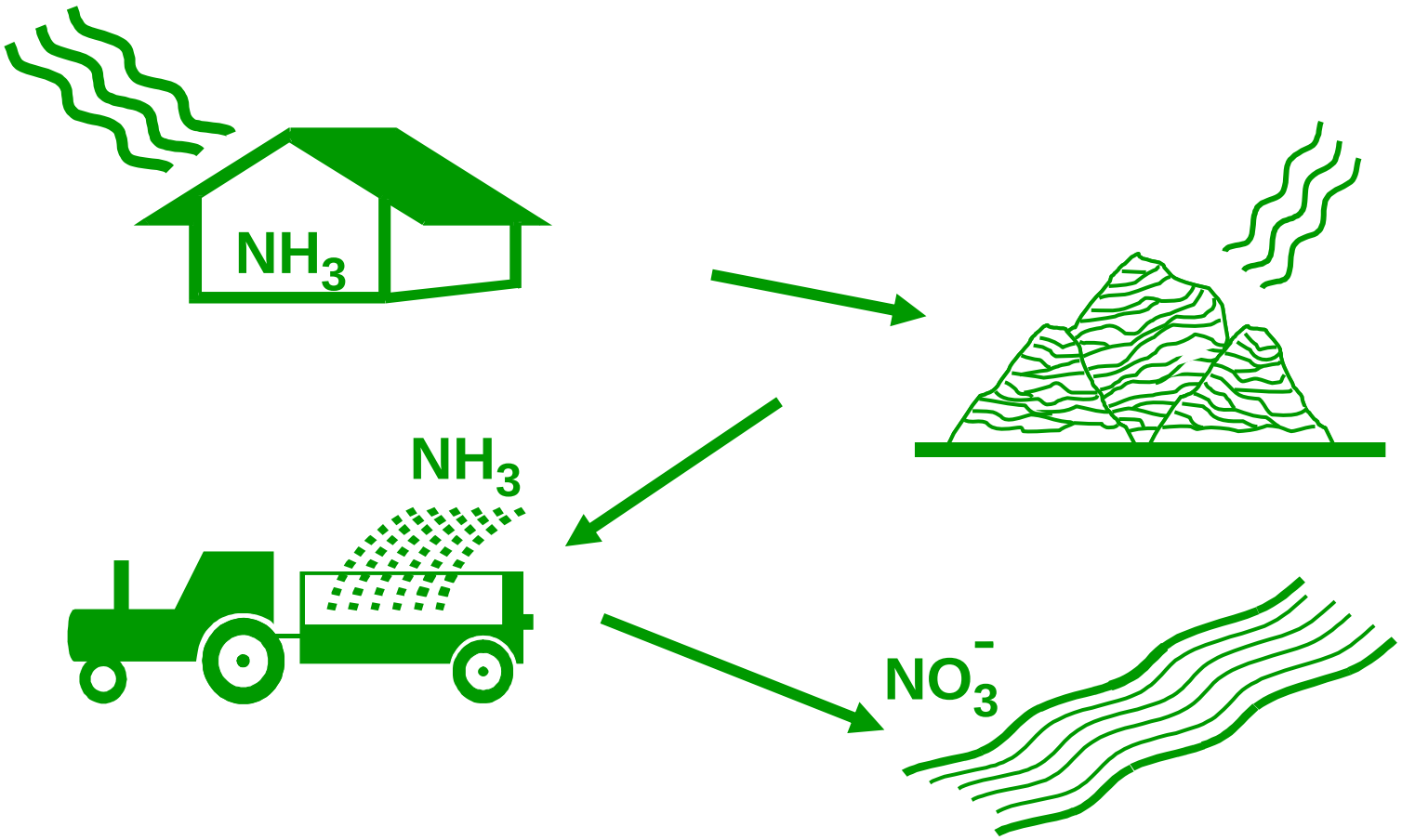
# large impact ! minor impact " no direct impact	Impact of pollution type on the				
	general public	staff	live birds	food quality & safety	country-side
Emission of gases	"	#	#	"	#
Disease risks	#	#	#	#	!
Solid materials	!	#	#	!	#
Organic load	"	"	!	"	#
Nutrient load	"	"	"	"	#
Nuisance	#	!	!	"	!

- What are the problems ?
- **Strategies and regulations**
- Manure management technologies
- Conclusions

How to overload the local environment !

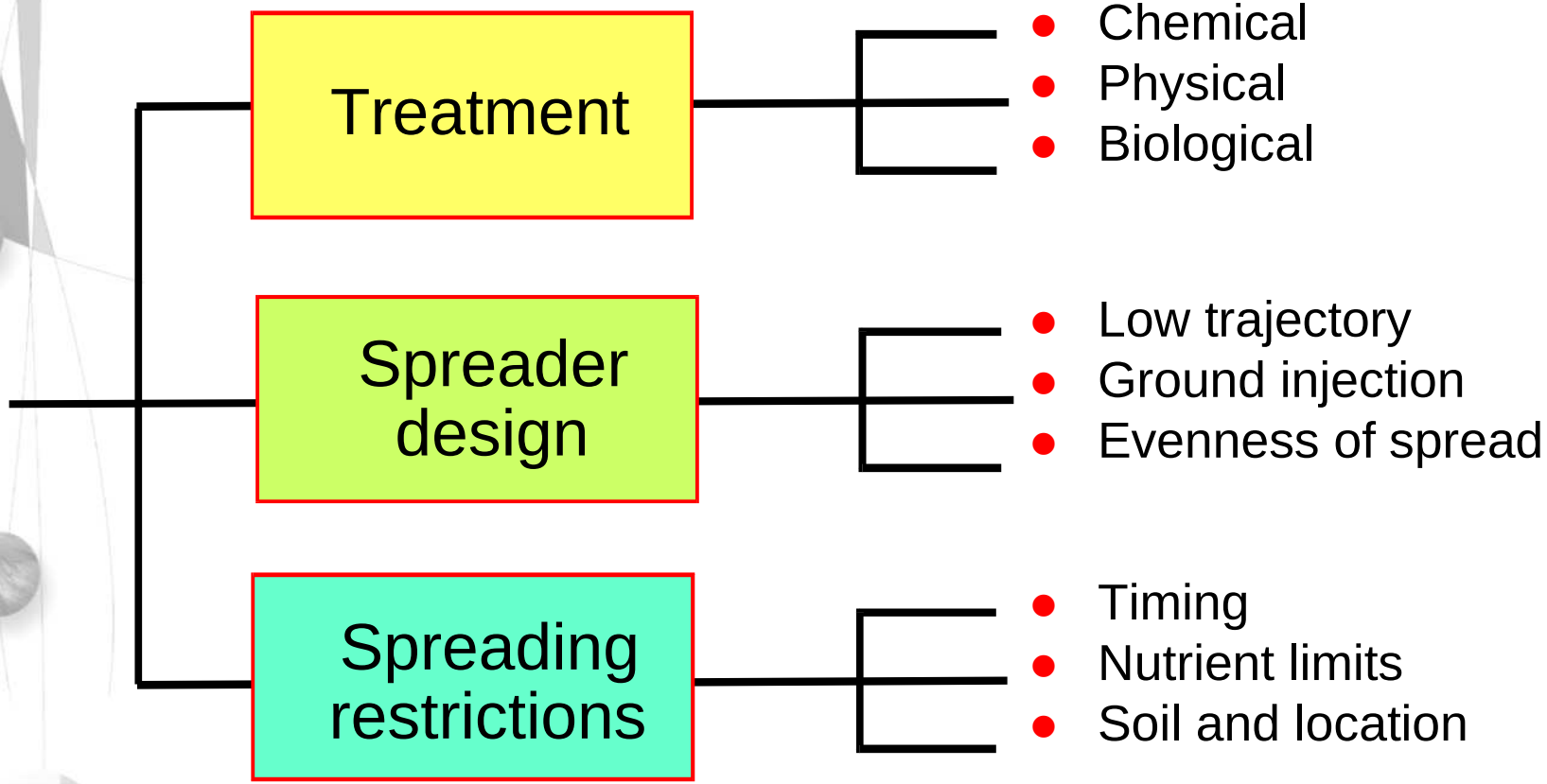
Cornerstone of strategy is sustainability - achieving a nutrient balance with the environment

The overall strategy



Moving the problem is no answer!

What are the options?



Regulation types

1. **<u>EU Directives</u> – apply to all EU countries (mandatory) using national legislation – some neighbouring countries may also choose to follow the same rules**
2. **<u>National legislation</u> (mandatory) – dealing with special local problems with the environment**
3. **<u>National guidelines</u> – not compulsory but if disregarded and incidents occur, this may be used as additional evidence**
4. **<u>Food quality standards</u> (commercial) – rules to satisfy retailers and other purchasers – can be more strict than government regulations!**
5. **<u>Subscription to specific schemes</u> – organic, free range etc. Products marketed under such a label legally must observe related rules (trade and description rules)**

Main impact of current EU legislation

- Minimum storage periods – capacities upto 12 months required
- Prohibited periods (esp winter) for land spreading of manures
- Prohibited weather for land spreading (eg: waterlogged/frozen)
- Stipulation of manure spreading methods; eg: injection
- Covering of manure stores (especially for reduction of emissions)
- Limitations on animal numbers for a given available land area
- Compulsory manure management plans
- Manure (nutrient) bookkeeping – limited application of N, P

So far, such legislation is mostly aimed at an environmental agenda.

Key EU Directives

1. NEC Directive 2001/81/EC
2. The IPPC Directive 96/61/EC
3. The Sewage sludge (in agriculture) Directive 86/278/EEC
4. The Waste Directive 2006/12/EC
5. The Drinking Water Directive 98/83/EC
6. The Bathing Water Directive 76/160/EEC
7. The Urban Wastewater Directive 91/271/EEC
8. The Nitrate Directive 91/676/EEC
9. The Groundwater Directive 80/68/EEC
10. The Water Framework Directive 2000/60/EC
11. Protection of farmed animals Directive 98/58/EC
12. Animal By-Products Directive 1774/2002

EU Nitrate Directive (1991)

- **Control of release of N into the environment from Agriculture**
- **Target – protection of drinking water quality in terms of nitrate contamination (max 50 ppm as N)**
- **Indentification of high risk areas – NVZ (nitrogen vulnerable zones)**
- **Limitation of *organic* manure application in terms of total N in such areas**
- **Initial limit 210 kg N per hectare initially falling to 170 kg by 2005**

EU IPPC Directive

Integrated pollution prevention and control

- **Principle of preventing (and/or reducing) emissions to air, water and soil. To achieve a high level of protection for the environment *taken as a whole*.**
- **Implemented and revised by sector; agriculture sector will be completed early 2007.**
- **Principle of BAT (best available technique) as set out in BREF documents for each sector**
- **For livestock, all existing pig units (over 2000 places) and poultry (over 40,000 places) will need to be licensed by end January 2007.**

EU IPPC Directive

Key environmental impacts of concern

- Pollution of water (direct and indirect)
- Pollution of soil (especially P re land spreading)
- Release of ammonia to the air
- Dust emissions
- Odours
- Other emissions (methane, nitrous oxide …..)
- Noise

BUT without negative impacts on:

- Energy use
- Water use

EUAnimal By-products directive

- Animal carcases, parts of animal carcases (including blood) and products of animal origin which are not intended for human consumption;
- Manure and gut contents;
- Catering waste containing meat or products of animal origin and which is intended for feeding to livestock, use in a biogas or composting plant

Category 1 High-risk material and must be completely destroyed.

The permitted disposal routes are

- incineration
- normal rendering followed by incineration
- pressure rendering (133°C and 3 bar pressure) followed by landfill

EU Animal Waste Directive 90/667

Category 2 High-risk material

Includes diseased animals animals which die on farm but which do not contain SRM at the point of disposal

The disposal routes are as Category 1 plus:

- **pressure rendering to (133°C and 3 bar pressure) followed by disposal to landfill, or use as a fertiliser or treatment in a biogas or composting plant**

Category 3

Material which is no longer fit for human consumption – but can be used in animal feed

- What are the problems ?
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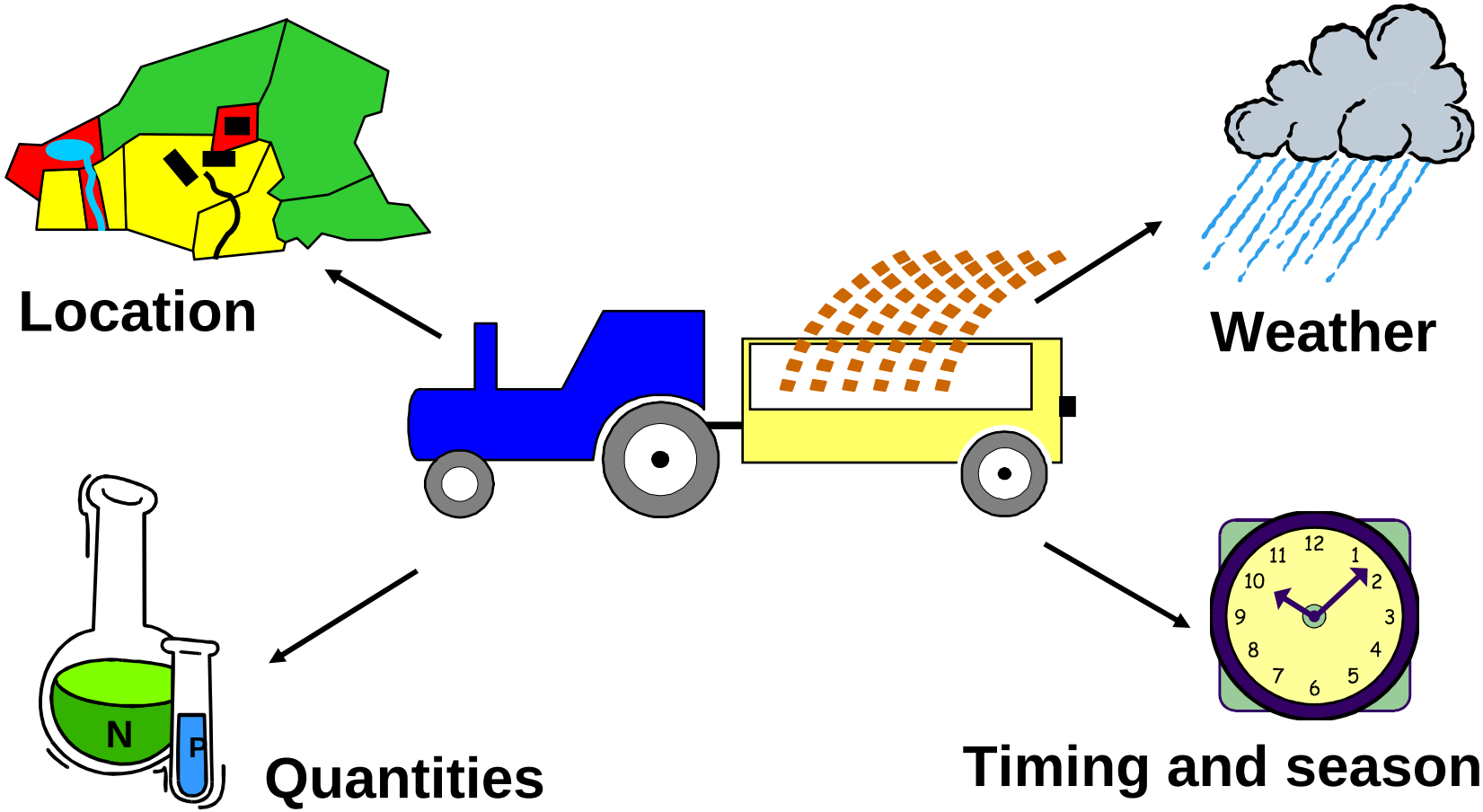
Land application of wastes

Crops and land use can be divided into categories of vulnerability starting from the highest risk from contamination

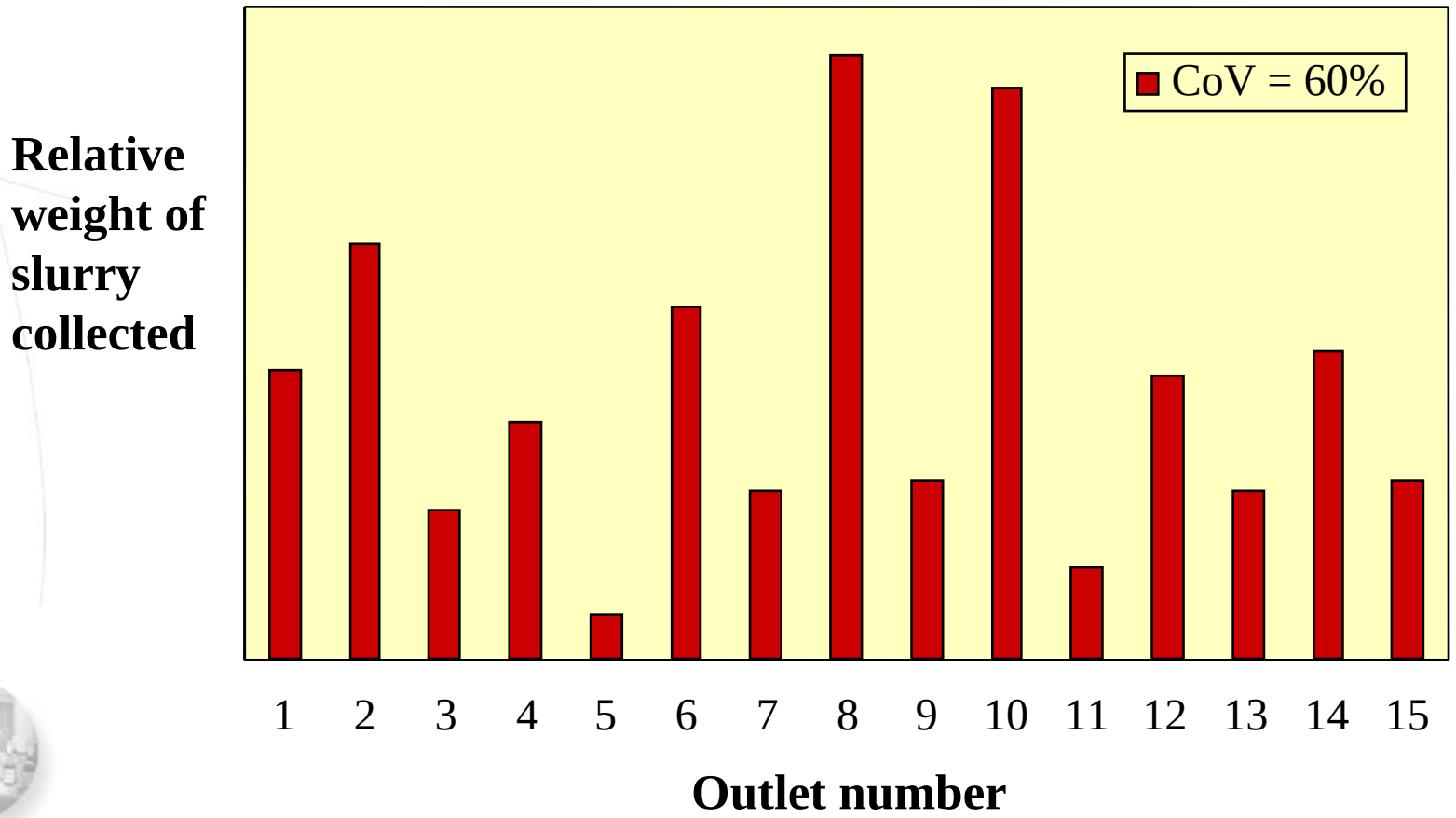
- **Salad leaf crops (lettuce)**
- **Salad root crops (raddish)**
- **Vegetable leaf crops (cooked) (brussels)**
- **Vegetable root crops (cooked) (potatoes)**
- **Grain crops (wheat)**
- **Crops for feed stock in food industry (oil seed rape)**
- **Orchard crops (apples)**
- **None food crops (timber)**

Spreading strategies

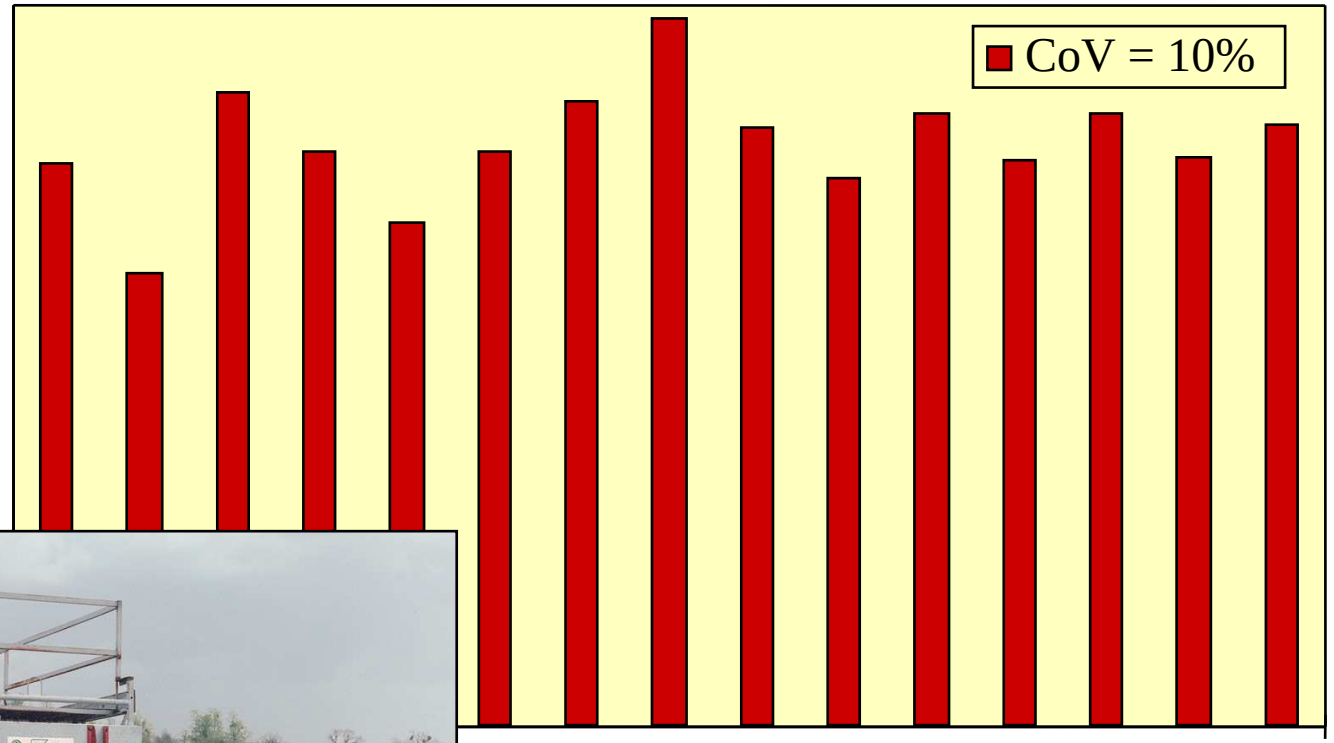


Accurate spreading of slurries

Lateral distribution – unmodified tanker



Accurate spreading of slurries



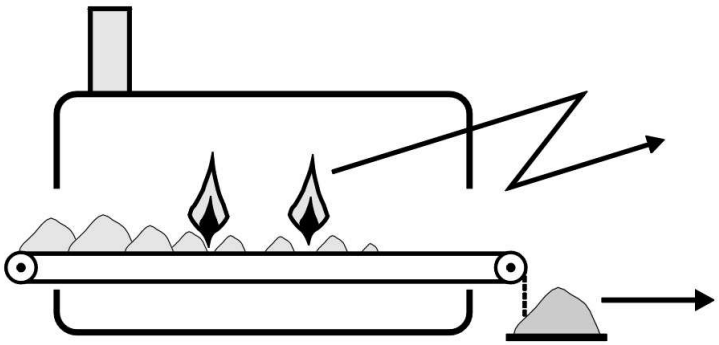
Tanker fitted with fluidic diodes

Accurate spreading of slurries

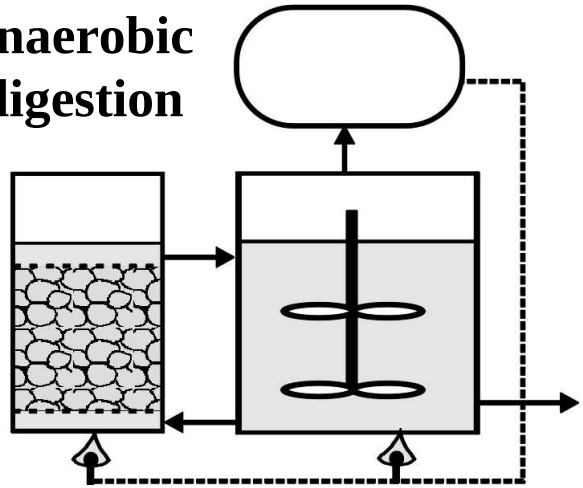
Rapid nutrient sensing: combined with GPS to apply appropriate doses to fields as required by the crop. Integration of field data, crop, season, manure compostion and location

Treatment of solid wastes

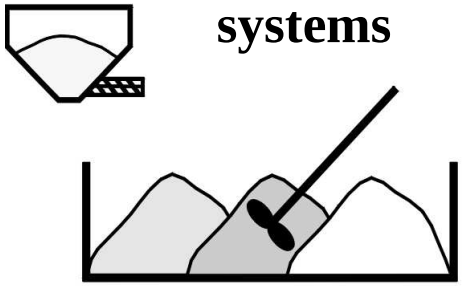
Power generation



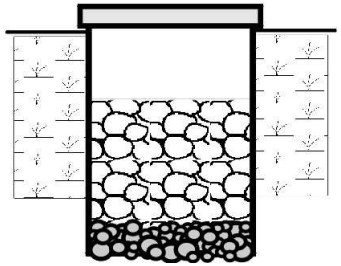
Anaerobic digestion

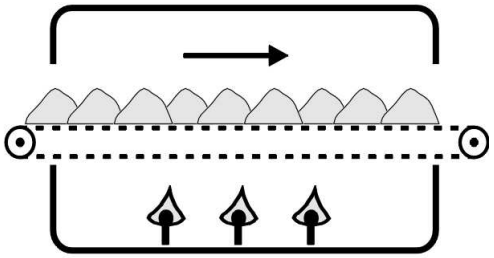


Composting systems



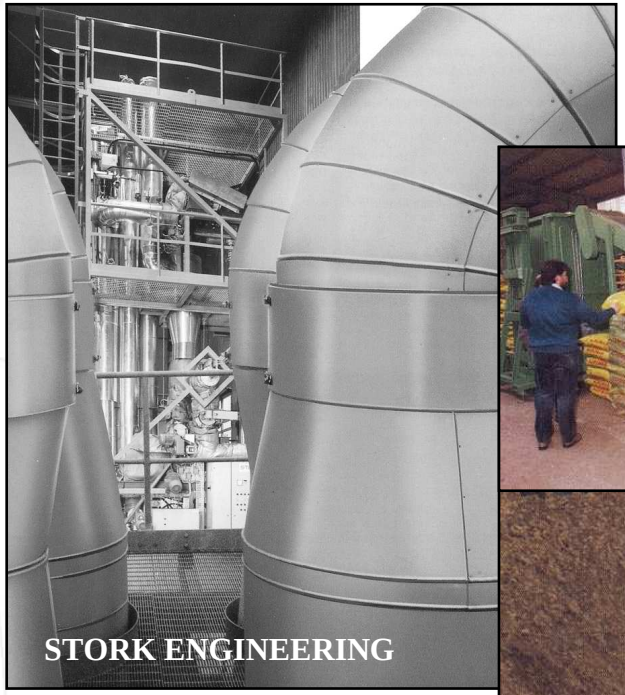
Digestion pit





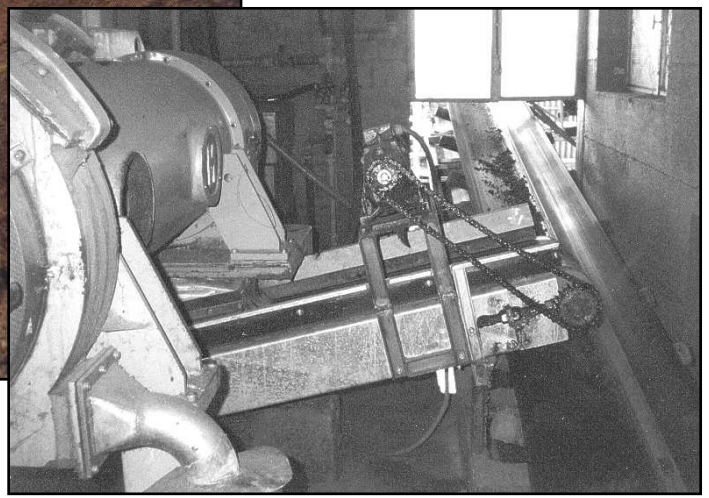
Incineration

Solid handling equipment



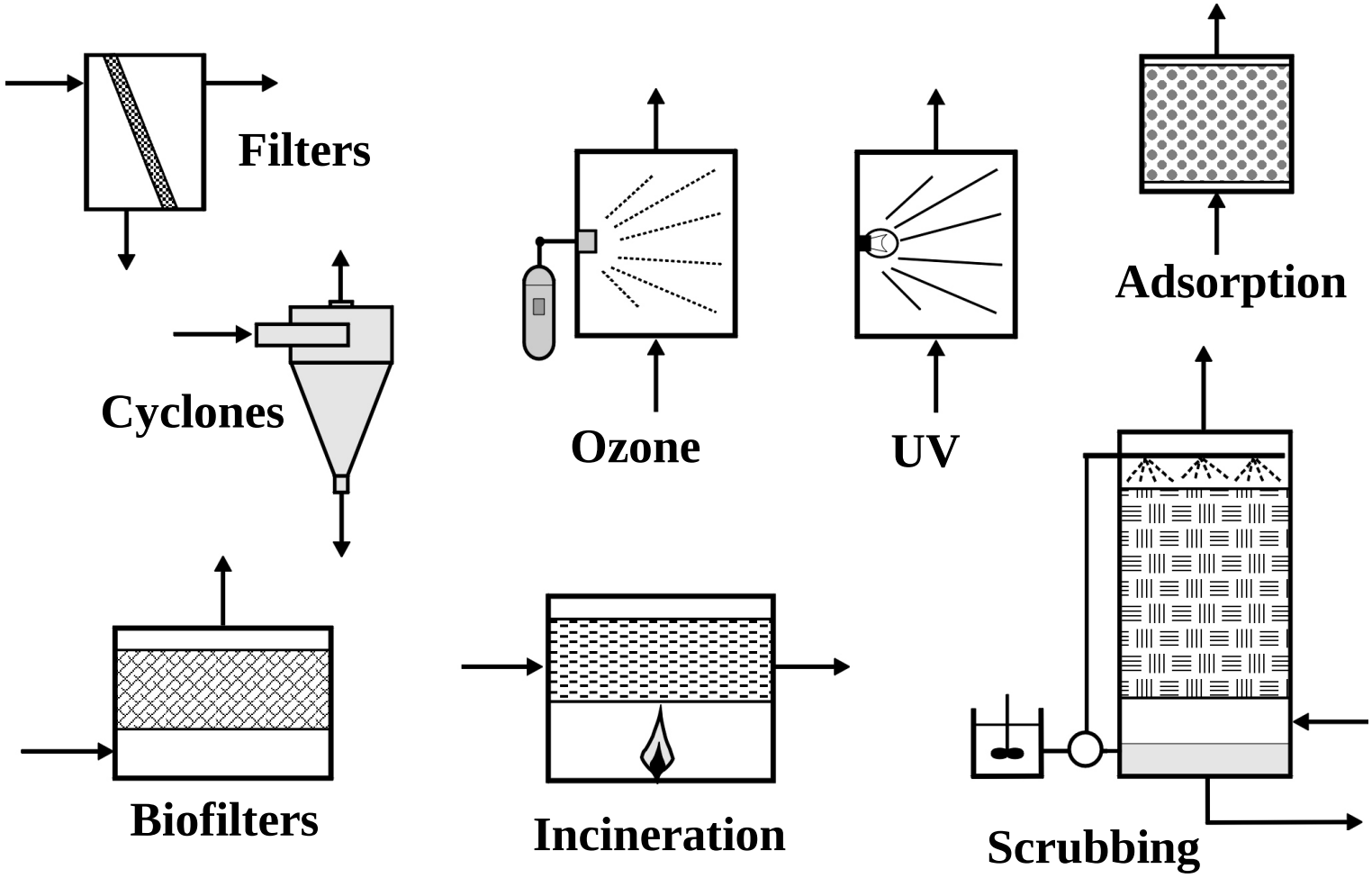
Drying

Composting



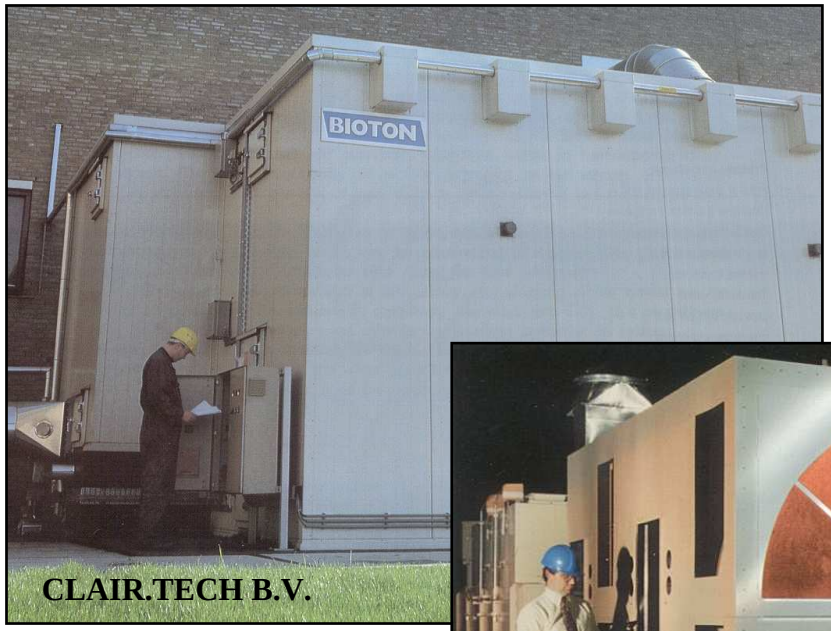
Pelletizing

Treatment of emissions to air



Air treatment equipment

Commercial biofilter



CLAIR.TECH B.V.

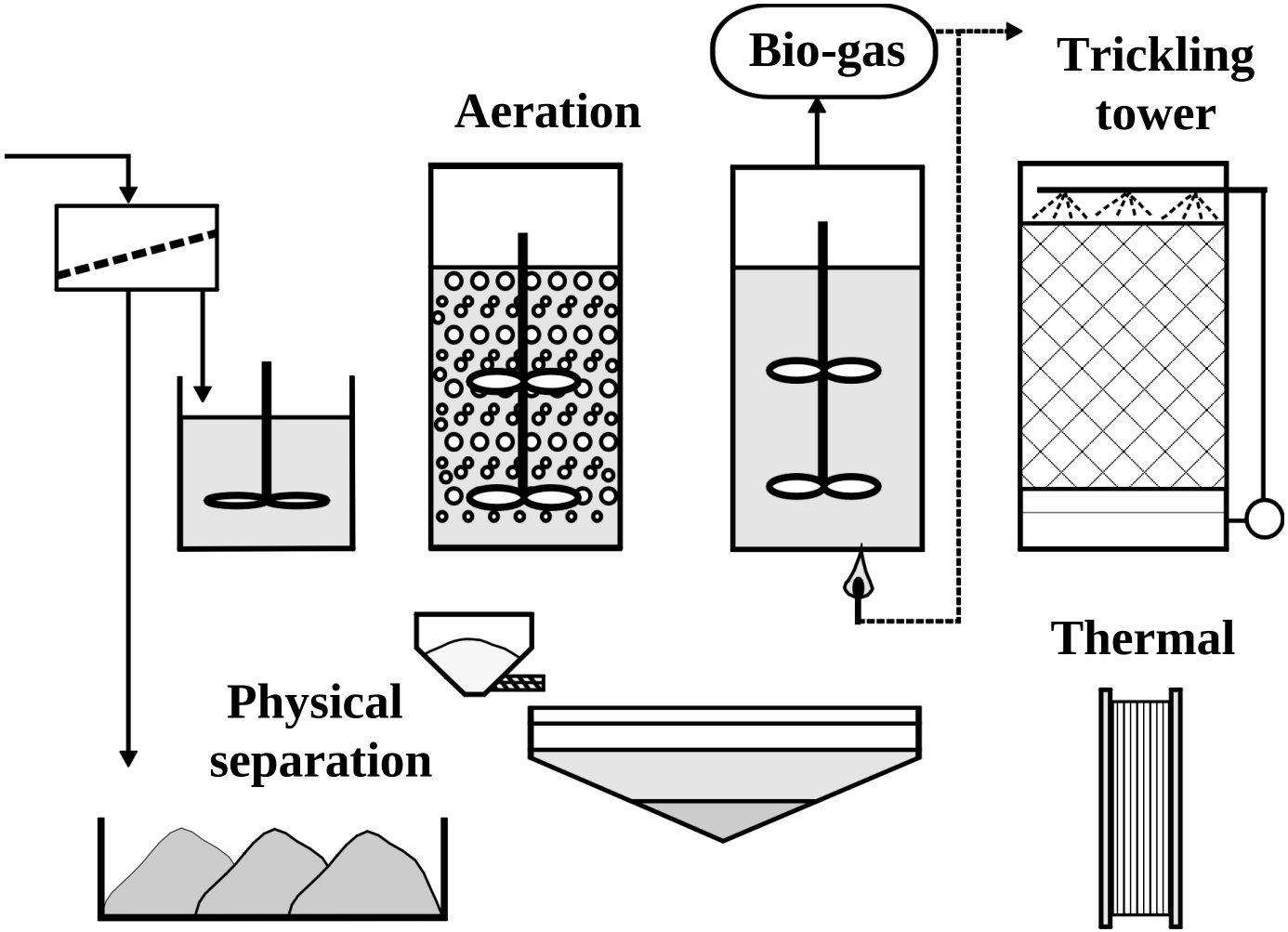
CHEM RESIST LTD

Scrubber for ventilation air

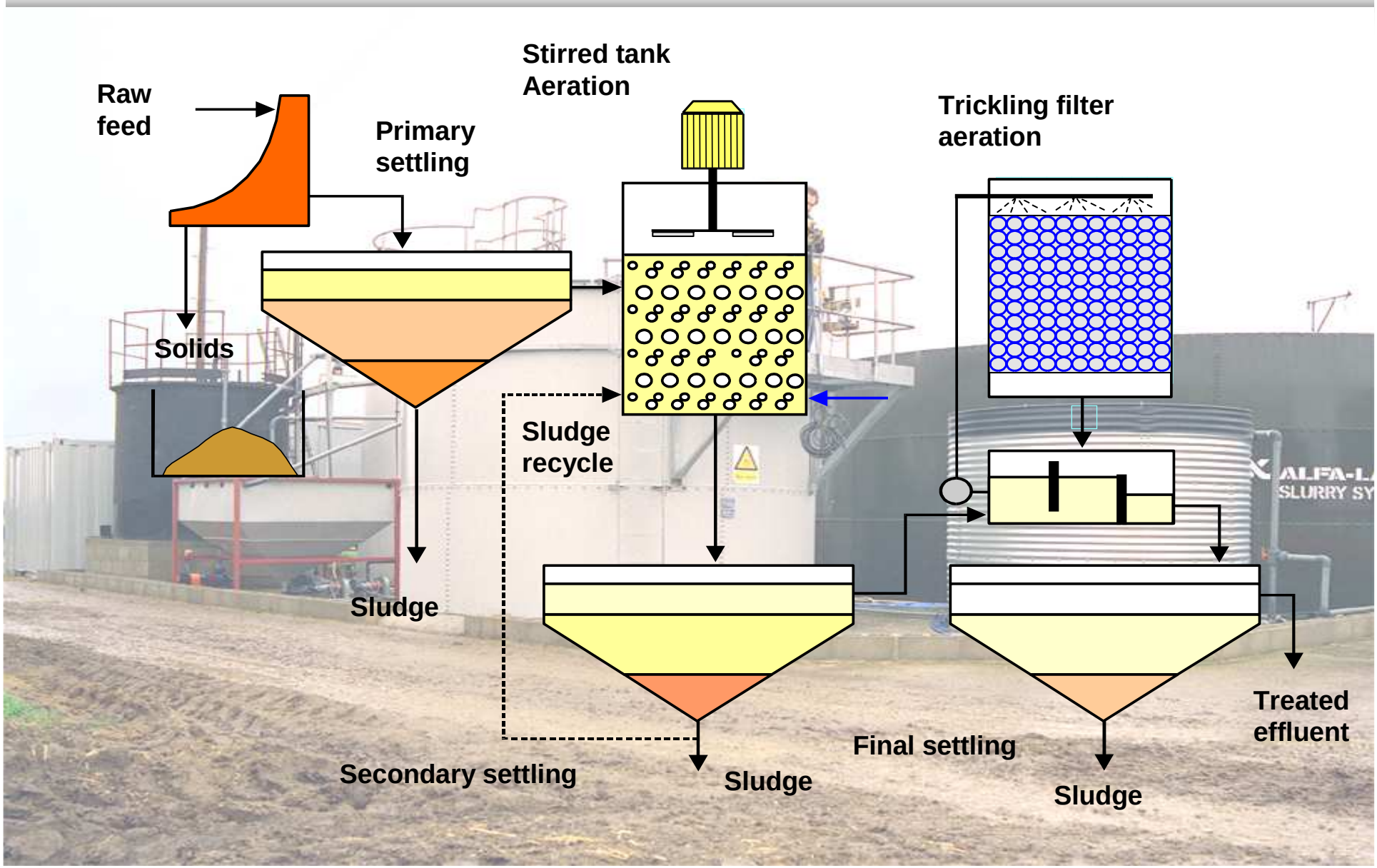
MUNTERS CORPORATION

Adsorber module

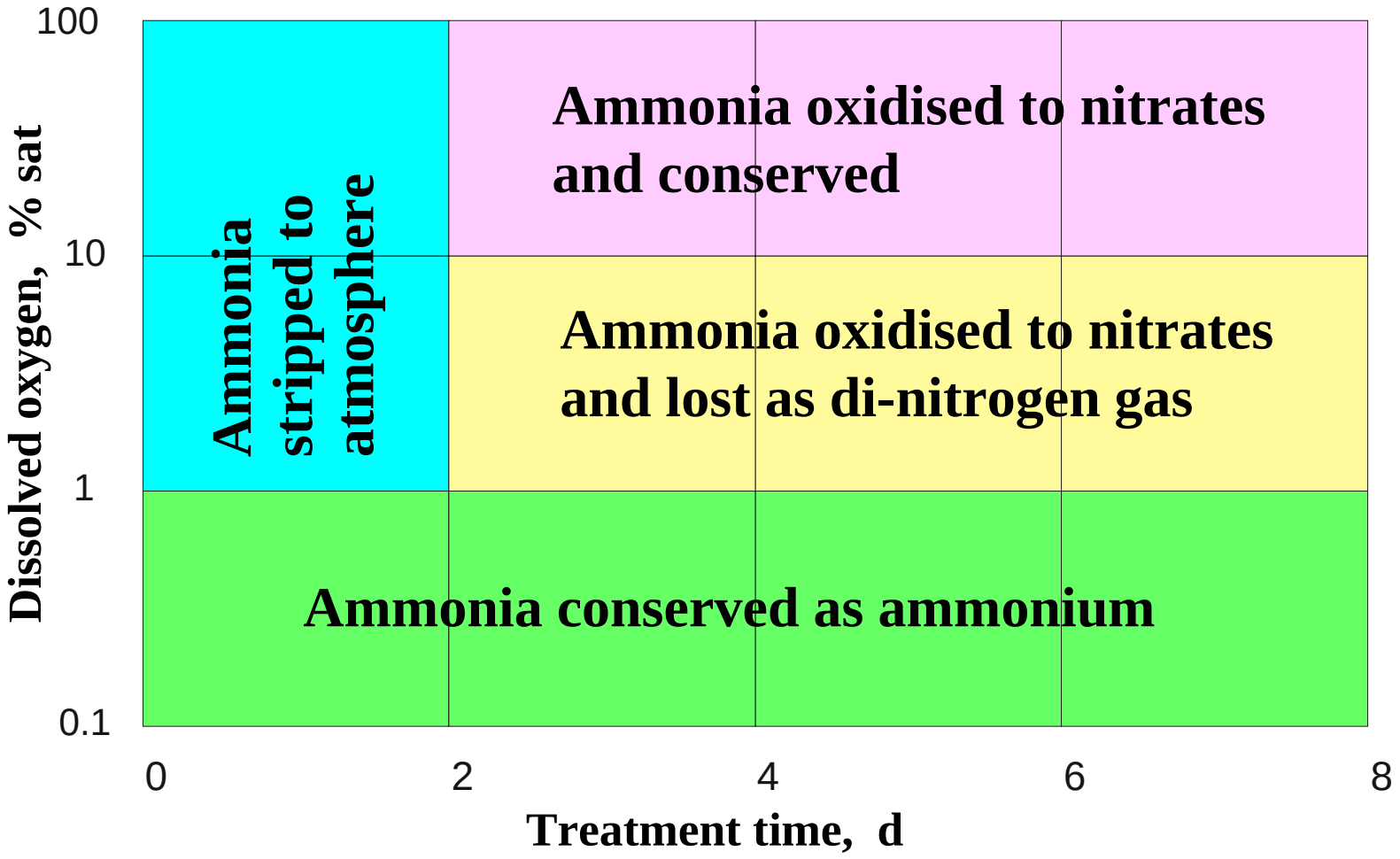
Treatment of liquid effluent



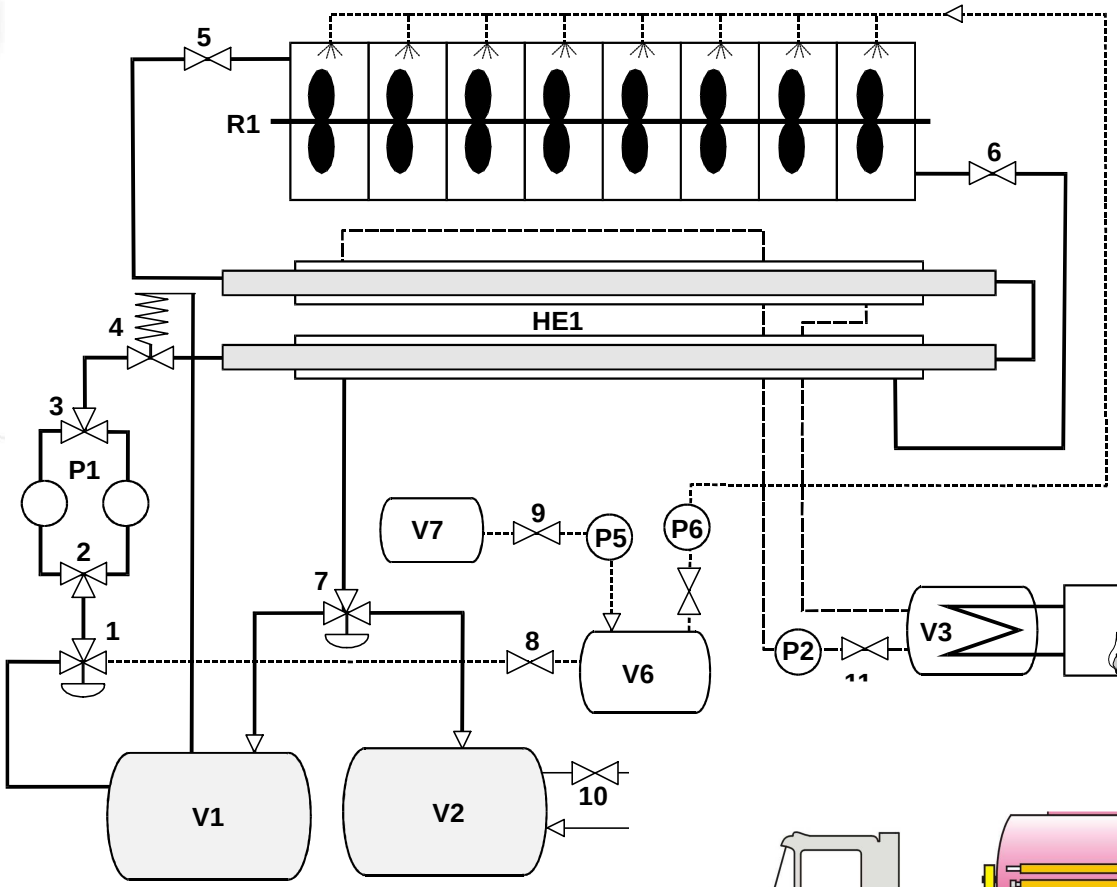
Aerobic treatment system



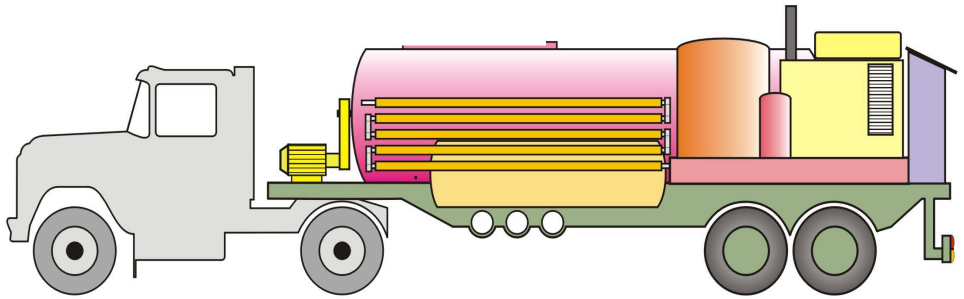
The effect of treatment on NH_3



Mobile treatment unit (thermal)



- For use in the event of outbreaks of notifiable diseases
- Plant completely self contained
- Capacity around 20 to 40 tonnes per hour of effluent



Thermal treatment potential

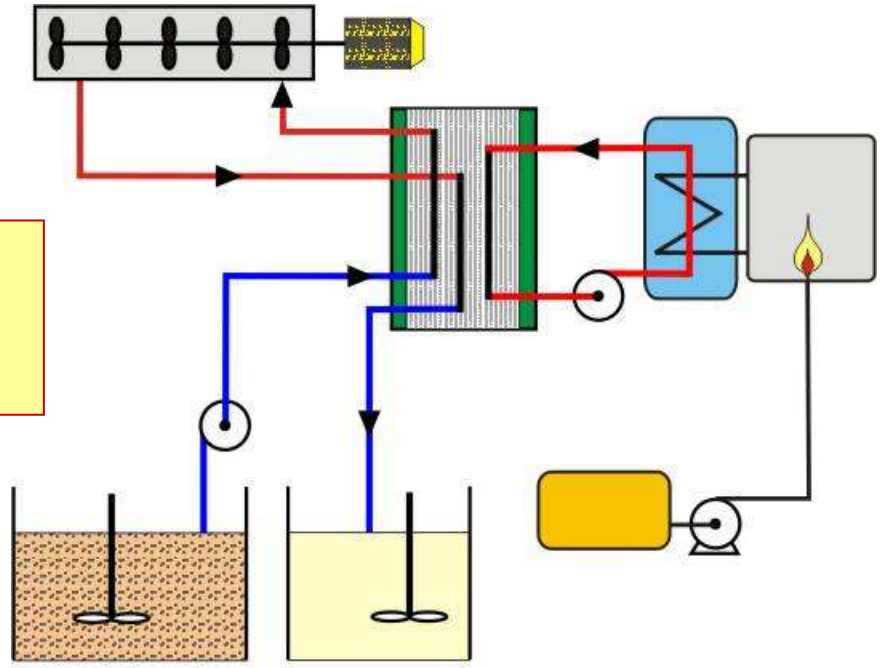
- **Inactivation of a range of pathogens including FMDV and CSFV**
- **Continuos process; consistency and high capacity**
- **4-log reduction achieved in trials using active virus at doses up to 10^7**
- **Target temperatures in range 50 to 70°C - suitable for many pathogens**
- **Minimum residence time of 5 minutes**
- **With 70% heat recovery, costs could be as low as 1€ per tonne of effluent**

Energy considerations

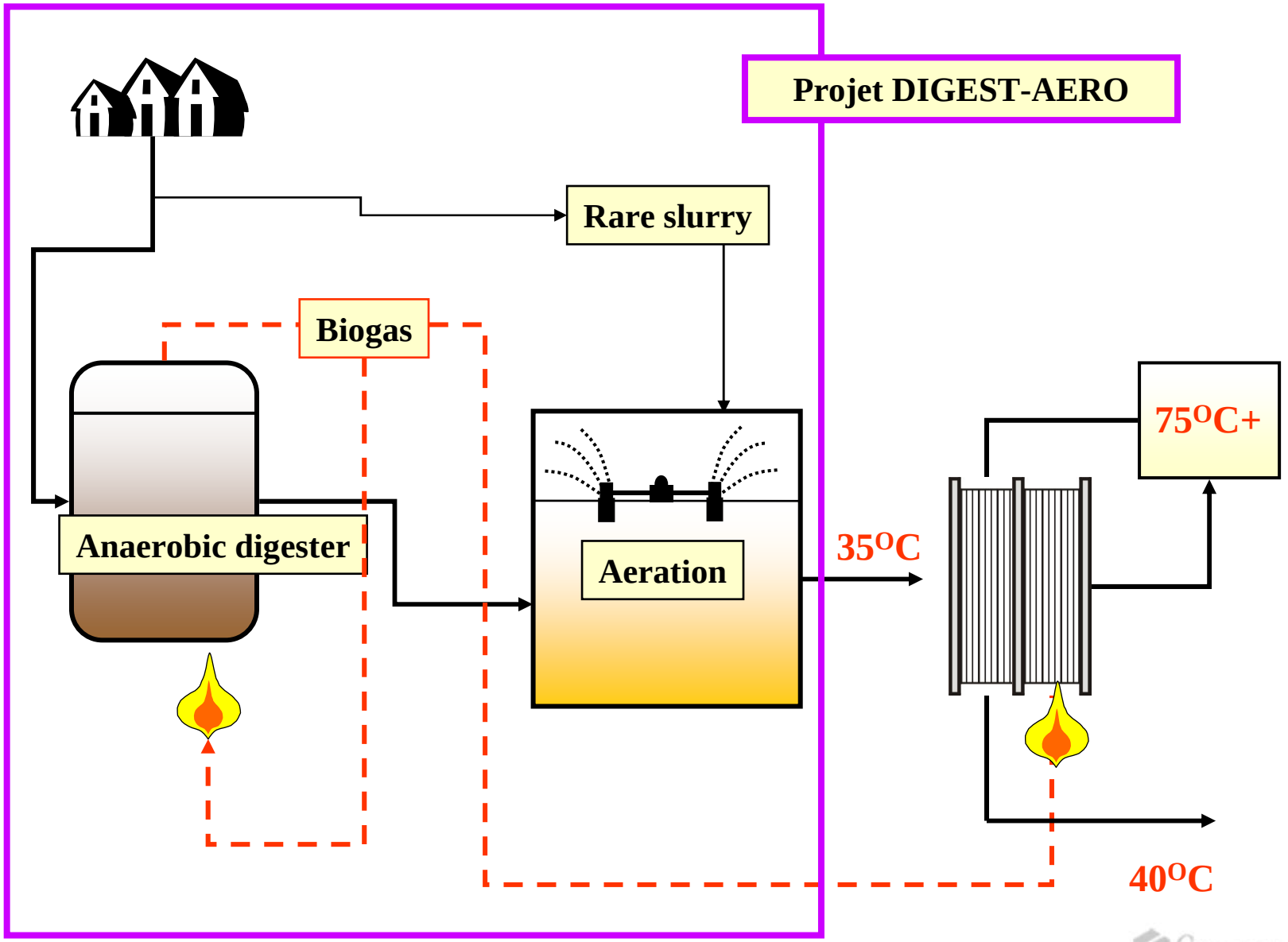
One metre-cube of pig slurry (5% DM) can produce 250-300 Mj of themal energy

To heat water from 20 to 80ºC – 250 Mj
… with 90% recovery – 25 Mj
For aerobic treatment – 90 Mj (*mechanical energy*)
For drying – 2000-3000 Mj

1 Mj = 0.28 kWh
= 2 centimes (electricity)
= 1 centimes (oil or coal)



Treatment options - liquids 1



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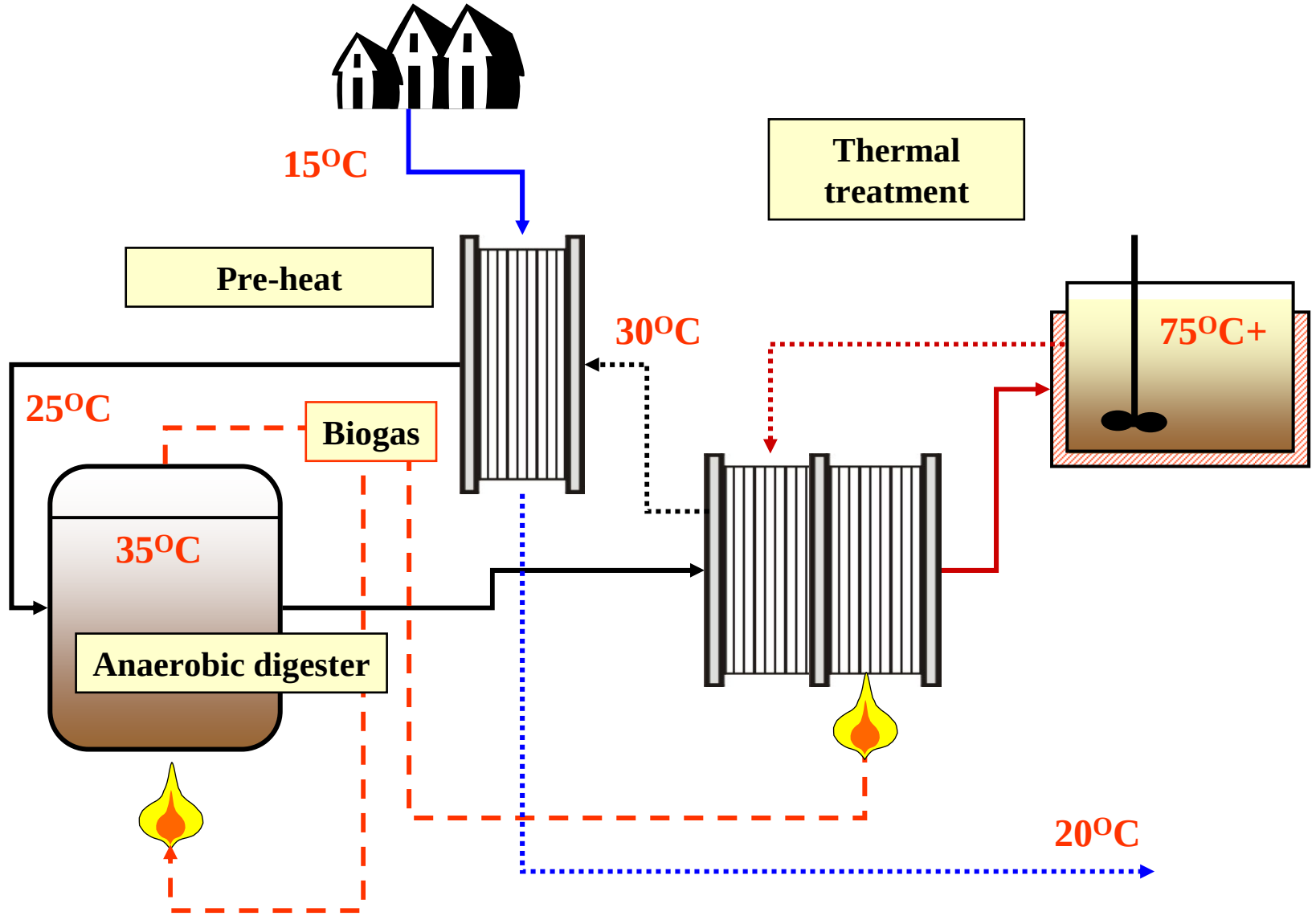
Treatment options - liquids 2



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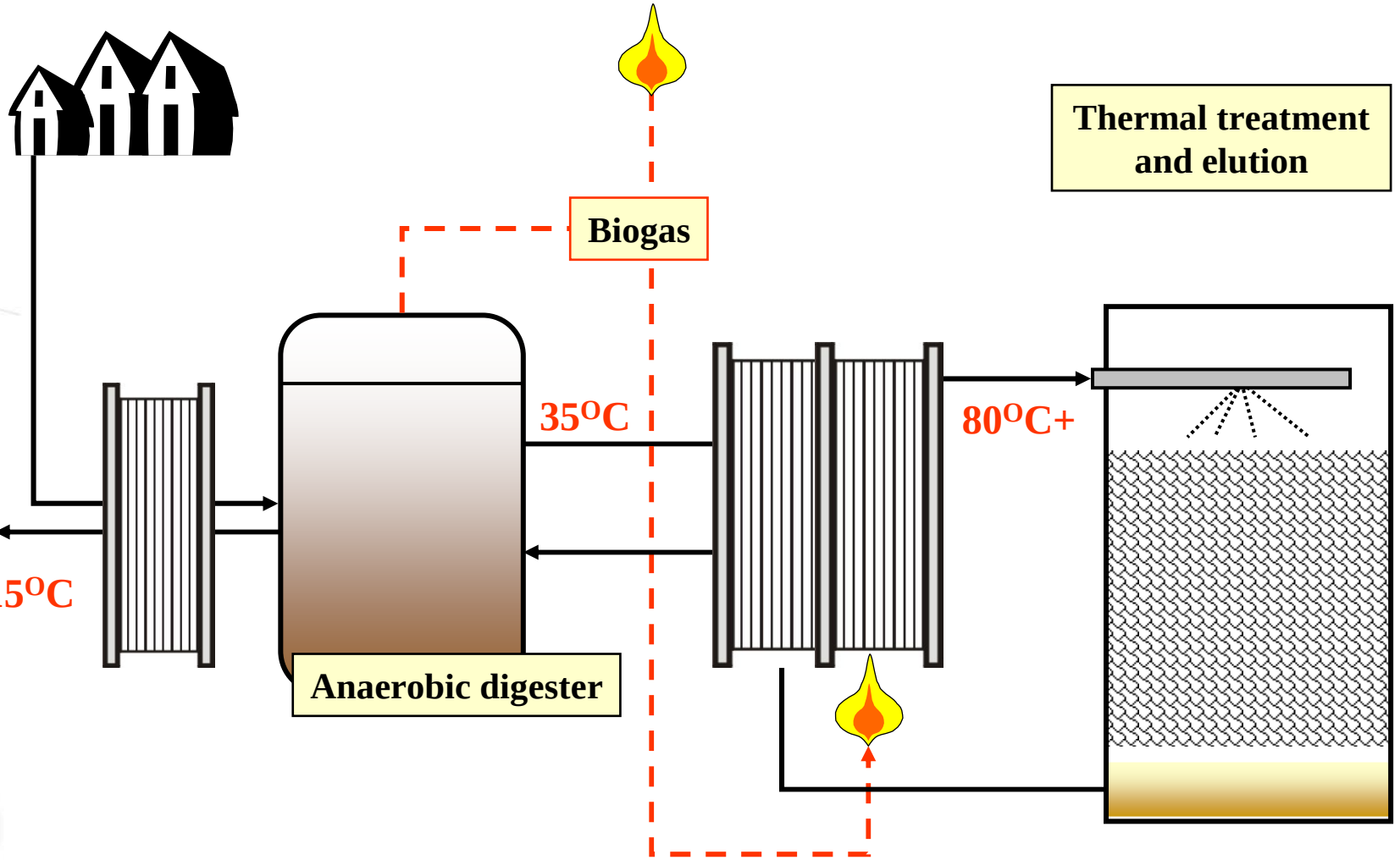
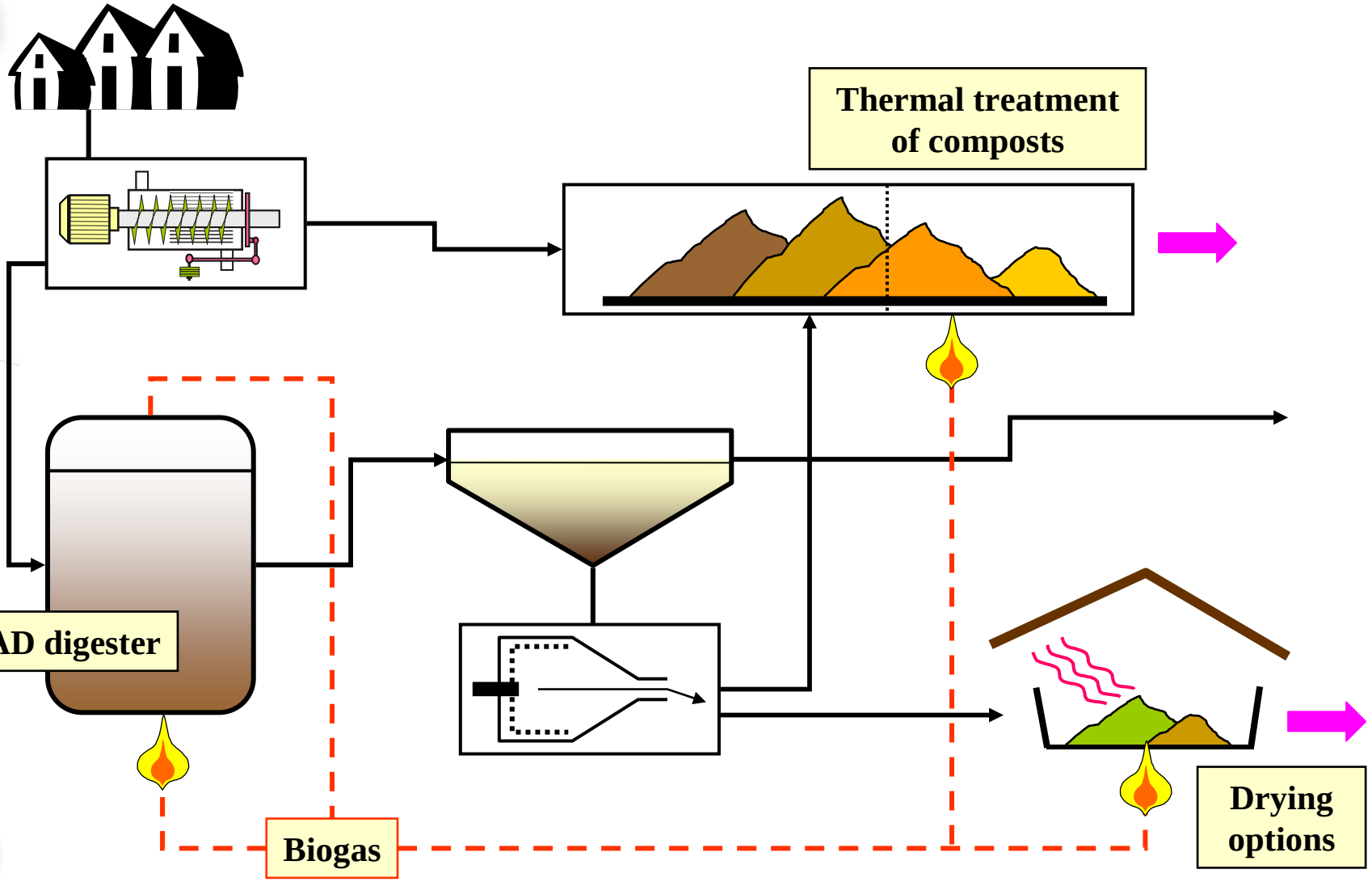
Treatment options - solids 1



Treatment options - solids 2



Conclusions 1

1. **Manure management is a crucial part of the modern livestock industry; poorly managed, it can substantially degrade the environment in terms of water and air quality and both human and animal health**
2. **A central theme is to achieve sustainable development – this implies achieving a nutrient balance to avoid excesses that would otherwise end up as pollution**
3. **Most strategies depend on targetted land application meeting crop needs but avoiding high risk areas**
4. **Most EU regulation is currently focusssed in this area but BAT (within IPPC) may yet prescribe specific management systems for manure**

Conclusions 2

5. **Dealing with nutrient surplus often requires the adoption of treatment strategies to enable the removal or exportation of the excess as useful organic products**
6. **Dealing with health issues (both animal and human) requires additional measures: the use of thermal treatment is potetially an alternative to santizing chemical and may be applicable more generally were food crops are particularly vulnerable**

One last thing ……..

Manure Management (2003)

- **book available via: *Editions Quae* (Paris)**
- **http://www.quae.com**
- **e-mail to: emmanuelle.jannes-ober@cemagref.fr**
- **or poste: Chef du service de l'Information Scientifique et Technique**

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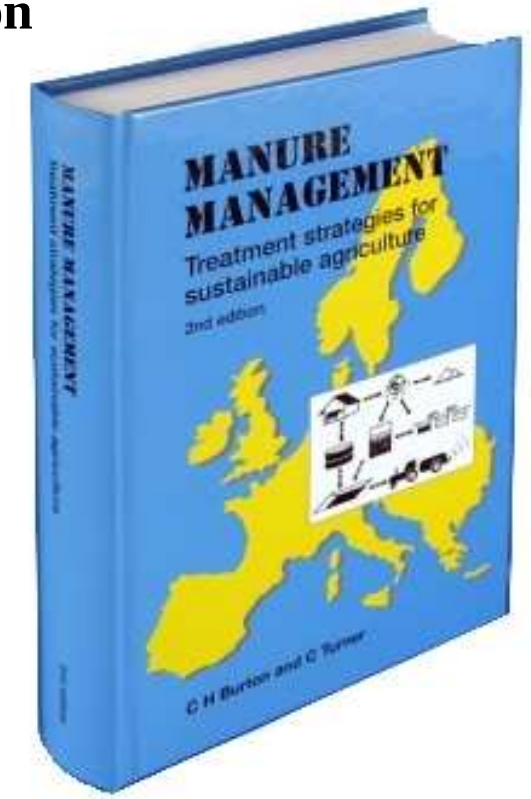
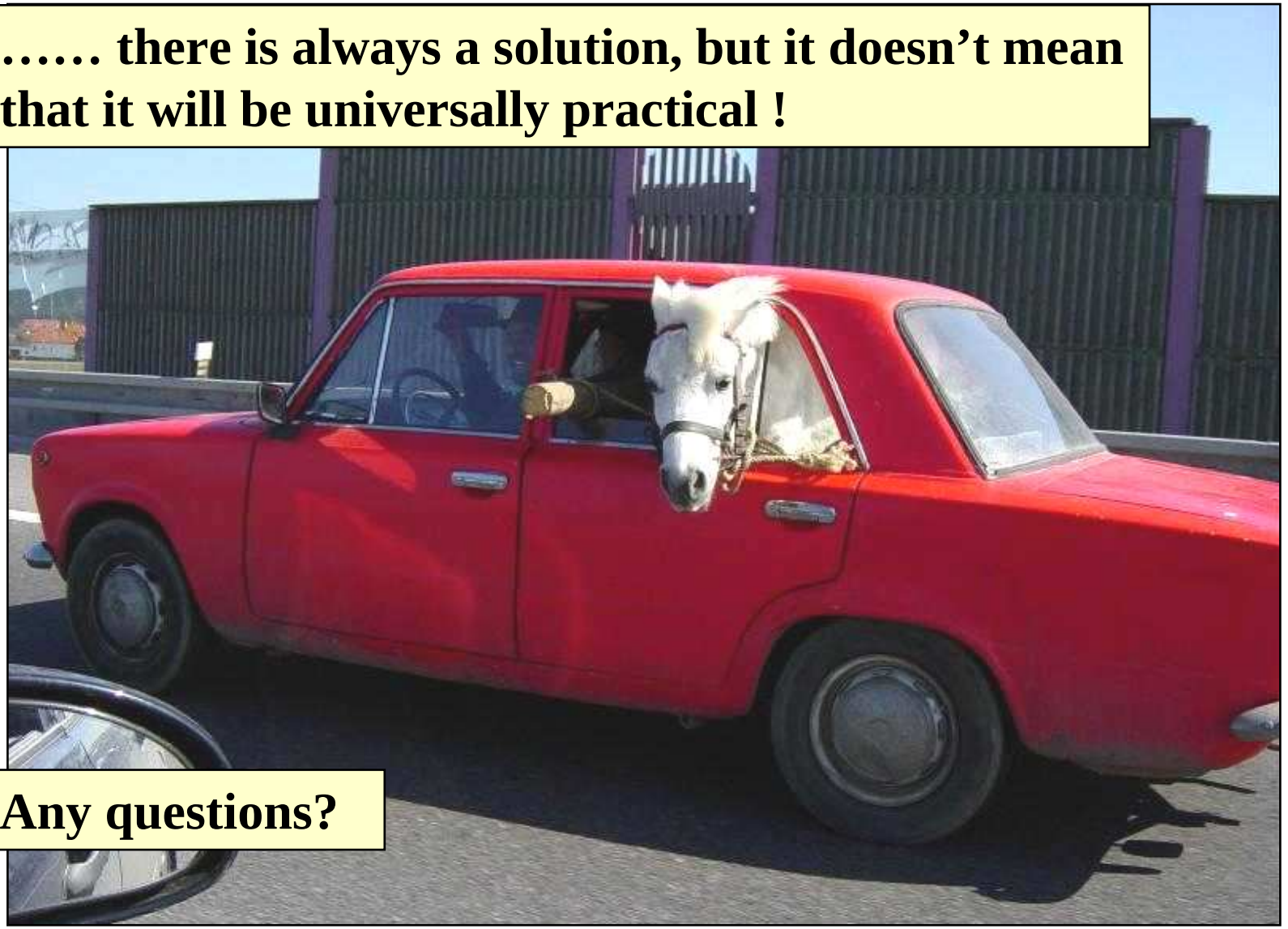


And finally ……..

…… there is always a solution, but it doesn't mean that it will be universally practical !



Any questions?