

•
•
•
UNECE Ammonia Expert Group
Poznan, 29.04 - 01.05. 2004

Costs of Ammonia Abatement Techniques in Germany on two Model Farms

Helmut Döhler
Brigitte Eurich-Menden

Association for Technology and
Structures in Agriculture

Kuratorium für Technik und Bauwesen in
der Landwirtschaft e.V. (KTBL)
Darmstadt

- **Abatement measures during housing, storing and application of manures resp.**
- **Specific costs (per animal place, per volume manure, per unit product)**
- **Two model farms (dairy ; pig fattening)**
- **Projections**

- **Compared to reference systems (extra costs)**
- **Capital, labour, operational costs according to KTBL calculation standards regarding effects of scale**
- **Benefits so far not taken into account; no assessment of affordability**

KTBL-Data

- **Describing single processes as well as production chains, model farms**
- **for economic and ecologic assessment**
- **High quality and actuality: data sets generated regarding latest trends in practice**
- **Highly accepted, since consensus is achieved on by national experts (KTBL expert groups)**

Abatement Measures

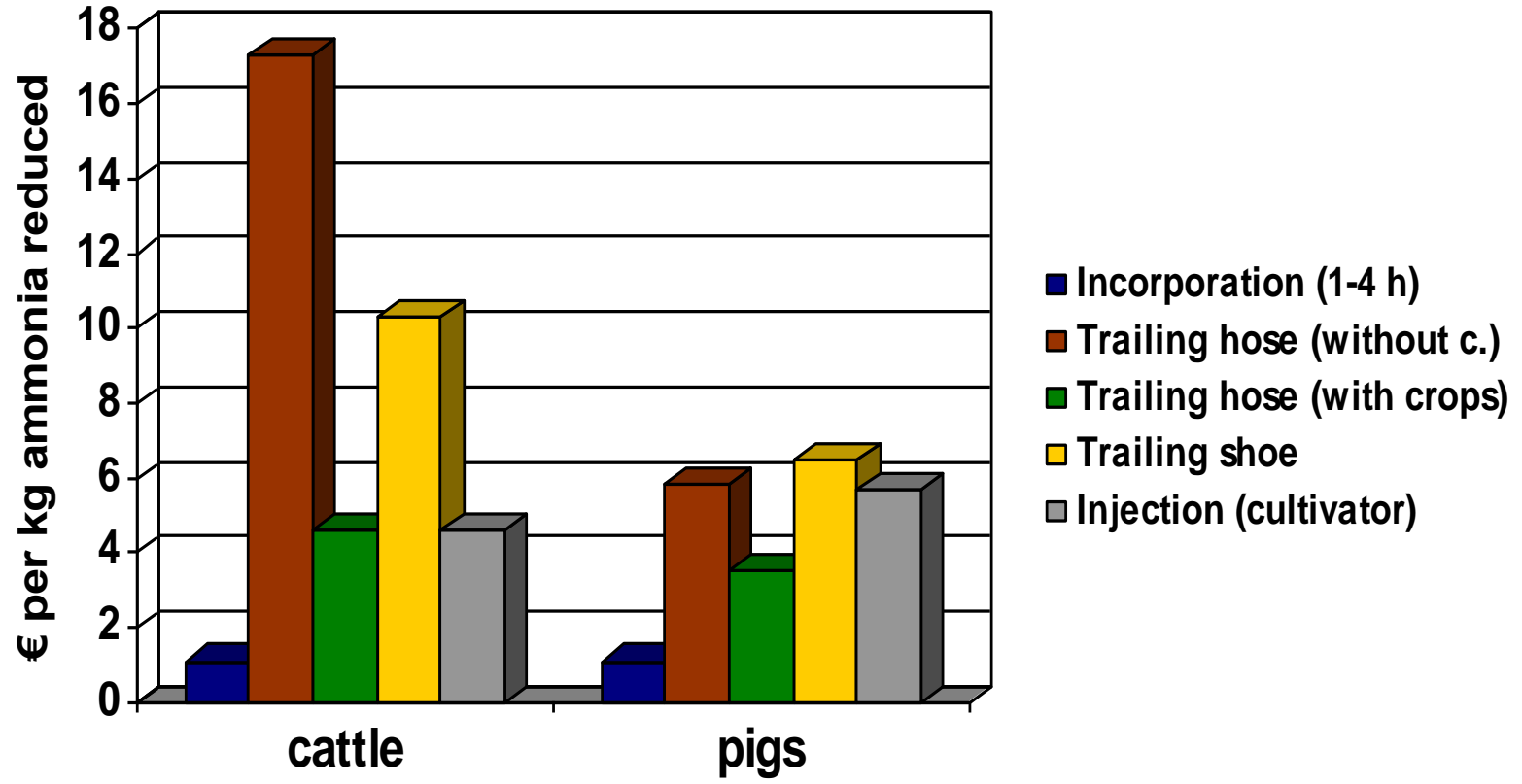
Abatement measures		Cattle	Pigs
Housing	Grooved floor	X	
	Large groups		X
	Natural ventilated houses		X
Feeding	Phase feeding		X
Storage	Covering slurry stores	X	X
	Enlargement of storage capacity	X	X
Application	Low emission slurry application techniques	X	X
	Incorporation (1-4 h)	X	X
	Slurry dilution	X	

Abatement measures and costs, application

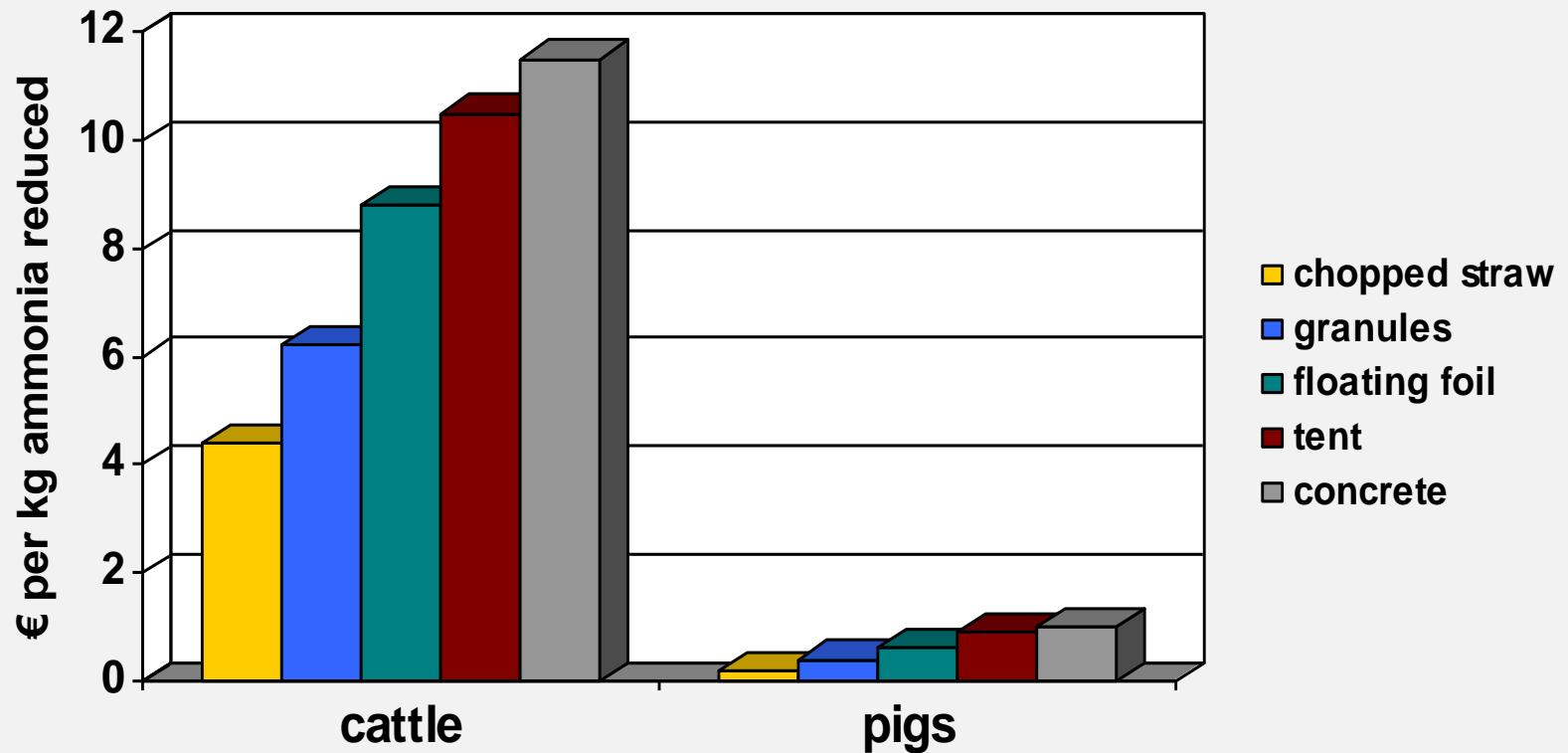
Yearly amount	500-m ³	Extra costs comp. to splash plate	1000-m ³	Extra costs comp. to splash plate	3000-m ³	Extra costs comp. to splash plate
Appl. technique	€/m ³	€/m ³	€/m ³	€/m ³	€/m ³	€/m ³
Splash plate (Reference)	5,2	-	3,9	-	2,3	-
With incorporation (1-4 h)	6,0	0,8	4,7	0,8	3,0	0,8
Trailing hose	6,8	1,8	5,5	1,7	3,0	0,8
Trailing shoe	9,3	4,2	7,5	3,6	3,9	1,6
Slit injector	11,7	5,9	8,9	5,2	4,5	2,3
Injector (cultivator)	10,3	5,2	8,8	4,9	4,9	2,6

UBA (2002)

Abatement costs: application

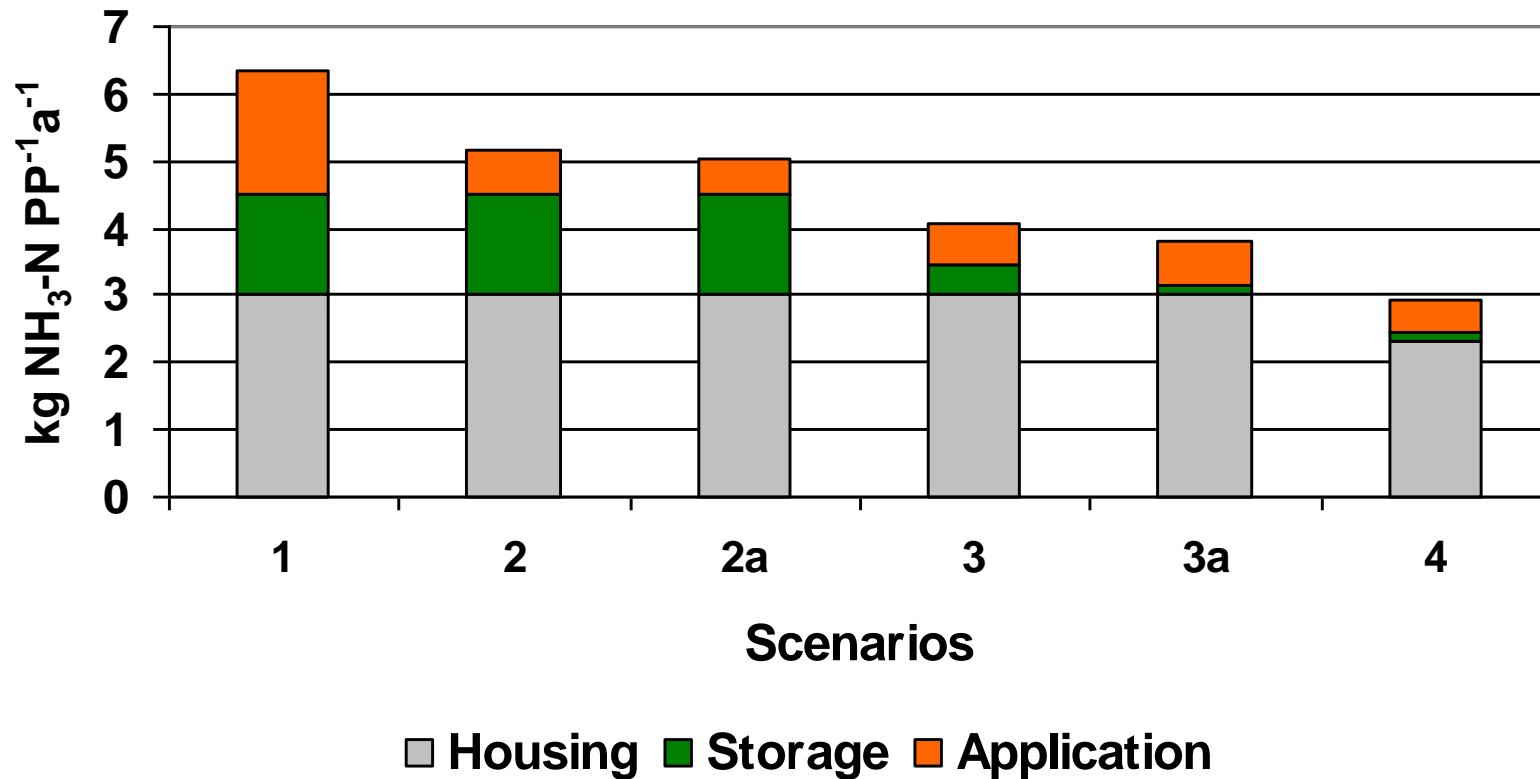


Abatement costs: covering storages

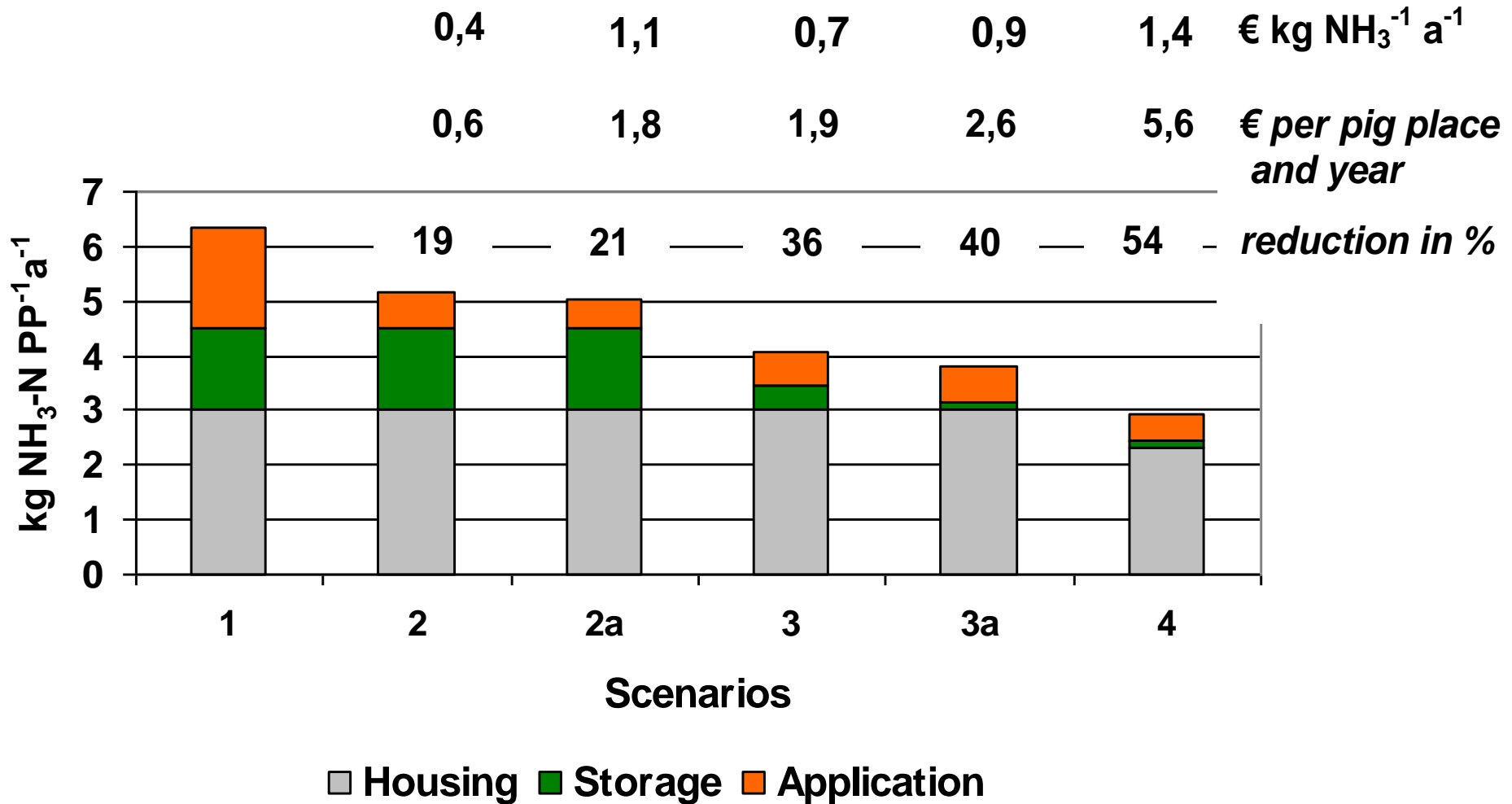


measure	scenarios					
	1*	2	2a	3	3a	4
housing	Insulated, fully slatted floor, forced ventilated,, 1000 places					
feeding	Standard feeding management , 1 phase, excretion 13 kg N per fattening place per year					phase- Feeding; 11 kg
storage	Circular concrete store, capacity 7 month n no floating cover			straw	tent	
applica- tion	splash plate 70 % without incorporation 30 % on growing crops	splash plate 50 % with incorporation 50 % on growing crops	splash plate 50 % with incorporation Trailing hose 50 % on growing crops	splash plate 50 % with incorporation Trailing hose 50 % on growing crops	splash plate 50 % with incorporation Trailing hose 50 % on growing crops	splash plate 50 % with incorporation Trailing hose 50 % on growing crops

pig fattener model farm: Abatement costs



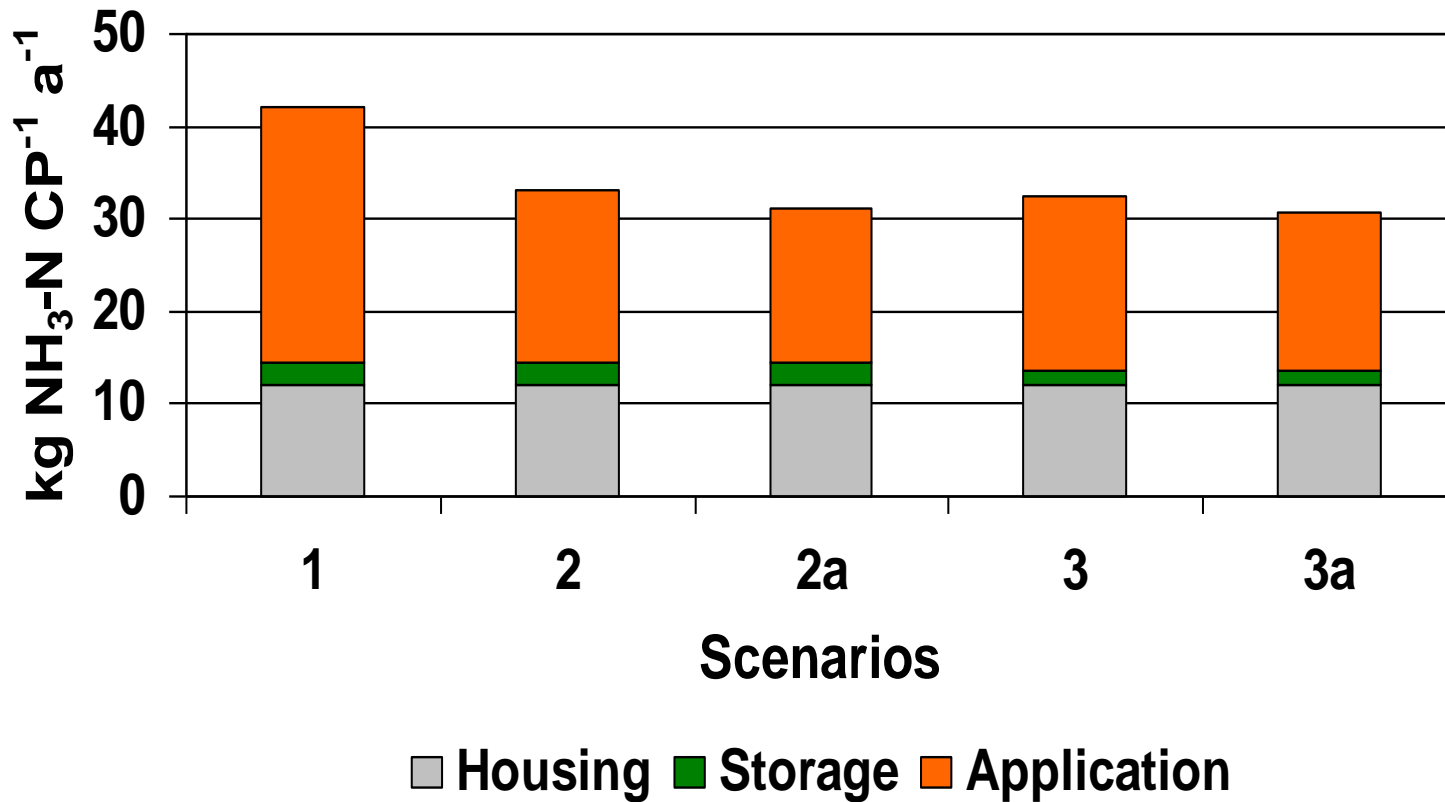
pig fattener model farm: Abatement costs



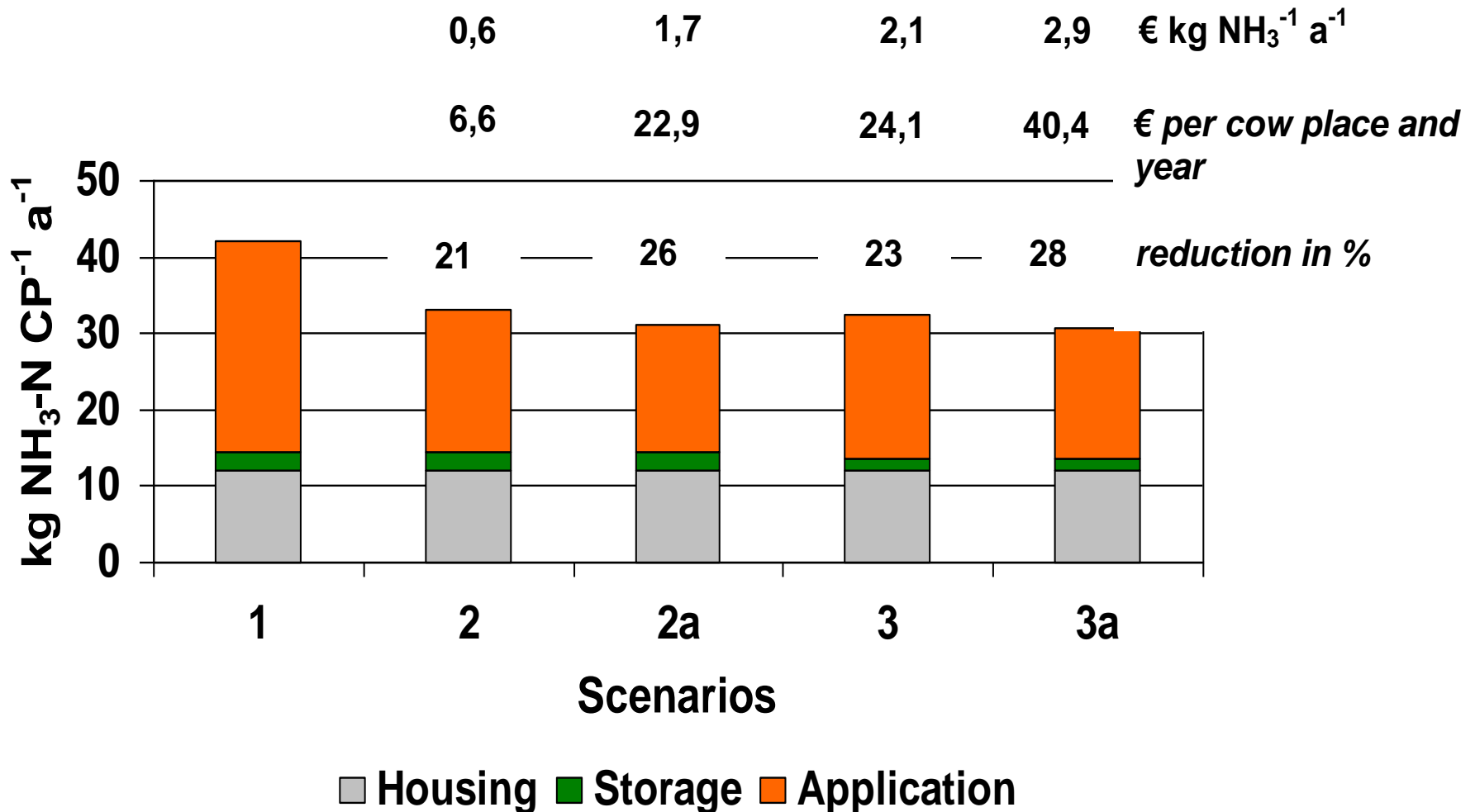
measure	scenarios				
	1*	2	2a	3	3a
housing	open cubicle housing, liquid slurry system, conventional feeding, 108 kg N pro animal place and year, average annual milk yield of 6000 l; 70 cows plus young stock				
storage	Circular store; storage capacity of 5 months, natural crust			Floating foil	floating foil
application	splash plate 30 % on stubble without incorporation 30 % on growing crops 40 % on grasslands	splash plate 25% on stubble with incorporation 45 % in growing crops 30 % on grassland	splash plate 25% on stubble with incorporation 45 % on growing crops trailing shoe 30 % on grassland	splash plate 25% on stubble with incorporation 45 % on growing crops 30 % on grassland	splash plate 25% on stubble with incorporation 45 % on growing crops trailing shoe 30 % on grassland

**basic scenario presents the situation before the fertilisation ordinance came into force.*

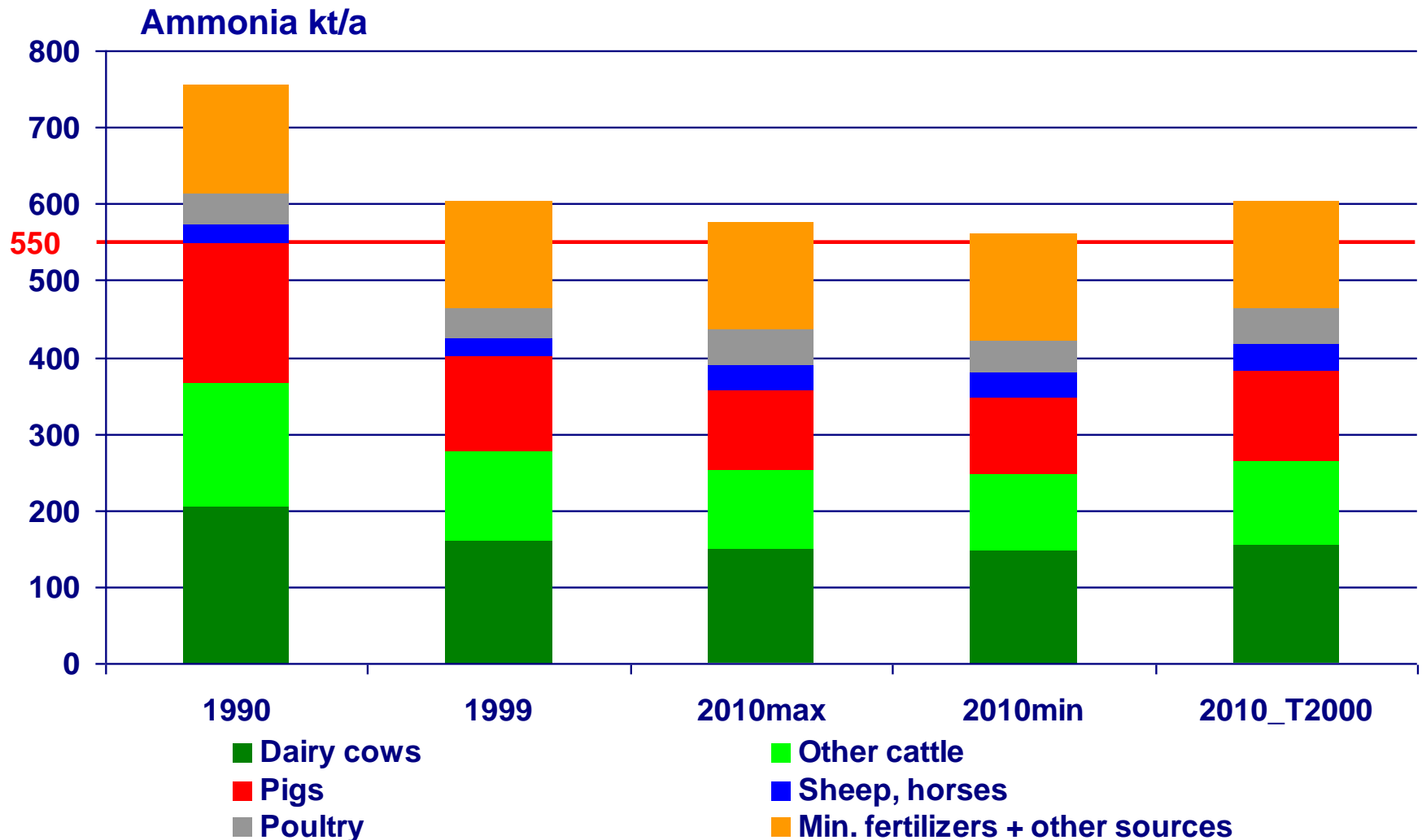
dairy model farm: abatement costs



dairy model farm: abatement costs



Total NH₃ emissions 1990, 1999 and 2010



Abatement scenarios 2010

- **R Reference 2010 T 2000**

Development of livestock by current trend (dairy cows ↓, poultry, pigs =; technical assumptions from the year 2000)

- **S1 Scenario 2010 Governmental support**

- 50 % of all fattening pigs > 600 places: phase feeding
- 50 % of all poultry: phase feeding
- 50 % of slurry application with trailing hoses and injectors (p+c)
- 50 % of slurry incorporated (p+c)
- 50 % of storage covered (pigs)

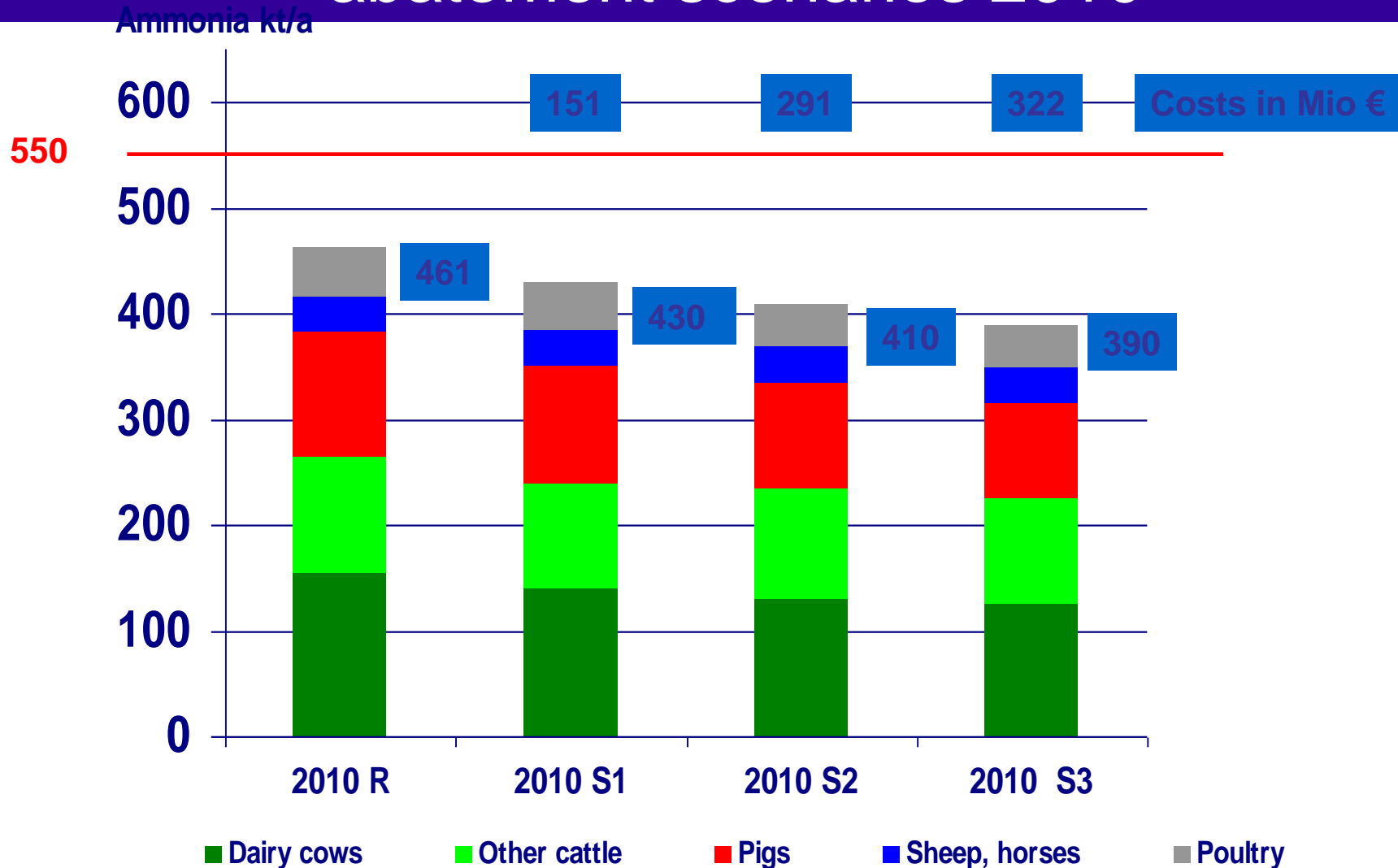
- **S2 Scenario 2010 regulations**

- several obligations; e.g. 100 % of storages to be covered

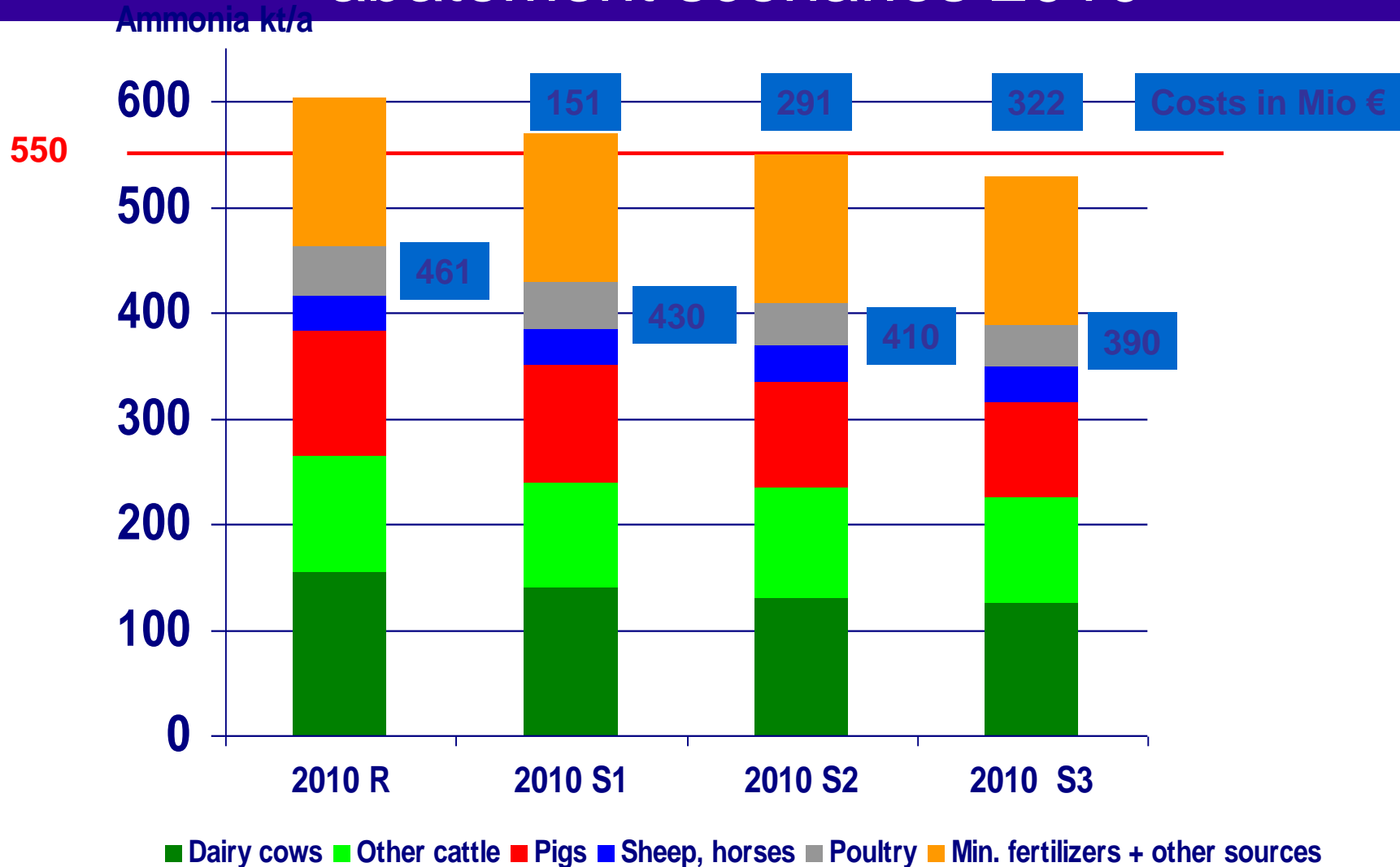
- **S3 = S1 + S2**

- unlikely to be reached, implementation of almost 100 %

NH₃ emissions livestock farming, abatement scenarios 2010



Total NH₃ emissions, abatement scenarios 2010



Measures, Potentials, Costs

Measures	Potential for reduction t NH ₃ / year	Costs € / kg NH ₃	Control
----------	---	---------------------------------	---------

Cattle:

grooved floor system	5.500	6,1-8,7	good
covering of tanks	3.000	7,7	good
storage capacity	17.500	7,7	good
low emissions techniques appl.	33.000	6,1	medium
dilution of slurry	17.000	3,8	diff.
incorporation within 1 hour	21.700	< 2,6	diff.

Pigs:

naturally ventilated houses	400	5,1	good
phase feeding	?	1,3	diff.
covering of tanks	9.500	0,8	good
storage capacity	3.300	8,2	good
low emissions techniques appl.	4.400	7,2	medium
incorporation within 1 hour	4.700	< 2,6	diff.

German Code of
good agricultural
practice for reducing
ammonia emissions

AID/KTBL-broschure
published in 2003



Abatement costs, Storage

Abatement measure	Abatement costs (DM per kg NH ₃ reduced)							
	Dairy cows				Fattening pigs			
	Reference 1	Store volume in m ³			Reference 2	Store volume in m ³		
	Reduction %	250	500	1500	Reduction %	250	500	1500
Natural crust	-	-	-	-	30	-	-	-
Chopped straw	33	10,2	8,7	5,6	80	0,5	0,4	0,3
Granules	50	14,3	12,2	7,8	85	1,0	0,8	0,5
Floating cover	50	20,0	17,2	10,9	85	1,4	1,2	0,7
Tent	67	23,6	20,2	12,9	90	2,0	1,7	1,1
Concrete lid	67	26,2	22,5	14,3	90	2,2	1,9	1,2
Concrete lid	67	27,2	23,3	14,8	90	2,3	2,0	1,3

Quelle: UBA (2001), Annahmen: Referenz 1: mit Schwimmdecke potentielle Emission 2,3 kg NH₃, Referenz 2: ohne Schwimmdecke potentielle Emission 1,5 kg NH₃