



Sustainable management of sewage sludge in North Rhine-Westfalia, Germany

International Conference
Sustainable management
of sewage sludge and biowaste

Dr. Michael Oberdörfer

State Agency for Nature, Environment and Consumer Protection of the Land North Rhine-Westfalia



- Consultancy for the Environment Ministry on specific technical problems
- Tasks:
 - nature conservation
 - fishing
 - effects to men, plants, materials
 - soil protection
 - environment academy
 - water protection
 - laboratories
 - waste management
 - plant safety
 - consumer protection
- About 1200 employees
- No subordinated administrative bodies

Overview

1. German legislation
2. Persistent pollutants in sewage sludge
3. Sewage sludge as phosphorous resource
4. Management of sewage sludge in North Rhine-Westfalia (= NRW)
5. Summary

1. The German Sewage sludge ordinance (1992)

Regulations in addition to the Sewage sludge Directive 86/278/EEC:

- **Soil:**
 - 7 heavy metals (+ chromium)
 - analysis of: pH, Potassium, Magnesium, Phosphorous
- **Sewage sludge:**
 - 7 heavy metals (+ chromium)
 - analysis of: pH, Potassium, Magnesium, Phosphorous, total Nitrogen, Ammonia Nitrogen, organic matter, dry matter
 - Dioxins, PCB, AOX (= halogenated organic compounds adsorbed at activated carbon)
- **Additional prohibitions for sludge application (grazing land, forest, water-protected areas, nature protection areas etc.)**



1. Actual movements in German legislation

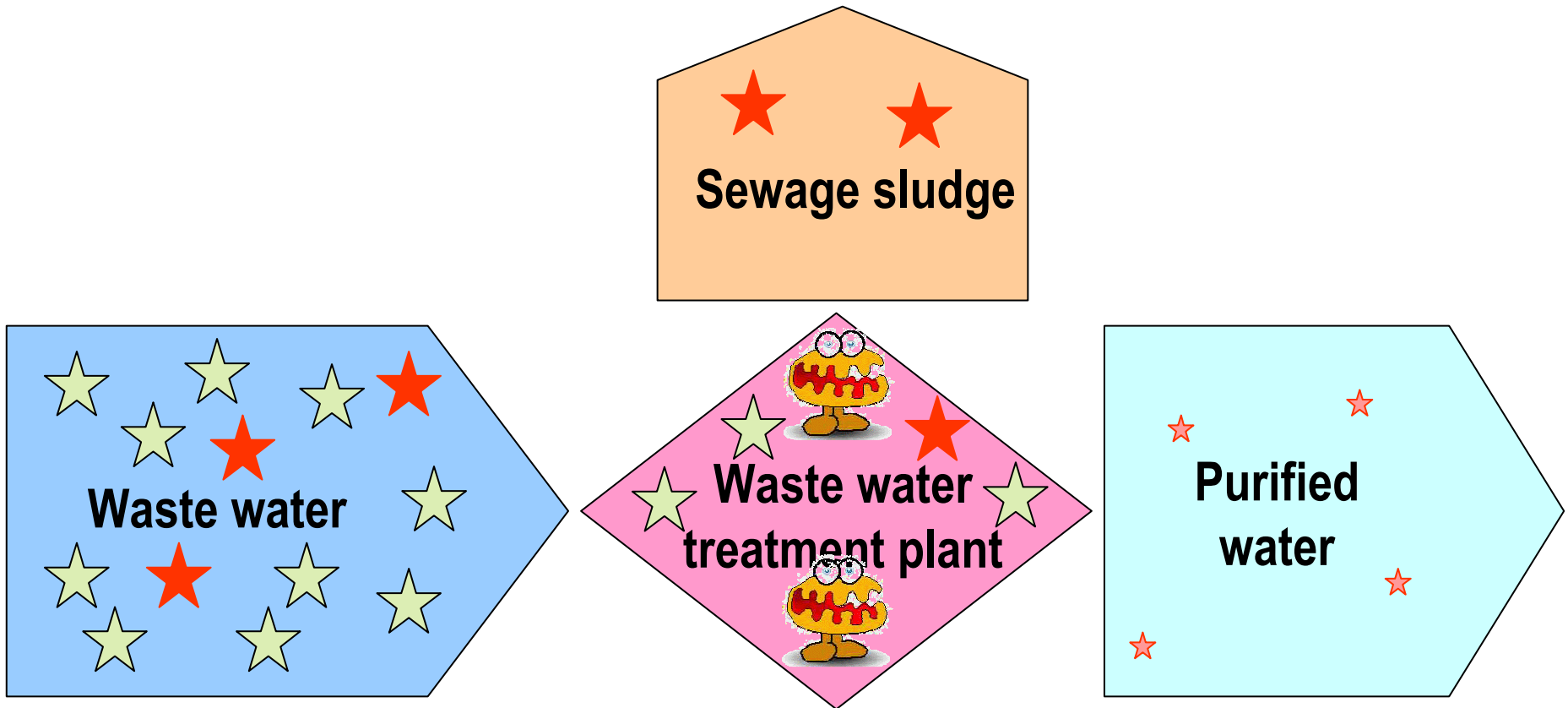
- **Decision of the Parliament 2002:**
 - To reduce the inserting of pollutants into soil by applying fertilisers (manure, mineral fertiliser, sewage sludge, biowaste)!

- **Draft for amendment of sewage sludge ordinance 2007:**
 - Reduction of limit values for pollutants in sewage sludge
 - Regulation of new organic pollutants:
Benzo(a)pyrene, PFC (Polyfluorinated Compounds)

- **Fertiliser legislation 2008:**
 - only direct application of sewage sludge without mixing (NRW: prohibition of composting sewage sludge)
 - no processing of waste from grease separators in the waste water treatment plant from other operators



2. Sewage sludge as sink for persistent pollutants



★ Biologically degradable pollutant

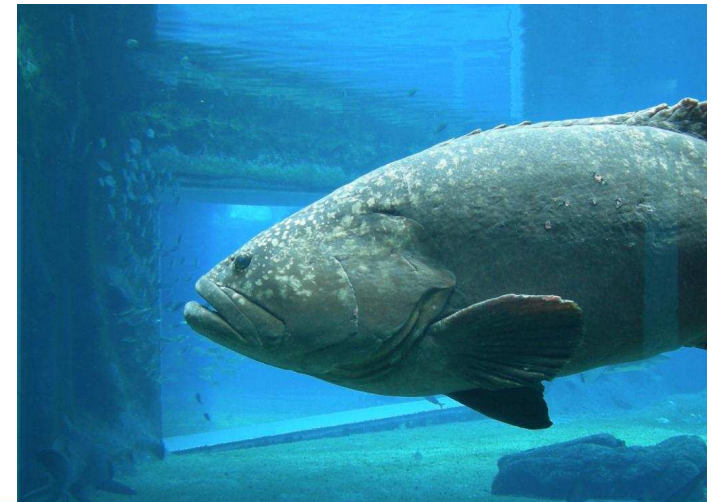
★ Persistent pollutant

2. The German Waste water levy ordinance

- An effective legal instrument to reduce the load of pollutants into rivers
- Limit values for the discharge of pollutants into the sewer system, respectively the river
- Exceeding of the limit values means money (= levy) for the polluter
- Investment in order to reduce the load of pollutants reduces the levy

Result:

The discharge of pollutants into the waste water has been reduced significantly, which means a better quality of sewage sludge and of the water



2. Origin of persistent organic pollutants

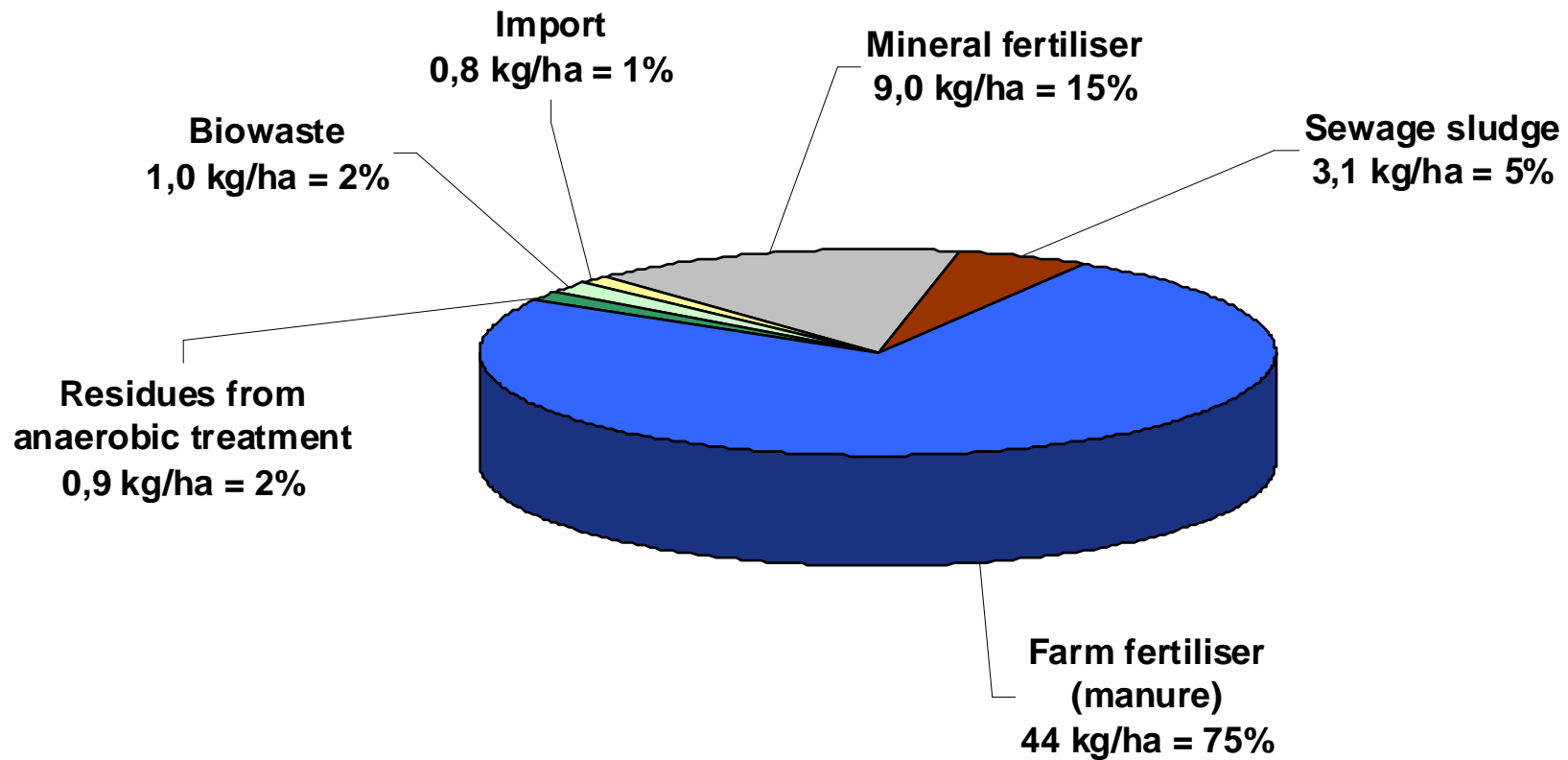
Group of compounds	Compound	Origin
Chlorinated phenols	Triclosan	Disinfectant in cosmetic products (up to 0,3%), sanitary products, textiles
Musk compounds	Galaxolid	Fragrance in cosmetics, washing and cleaning agents
	Tonalid	
Organotin compounds	Monobutyltin	Stabilisation agent in PVC
	Dibutyltin	
	Tributyltin	Biocide in antifouling paint for ships, textiles, paint
Polybrominated Diphenylether	Pentabromediphenylether	Flame retardants in plastics
	Decabromediphenylether	
Polycyclic aromatic hydrocarbons (PAH)	Benzo(a)pyrene	Incineration, combustion
Polychlorinated Biphenyls (PCB)	PCB ₆	nonpoint sources
Polychlorinated Dibenzodioxins and -furans	PCDD/F	Incineration, imported textiles
Phthalates	DEHP	Softener in PVC
Detergents	LAS	Washing agents
	Nonylphenol	Polymerisation, detergent
Polyfluorinated Compounds	Perfluorooctanesulfonic acid (PFOS)	Galvanisation, fire extinguishant

3. Phosphorous: a limited raw material

- Phosphorous is essential for food production and can't be substituted
- Harvest of food means extraction of phosphorous from the soil
- The worldwide phosphorous resources are limited
- In many cases too much phosphorous is applied in agriculture and soils are saturated with phosphor = option for reduction in application
- Sewage sludge is applied as phosphorous fertiliser and contains about 2% phosphorous



3. Phosphate in agriculture in NRW



3. Phosphorous recycling

- Germany promotes research & development of phosphorous recycling
- Possible phosphorous resources, besides farm fertiliser and import:
 - Waste water from households resp. sewage sludge (ca. 66.000 t P/a)
 - Meat and bone meal (ca. 24.000 t P/a)
- In theory it's possible to recover 90% of the phosphor, which enters via the waste water a wwtp, from the ashes of incinerated sewage sludge
- Challenges:
 - Separation of phosphorous from heavy metals
 - Phosphorous has to be available for plants
 - The process has to be applicable in practice (not only laboratory)
 - The process has to be economical
- A few processes are already implemented but many processes are still too expensive (compared to the market price for phosphorous)

4. Management of sewage sludge in NRW

- About 680 waste water treatment plants (= wwtp)
- Connected inhabitants (= inh): 18 Mio
Connected population equivalent (= pe): 27 Mio
- Special situation in NRW:
10 Water Associations produce 50% of sewage sludge
- Operators with many wwtp have a network:
 - Sludge from a small wwtp with no option of anaerobic treatment will be delivered to a bigger wwtp with a digester;
 - 6 central sewage sludge dewatering plants are operated in NRW
- The quality of sewage sludge in NRW is determined by:
 - significant industrial impact
 - a lot of run-off rain water from sealed areas

4. Quality of sewage sludge

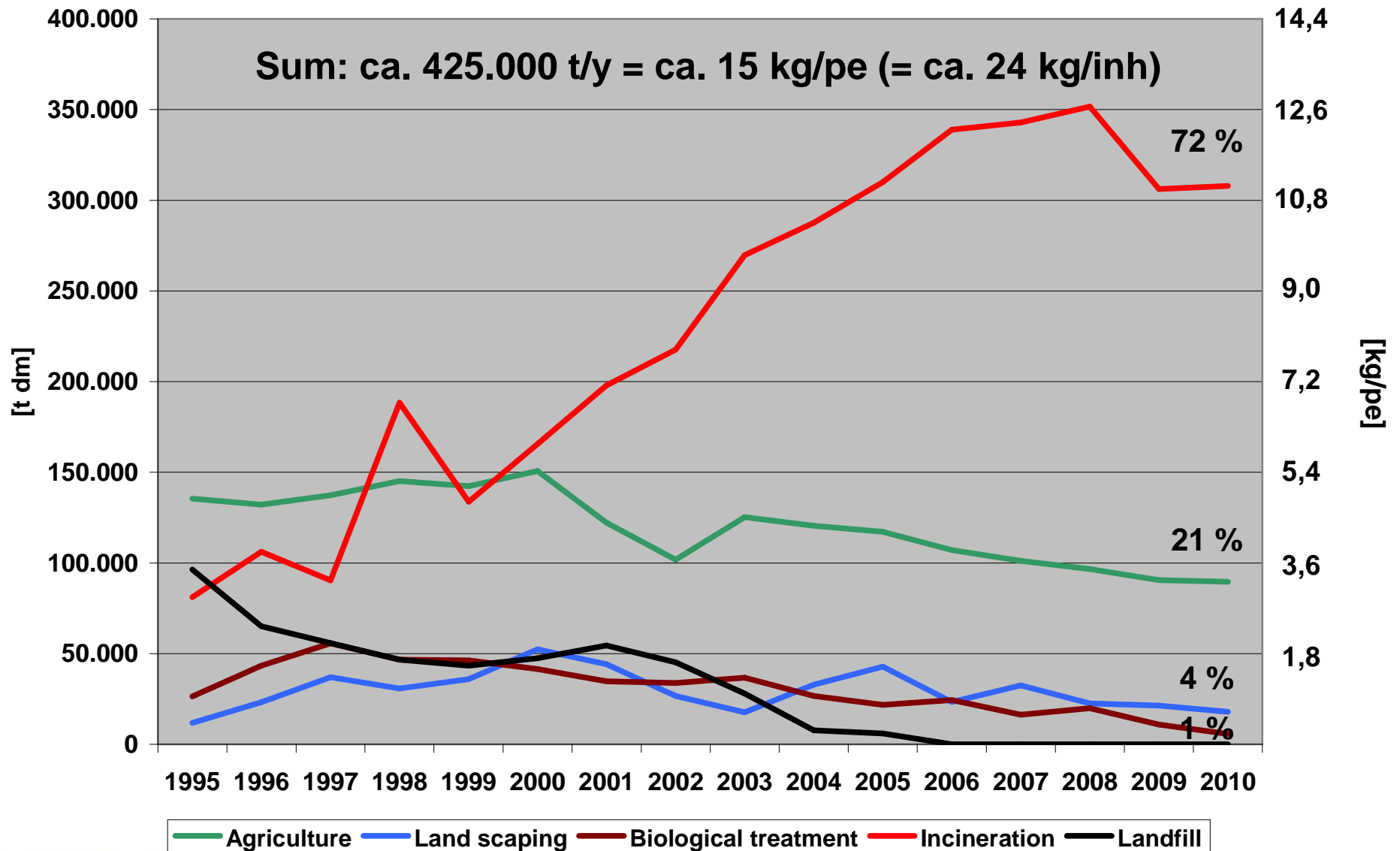
Parameter	86/278/EEC	Germany in force	Germany draft	NRW (median)
Cadmium	20 - 40	10/5	2,5	1,0
Chrome	-	900	100	37
Copper	1000 - 1750	800	700	332
Lead	750 - 1200	900	120	50
Mercury	16 - 25	8	1,6	0,5
Nickel	300 - 400	200	80	29
Zinc	2500 - 4000	2500/2000	1500	827
AOX	-	500	400	156
PCDD/PCDF	-	100 ng TEQ	30 ng TEQ	9 ng TEQ
PCB 28, 52, 101, 138, 153, 180	-	each 0,2	each 0,1	each 0,01 – 0,02
Benzo(a)pyrene	-	-	1	0,3
Polyfluorinated Compounds	-	-	0,2	< 0,1

4. Co-digestion of biowaste in wwtp

Parameter	Sewage sludge 86/278/EEC	Sewage sludge Germany in force	NRW biowaste co-digestion
Cadmium	20 - 40	10/5	2
Chrome	-	900	80
Copper	1000 - 1750	800	120
Lead	750 - 1200	900	80
Mercury	16 - 25	8	1
Nickel	300 - 400	200	60
Zinc	2500 - 4000	2500/2000	600
AOX	-	500	150

- Limit values derived from requirements for discharge of waste water
- General permit only for a limited number of specific waste types
- Individual permit for other waste types after life-cycle assessment

4. Management of sewage sludge in NRW



4. Some features of sewage sludge incineration

- Disposal option with long-term guarantee
- German states promoting sewage sludge incineration:
NRW, Bavaria, Baden-Württemberg
- In The Netherlands and in Switzerland sewage sludge is incinerated 100%
- Destruction of all organic persistent pollutants
- Low calorific value:
 - ➔ Co-incineration with high calorific material
 - ➔ Mono-incineration in Fluidised Bed Combustion plants
- High proportion of ash: ca. 50%
- Expensive in comparison to other disposal options

5. Summary

- The discussion in Germany on the application of sewage sludge in agriculture is highly polarised because:
 - sewage sludge is a sink for persistent pollutants
 - sewage sludge is a source for the limited raw material phosphorous
- The discharge of persistent pollutants into the waste water has to be regulated effectively in order to improve the quality of sewage sludge
- The regulation of pollutants in Directive 86/278/EEC is far away from the state of the art
- The incineration of sewage sludge protects the soil from pollutants but is comparatively expensive
- The utilisation of phosphorous from sewage sludge or bone and meat meal for agriculture is still a challenge:
 - only few technologies have been implemented up to now
 - the market price for phosphorous is decisive for the implementation

Thank you very much for your attention!



Contact:
michael.oberdoerfer@lanuv.nrw.de