THE INFLUENCE OF THE INDUSTRIAL POULTRY GROWING AT SC AVICOLA CREVEDIA SA, DÂMBOVIȚA COUNTY, ON THE ENVIRONMENT

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Abstract. The SC Avicola Crevedia SA obtains and raises chicken for meat, and products processing and delivering. The maximum production capacity is of 8,474,100 chicken heads/year, processed meat. Relevant information is needed to support the company in obtaining the integrated environment authorization, so that the society meets the pollution prevention, diminution and control requirements. For this purpose, a RIISA team drew up, in 2004-2005, the necessary environmental studies. Soil, water and air were sampled in several precincts of the different sites of the company. Based on the obtained results, this paper presents the influence of industrial poultry growing at SC Avicola Crevedia SA, Dâmbovița County, on the environmental components.

Introduction

SC AVICOLACREVEDIA SA obtains and raises chicken for meat, processing and delivering products on the retail markets. The maximum production capacity is of 8,474,100 chicken heads/year and 14,400 t/year processed meat. The company owns a 77.7136 ha land area in the Crevedia locality, Dâmbovița County, on which several buildings are placed, necessary for a good achievement of the production process.

The paper presents the influence of industrial poultry growing on the environmental components (water, soil, and air) based on samples analyzed in the laboratory. For this purpose, the quality of soil, ground water, waste waters and air are determined in the farms, water treatment station and slaughter-house precincts,

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as well as the quality of fresh dejections of the poultry growing hall, of the sludge of the water treatment station and of the soil on which poultry manure was applied.

1. Material and Method

The company carries on its activity in eleven chicken growing farms and the due annexes, located on eight sites, a slaughterhouse complex and a water treatment station. When presenting the influence of the activity on the environment, the fact that all farms will be modernized and totally populated was taken into consideration. At the time the study was carried out, part of the farms were in a conservation state, as they were to be modernized by shifting to pyramidal bank growing system. In these farms, serious environmental problems used to be registered, due to the high loading of waste waters and poultry dejections depositing on the ground, when chicken for meat were raised.

The potential pollution sources on the investigated site are mainly the activities carried out in the poultry growing farms, slaughter house and water treatment station. Important activities with environmental impact are the gathering, depositing and utilization of the dejections and litter when the halls are depopulated; the collection and purging of the waste waters produced by cleaning the halls and by the slaughter house; the emissions of polluting substances (ammonia and dust) into the atmosphere, through the poultry halls ventilation; collecting the sludge from the treatment station.

A RIISA Bucharest team drew up the necessary studies (Lăcătuşu et al., 2005) so that the company meet the prevention, diminution and pollution control demands and supply relevant information supporting the request for the integrated environment authorization. To this end, the available reference material was studied, recognition observations were made on the site and soil, ground water, waste water, air, poultry dejections and sludge from the water treatment station were sampled.

For the *soil quality*, the soil was sampled with the agrochemical probe, in the 0-10 and 25-35 layers, from several points located: at the headquarters, in the poultry farms precincts (in all the eight sites, farms 1-11), at the slaughter house, at the water treatment station and on the agricultural land of the local owners, on which 20 t poultry dejections/ha were applied: two potato growing plots at Slobozia Moară and Lungulețu, located in the poultry farms vicinity and a corn growing field to be used as controls.

A poultry manure sample (dejections and litter) from the Farm no.6 and a sludge sample from the water treatment station were collected.

For the *drinking water quality*, five samples were collected from the watter-supply network system of the Farms 2, 3, 7, and 11 and from the drinking water basin of the slaughter house. For the *waste water quality*, three samples were

collected from the sewerage system of the Farms 3, 6, and 7, two samples from the water treatment station (station entrance and exit), and a sample from the slaughter house.

Emissions were instantly sampled to determine the *ammonia concentration* in the following sites: Farm 2, outside Hall 2 (25 days chicken) and inside Hall 3 (20 days chicken), Farm 6 - outside, between Halls 7 and 8 (40 days chicken), Farm 4 - outside Hall 1 (7 days chicken), Farm 7 - outside Hall 1 (12 days chicken). Measurements aim to establish the ammonia concentration values for a 30 minutes sampling period.

Analises were performed on the soil, water, air, sludge and dejections samples, according to RIISA laboratories usual methods and the standards in force (ICPA, 1981, 1986).

2. Results and Discussions

SC Avicola Crevedia SA activity influence on soil. The characteristic soil type for the area where SC Avicola Crevedia SA is placed belongs to the Luvisols[3] class and it is represented by Chromic Luvisols (LCvr).

The soils of the 1-8 sites precincts. The soils of the headquaters, Farms, slaughter house and water treatment station precincts belong to the Regosols class and they are represented by Anthropic Regosols (RGah), except for the soils of the Farms 3 and 9 precincts which are Chromic Luvisols (LCvr) and belong to the Luvisols class (Florea and Munteanu, 2003); these soils have a loamy –clayey-loamy – clayey – sandy loam texture.

The soils have a neutral and slightly alkaline reaction (pH = 6.90-8.45), they are base saturated (except for the soil of Farm 3 which is eubasic) and not salty. They have total soluble salts contents between 14 and 136 mg/100 g soil.

The humus contents are very low up to medium (1.5-6.1%), the highest value, 9%, is registered at Farm 4. The total nitrogen contents are low up to high (0.113-0.441%).

The soils have low up to high nitrates contents (3.8-43.0 mg $N\text{-}NO_3$/kg), as reported to field crops. Very high values are to be found at the slaughter house (55 mg $N\text{-}NO_3$/kg), Farm 2 (110 mg $N\text{-}NO_3$/kg), and Farm 7 (85 and 167 mg $N\text{-}NO_3$/kg). Ammonium contents are low up to normal (1.4 and 19.6 mg $N\text{-}NH_4$/kg). A higher value was registered at the slaughter house (22.6 and 27.6 mg $N\text{-}NH_4$/kg).

[3] WRB-SR 1998

Most samples have high and very high mobile phosphorus and potassium contents, from 14 to 1,071 mg/kg, respectively 70-1,478 mg/kg; these contents have an anthropic origin, due to the poultry growing technology.

No tendency for heavy metal pollution was registered. The determined values are: Zn 79-156 mg/kg, Mn 429-646 mg/kg, Fe 10649-25924 mg/kg, Cu 7-24 mg/kg, Pb 24-173 mg/kg, Ni 39-62 mg/kg, Co 26-39 mg/kg and Cr 35-62 mg/kg. All these values are lower than the alert threshold for less sensitive use, according to MAPPM Order no.756/1997.

Tab. 1 - Chemical properties of the poultry manure (dejections and litter) from SC AVICOLA CREVEDIA SA*, Farm 6

Chemical properties	**M.U.**	**Value**	**Chemical properties**	**M.U.**	**Value**	**Chemical properties**	**M.U.**	**Value**	***Limits***
pH (1:10)	pH units	7.30	Watery extract 1:5			Total heavy metals contents			
Humidity	%	18.5	HCO_3^-	mg/100g	1983	Zn	mg/kg	421	*2000*
Macro elements			SO_4^{2-}	mg/100g	95	Cu	mg/kg	39.8	*500*
$N\text{-}NO_3$	mg/kg	642	Cl^-	mg/100g	319	Mn	mg/kg	1.538	
$N\text{-}NH_4$	mg/kg	12170	Ca^{2+}	mg/100g	53	Fe	mg/kg	316	
P_{AL}	mg/kg	3277	Mg^{2+}	mg/100g	68	Pb	mg/kg	10	*300*
K_{AL}	mg/kg	26489	Na^+	mg/100g	168	Ni	mg/kg	15	*100*
Organic matter***	%	80.1	K^+	mg/100g	502	Co	mg/kg	10	*50*
Total nitrogen	%	3.2	Mineral residue	mg/100g	3187	Cr	mg/kg	26.7	*500*
			Electric conductivity	µS/cm	8350	Total			
			Cond. residue	mg/100g	2839	PCB	µg/g	bdl****	

* Analytical values have been calculated for air dried material
** Maximum allowable limits for heavy metals contents in the sludge intended for agricultural use (mg/kg dry matter; 0344/2004)
*** Organic matter obtained by incineration loss
**** bdl – below detection limit

Control soils in farms vicinity. The control soils are situated South-West of Farm 2, on an agricultural plot, on a fallow ground between Farms 4 and 10, and 200 m of Farm 7. They are represented by Chromic Luvisols (LCvr) of the Luvisols class (Florea and Munteanu, 2003). They have a loamy – clayey-loamy structure. The reaction is neutral up to slightly alkaline (pH = 6.60-7.84), they are base saturated except for the one in the fallow which is eubasic. They are not salty; the total salt content is of 9-26 mg/100 g soil.

Organic matter values are low (1.6-3.5%) and those of total nitrogen are medium up to high (0.128-0.241%); nitrates and ammonium contents are low (3.2-9.3 mg $N\text{-}NO_3$/kg; 1.4-16.1 mg $N\text{-}NH_4$/kg respectively).

Tab. 2 – Chemical properties of the sludge of the water treatment station of SC AVICOLA CREVEDIA SA*

Chemical properties	M.U.	Value	Chemical properties	M.U.	Value	Chemical properties	M.U.	Value	*Limits***
pH (1:10)	pH units	6.43	Watery extract 1:5			Total heavy metals contents			
Humidity	%	70	HCO_3^-	mg/100g	85	Zn	mg/kg	1,535	*2000*
Macro elements			SO_4^{2-}	mg/100g	114	Cu	mg/kg	72.5	*500*
$N\text{-}NO_3$	mg/kg	113	Cl^-	mg/100g	142	Mn	mg/kg	543	
$N\text{-}NH_4$	mg/kg	12.6	Ca^{2+}	mg/100g	98	Fe	mg/kg	17,650	
P_{AL}	mg/kg	2712	Mg^{2+}	mg/100g	8	Pb	mg/kg	88.8	*300*
K_{AL}	mg/kg	281	Na^+	mg/100g	22	Ni	mg/kg	38.9	*100*
			K^+	mg/100g	5	Co	mg/kg	34.4	*50*
Organic matter***	%	42.5	Mineral residue	mg/100g	474	Cr	mg/kg	51.7	*500*
Total nitrogen	%	1.96	Electric conductivity	µS/cm	727				
						Total HCH	mg/kg	0.0280	*500*
			Cond. residue	mg/100g	494	Total DDT	mg/kg	0.0340	
						Total PCB	mg/kg	0.0051	*0,8*

* Analytical values have been calculated for air dried material
** Maximum allowable limits for heavy metals contents in the sludge intended for agricultural use (mg/kg dry matter; 0344/2004)
*** Organic matter obtained by incineration loss

The control soils have very high mobile phosphorus contents (51-454 mg/kg) low up to high contents of mobile potassium (80-501 mg/kg), due to fertilization.

There is no heavy metals pollution tendency, as the concentrations are: Zn 85-136 mg/kg, Mn 553-646 mg/kg, Fe 22996-26179ppm, Cu 5-11ppm, Pb 29-34ppm, Ni 41-57 mg/kg, Co 30-32 mg/kg and Cr 52-58 mg/kg, bellow the alert threshold for sensitive use (MAPPM Order no.756/1997).

Poultry manure quality. The poultry manure (dejections and litter) sampled from Farm 6 has a slightly alkaline pH and a high nitrate and ammonium content (Table 1). It has an 80.1% organic matter content and corresponds, from the point of view of total soluble salts content, to a chloruric salinized material with acid carbonate and potassium predominance.

It also contains important amounts of nitrogen, phosphorus and potassium, which could improve the supplies of the soils on which it will be applied as natural fertilizer.

Calculations revealed that 1 kg manure with 18.5% humidity contains 26 g of total nitrogen; the company produces 17,442 t manure a year when it runs at full capacity. This quantity contains 453.492 t nitrogen and a 2,667.6 ha agricultural land is needed for application, so that the dose allowed by the Nitrates Directive 91/676/EEC (170 kg/ha) is not exceeded.

The heavy metals contents of the manure from Farm 6 are much inferior to the maximum allowable concentrations of sludge admitted for agricultural use according to MAPPM Order no.344/2004. The poultry manure constitutes a source of macro- and micro-elements for the soils on which it is applied.

Tab. 3 – Main chemical properties of the soils on which poultry manure from SC AVICOLA CRVEDIA SA was applied and of the control soil

- Sample No.	Identification	Depth cm	pH_{H_2O}	N-NO_3	N-NH_4	Organic matter	Total N	P_{AL}*	K_{AL}**	Cond. res. mg/100 g soil
				mg/kg		%		mg/kg		
1	Slobozia Moară Potatoes plot + 20t dejections/ha	0-10	7.55	17.6	20.9	1.7	0.116	283	265	51
2		25-35	7.65	19.2	10.7	1.7	0.122	301	248	58
3	Lunguleţu Potatoes plot + 20t dejections/ha	0-10	7.60	30.3	5.4	2.5	0.163	415	267	65
4		25-35	7.66	25.3	12.0	2.2	0.151	376	289	61
5	Lunguleţu, control Corn plot	0-10	7.77	6.0	5.6	2.4	0.161	272	272	44
6		25-35	7.78	4.9	2.7	2.2	0.116	240	240	43

* calculated for the air-dried (105ºC) soil
** re-calculated values dependent on soil reaction

Tab. 4 – Total heavy metals contents (mg/kg) of the soils on which poultry manure from SC AVICOLA CRVEDIA SA was applied and of the control soil

Sample No.	Identification	Depth cm	Zn	Cu	Fe	Mn	Pb	Ni	Cr	Co
			mg/kg							
1	Slobozia Moară Potatoes plot + 20t dejections/ha	0-10	70	7,9	19432	450	24	67	42	37
2		25-35	76	7,7	19560	398	24	47	35	34
3	Lunguleţu Potatoes plot + 20t dejections/ha	0-10	109	9,5	18796	481	39	44	39	30
4		25-35	71	8,4	19814	471	29	47	42	32
5	Lunguleţu, control Corn plot	0-10	90	10	21342	574	29	47	35	28
6		25-35	71	10,8	23378	584	34	57	45	37

The quality of the sludge of the water treatment station. The sludge sampled at the water treatment station has a slightly acid pH, a 70% humidity, a high nitrate content and a low ammonium one (Table 2).

Tab. 5 – Quality indicators for the drinking water of the supply network at SC AVICOLA CREVEDIA SA

Indicator	M.U.	Sampling points					***Law 458/2003****
		Farm 11	Farm 7	Farm 3	Slaughter house	Farm 2	
pH	pH units	7.66	7.73	7.88	7.26	7.88	*6.5-9.5*
Acid carbonates, HCO_3^-	mg/l	262	250	232	427	323	
Sulphates, SO_4^{2-}	mg/l	29	33	29	24	38	*250*
Chlorides, Cl^-	mg/l	14	36	31	191	38	*250*
Calcium, Ca^{2+}	mg/l	41	60	58	145	83	
Magnesium, Mg^{2+}	mg/l	15	13	7	26	3	
Potassium, K^+	mg/l	3	2	2	3	2	
Sodium, Na^+	mg/l	53	22	50	64	47	*200*
Mineral residue	mg/l	410	451	420	853	553	
Electric conductivity	µS/cm	450	485	460	1220	560	*2500*
Conductometric residue	mg/l	302	325	308	817	375	
Total hardness	germ. grd.	9.21	11.32	9.74	26.33	12.38	*5*
Ammonium, NH_4^+	mg/l	bdl	3.10	1.03	8.26	0.52	*0.5*
Nitrates, NO_3^-	mg/l	4.65	2.08	2.30	21.26	3.28	*50*
Phosphorus	mg/l	0.135	0.160	0.095	0.208	0.106	
Iron	mg/l	0.419	0.353	0.453	0.236	1.135	*0.2*
Manganese	mg/l	0.010	0.265	0.046	0.021	0.038	*0.05*
Zinc	mg/l	0.279	0.101	0.660	0.165	0.197	*5*
Copper	mg/l	0.022	0.081	0.013	0.010	0.017	*0.1*
Lead	mg/l	bdl	bdl	0.008	0.042	0.179	*0.025*
Chromium	mg/l	0.053	bdl	0.074	0.053	0.096	*0.05*
Nickel	mg/l	bdl	0.050	bdl	0.025	bdl	*0.02*
Cobalt	mg/l	bdl	bdl	bdl	bdl	bdl	
Cadmium	mg/l	0.001	0.002	0.005	0.003	0.003	*0.005*

** boundary values for drinking water quality*
*** bdl – below the detection limit*

The sludge sample has a 42.5% organic matter content and a chloruric salinization, chlorine amongst anions and calcium amongst cations are predominant. Significant quantities of nitrogen and phosphorus are present, lesser potassium. It constitutes a good quality fertilizer. The distribution on agricultural land must observe the 170 kg N/ha/year dose according to the 91/676/EEC Directive and the BAT (Best Available Techniques) specifications.

The sample contains heavy metals quantities much below the maximum allowable limits for agricultural sludge use according to Order no. 344/2004. The sludge constitutes a source of micronutrients for soil fertility.

Tab. 6 – Quality indicators of the waste water from the slaughterhouse and water treatment station of SC AVICOLA CREVEDIA SA

Indicator	M.U.	Sampling points			*NTPA 001/2002*[*]	*NTPA 002/2002*[**]
		Water treatment station		Slaughter house[**]		
		Entrance[**]	Big homogenization basin, Exit[*]			
pH	pH units	7.22	7.16	6.85	*6.5-8.5*	*6.5-8.5*
Slurry	mg/l	800	200	210	*60*	*350*
CCO-Cr	mg O_2/l	1245	893	1632	*125*	*500*
CBO_5	mg/l	487	317	728	*25*	*300*
Ammonium	mg/l	93.2	60.8	60.8	*3.0*	*30*
Nitrates	mg/l	8.20	7.09	5.54	*37*	
Phosphorus	mg/l	5.8	5.6	4.0	*2.0*	*5.0*
Calcium m	mg/l	139	145	103	*300*	
Magnesium	mg/l	24	16	39	*100*	
Potassium	mg/l	29	23	25		
Sodium	mg/l	91	86	83		
Chlorides	mg/l	238	193	242	*500*	
Sulphates	mg/l	90	71	95	*600*	*600*
Iron	mg/l	1.72	1.55	0.67	*5.0*	
Manganese	mg/l	0.35	0.44	0.37	*1.0*	*2.0*
Zinc	mg/l	0.48	0.42	0.50	*0.5*	*1.0*
Copper	mg/l	0.03	0.02	0.02	*0.1*	*0.2*
Lead	mg/l	bdl	0.01	0.18	*0.2*	*0.5*
Chromium	mg/l	bdl	0.05	0.03	*1.0*	*1.5*
Nickel	mg/l	0.03	0.05	bdl[***]	*0.5*	*1.0*
Cobalt	mg/l	0.03	0.05	0.05	*1.0*	
Cadmium	mg/l	0.003	0.002	0.002	*0.2*	*0.3*

[*] limit pollutants loading values of industrial and urban waters exhausted in natural receptors according to NTPA 001/2002 (HG nr.188/2002)
[**] limit pollutants loading values of waste water exhausted in the localities' sewerage and directly into the water treatment stations according to NTPA 002/2002 (HG nr.188/2002)
[***] bdl – below the detection limit

The soil on which poultry manure was applied. The soils on which poultry manure was applied and the control soil are Calcaric Fluvisols (FLca) of the Fluvisols class. They have a loamy-sandy texture.

The soils have a slightly alkaline reaction; they are base saturated and not salty. The soluble salts content in the soils on which poultry manure was applied is slightly higher than in the control soil. The organic matter and nitrogen contents are

similar and low. The mobile phosphorus content is very high and the mobile potassium content is high. The control has a low content of nitrates and ammonium, while the soils on which poultry manure was applied have higher contents, close to normal values.

Tab. 7 – Quality indicators of the waste water from the sewerage of Farms 3, 6, and 7 of SC AVICOLA CREVEDIA SA

Indicator	M.U.	Sampling points			*NTPA 001/2002*[*]
		Farm 7 Between H1 and H2	Farm 3 pumping station	Farm 6 washing water	
pH	pH units	7.13	7.05	7.00	*6.5-8.5*
Slurry	mg/l	550	1210	70	*350*
CCO-Cr	mg O_2/l	78	98	124	*500*
CBO_5	mg/l	35	42	57	*300*
Ammonium	mg/l	20.80	22.40	28.00	*30*
Nitrates	mg/l	3.46	2.66	5.76	
Phosphorus	mg/l	3.2	5.0	4.3	*5.0*
Calcium m	mg/l	45	64	98	
Magnesium	mg/l	11	19	11	
Potassium	mg/l	44	47	69	
Sodium	mg/l	108	68	63	
Chlorides	mg/l	59	61	186	
Sulfate	mg/l	29	19	52	*600*
Iron	mg/l	1.77	1.02	0.59	
Manganese	mg/l	0.15	0.35	0.25	*2.0*
Zinc	mg/l	0.45	0.11	0.27	*1.0*
Copper	mg/l	0.02	0.01	0.02	*0.2*
Lead	mg/l	0.01	bdl	0.04	*0.5*
Chromium	mg/l	bdl[**]	0.07	0.05	*1.5*
Nickel	mg/l	bdl	0.08	bdl	*1.0*
Cobalt	mg/l	bdl	bdl	bdl	
Cadmium	mg/l	0.002	0.002	0.005	*0.3*

[*] limit pollutants loading values of waste water exhausted in the localities' sewerage and directly into the water treatment stations according to NTPA 002/2002 (HG nr.188/2002)
[**] bdl – below the detection limit

These soils do not raise problems of heavy metal pollution (Table 4). The total heavy metals contents in the control soil is bellow the maximum allowable values for the soils (pH over 6,5) on which sludge is applied: Cu (100 mg/kg), Ni (50 mg/kg), Pb (50 mg/kg), Zn (300 mg/kg), Cr (100 mg/kg), or close to these in the case of chromium. Therefore, the control soil is appropriate for applying poultry manure without polluting effect on the soil or the groundwater; applying manure did not significantly modify the heavy metals total contents in the analyzed soils.

The influence of SC AVICOLA CREVEDIA SA activity on water. *Drinking water quality*. Groundwater was sampled from the supply network of the Farms 2, 3, 7, and 11 and from the water basin of the slaughterhouse. The samples have an alkaline reaction, with pH values between 7.26 and 7.88 (Table 5). The pH, electric conductivity, and the anionic and cationic composition values are within the limits established for drinking water by the Law 458/2003, except for the total hardness which outruns the allowable limit.

Waste water quality. The waste water sampled at the entrance and exit of the water treatment station (Table 6) outruns the limit values of pollutants loading (according to NTPA 002/2002) for: slurry, CCO-Cr (chemical oxygen consumption), CBO_5 (biochemical oxygen consumption), ammonium and phosphorus.

Tab. 8 – Air ammonia concentrations in different places of SC AVICOLA CREVEDIA SA

Localization	Value mg/m^3	*MAL* mg/m^3
Farm 2, hall 3, outside; 25 days chicken	7.3	*30*
Farm 2, hall 3, inside; 20 days chicken	11.8	
Farm 6, between halls 7 and 8, outside; 40 days chicken	24.0	
Farm 4, hall 1, outside; 7 days chicken	2.0	
Farm 7, hall 1, outside; 12 days chicken	2.4	

The waste water sample from the slaughterhouse outruns the same limit values for: CCO-Cr, CBO_5, ammonium and phosphorus.

The waste water samples from the sewerage of Farms 7 and 3 (Table 7) outrun the pollutants loading limit (according to NTPA 002/2002) only for slurry, and the waste water sample from Farm 6 is within the limits.

Altogether, the waste water exhausted into the Crevedia pond doesn't meet the quality conditions (NTPA 001/2002). The critical polluting points are the pretreatment station of the slaughterhouse and the water treatment station because they are discharged into the pond no. 7, which is part of the Colentina brook lake network.

The influence of SC AVICOLA CREVEDIA SA activity on air. Ammonia concentrations values in the momentary air samples were below the 30 mg/l maximum allowable limit.

Conclusions

SC AVICOLA CREVEDIA SA has 8 locations (11 farms, headquaters, slaughterhouse, water treatment station). The **soils of the precincts** have a neutral up to slightly alkaline reaction, they are base saturated and they have very low up to medium humus contents and low up to high total nitrogen contents. The nitrates concentrations are low up to high; very high values have been registered at the slaughter house, Farm 2 and 7. Ammonium concentrations are low up to normal and higher at the slaughter house. Most of the sampling points have high and very high contents of mobile phosphorus and potassium. These values have an anthropic origin due to the poultry growing technology. Total heavy metals contents are much below the alert threshold for less sensitive use and there is no tendency of pollution.

The **control soils** of the farm vicinity have a neutral up to slightly alkaline reaction, they are base saturated, not salty; they have low humus values and medium up to high total nitrogen contents, while nitrates and ammonium concentrations are low. They have very high mobile phosphorus contents and low and high mobile potassium contents; the high mobile phosphorus and potassium contents proceed from fertilization. The total heavy metals contents are much below the alert threshold for less sensitive use and there is no polluting tendency.

The **poultry manure** (dejections and litter) has a slightly alkaline pH, a high nitrates concentration and a very high ammonim one; from the point of view of total soluble salts contents it corresponds to a material with chloruric salinization in which acid carbonates and potassium are predominant. It also contains high quantities of total nitrogen, phosphorus and potassium. At least 266.7 ha agricultural land is needed for disposal of the manure so that the dose allowed by the 91/676/EEC Directive, 170 kg N7ha, is not outrunned. Heavy metals contents are lower than the maximum allowable limits for sludge to be used in agriculture; the poultry manure constitutes a source of macro- and micro-elements for the soils on which it is applied.

The **sludge from the water treatment station** has a slightly acid pH, a high nitrates content and a low ammonium one; from the point of view of the total soluble salts contents it corresponds to a material with chloruric salinization in which chloride and calcium are predominant. This material contains significant nitrogen and phosphorus quantities and less potassium and it constitutes a good quality fertilizer; its application on agricultural land must observe the 170 kg N/ha/year limit according to 91/676/EEC Directive. The heavy metals contents are much below the maximum allowable concentration for sludge use in agriculture.

The control soils and the soils on which poultry manure was applied have a loamy sand texture, a slightly alkaline reaction, they are base saturated and not salty, and the soluble salts content is slightly higher in the soils on which

manure was applied. The humus and total nitrogen contents are similar (low values); the mobile phosphorus contents are very high and the mobile potassium ones high. The control has low nitrates and ammonium contents, while the soils on which poultry manure was applied have higher contents, close to the normal soil values. The total heavy metals contents of the control is below the maximum allowable limits for the soils on which sludge can be applied and they are suitable for dejection application without polluting effect on the soil or the groundwater; applying manure doesn't significantly alter the heavy metals contents in the analysed soils and doesn't raise pollution issues.

All **drinking water** samples (Farms 2, 3, 7 and 11 and the water basin of the slaughter house) have total hardness, small outruns for the contents of some heavy metals and, except for the sample from Farm 11, exceeding amounts of ammonium.

The **waste water** sampled at the entrance and exit of the water treatment station exceeds MAL for slurry, CCO-Cr, CBO_5, ammonium and phosphorus, and the one from the slaughter house exceeds the MAL for CCO-Cr, CBO_5, and ammonium.

The waste water samples from the Farms 7 and 3 sewerage exceed MAL only for slurry, and the sample from Farm 6 is within the limits in all respects.

The waste water purged in the Crevedia brooke doesn't fulfill the quality conditions from the point of view of slurry content, CCO-Cr, CBO5, N-NH_4 and phosphorus; the critical point of waste water pollution are the pretreatment station of the slaughter house and the water treatment station, because they are discharged into the pond no. 7, which is part of the Colentina brook lake network.

Momentary measurements of the **ammonia emissions** have values below MAL.

References

Florea Nicolae, Munteanu Ioan (2003), *Romanian Soil Taxonomy System (Sistemul Român de Taxonomie a Solurilor SRTS)*, ICPA, Editura ESTFALIA, Bucureşti.

Radu Lăcătuşu, Nineta Rizea, Mihaela Lungu, Beatrice Kovacsovics, Rodica Lazăr, Ion Rîşnoveanu (2005), *Emplacement Report, Environment Survey level II and Report of the Environment Survey level II, Environmental impact assesment study, SC AVICOLA CREVEDIA SA, Dâmboviţa County (Raport de amplasament, Bilanţ de mediu nivel II şi Raport la bilanţul de mediu de nivel II, Studiu de evaluarea a impactului asupra mediului, SC AVICOLA CREVEDIA SA, judeţul Dîmboviţa)*, CE 11/2005, Arhiva ICPA Bucureşti.

*** ICPA (1981), *Agrochemical soil analyses methodology for establishing amendments and fertilizers need. I (Metodologie de analiză agrochimică a solurilor în vederea*

stabilirii necesarului de amendamente şi îngrăşăminte. I). Metode, rapoarte, îndrumări, nr.18, Redacţia de propagandă tehnică agricolă, Bucureşti.

*** ICPA (1986), Soil chemical analyses methods (*Metode de analiză chimică a solului)*, Redacţia de propagandă tehnică agricolă, Bucureşti.

*** *MAPAM Order no. 344/2004 regarding technical standards concerning environment protection and especially of soils when sludge is used in agriculture (Ordin nr. 344/2004 al MAPAM referitor la normele tehnice privind protecţia mediului şi în special a solurilor, când se utilizează nămoluri de epurare în agricultură),* Monitorul Oficial, partea I, nr. 66 din 27.01.2004.

*** *MAPPM Order no. 756/1997 regarding reference values for soil chemical elements contents (Ordinul nr. 756/1997 al MAPPM referitor la valori de referinţă pentru conţinutul de elemente chimice în sol)*, Monitorul Oficial, partea I, nr. 303 bis din 06.11.1997.

*** *Law no .458/2002 regarding drinking water quality (Legea nr. 458/2002 privind calitatea apei potabile)*, Monitorul Oficial, partea I, nr. 552 din 29.07.2002.

*** *Government Resolution no. 188/2002 for the approval of standards regarding waste water exhaustion in aquatic environment, with NTPA 001/2002 – limit values for pollutants loading of industrial and urban water exhausted in natural receivers and NTPA 002/2002 – limit values for pollutants loading of waste waters exhausted in the sewerage network of the localities and directly in the water treatment stations (Hotărârea de Guvern nr.188/2002 pentru aprobarea unor norme privind condiţiile de descărcare în mediul acvatic a apelor uzate, cu NTPA 001/2002 - valori limită de încărcare cu poluanţi a apelor industriale şi orăşăneşti evacuate în receptori naturali şi NTPA 002/2002 - valori limită de încărcare cu poluanţi a apelor uzate evacuate în reţelele de canalizare ale localităţilor şi direct în staţiile de epurare)*, Monitorul Oficial nr.187/20.03.2002.