

**Ministry of Waters and Environmental
Protection**

Estimation of costs associated
with the Implementation Plan
of EC Nitrates Directive (91/676/EEC)
in Romania

Bucharest
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I. Estimation of costs associated with the Implementation Plan of EC Nitrates Directive (91/676/EEC) in Romania

Approximation of directive

1.1. Legislative framework

The Directive 91/676/EEC on protection of waters against pollution caused by nitrates from agricultural sources was totally approximated as early as 2001, by adopting the following national acts:

- Romanian Government Decree no. 964/2000 approving the Action Plan for protection of waters against pollution caused by nitrates from agricultural sources and setting up the Commission and Assistance Group for the application of Action Plan to protect the waters against the pollution caused by nitrates from agricultural sources. The Commission for application of Action Plan to protect the waters against pollution caused by nitrates from agricultural sources includes specialists in the Ministry of Waters and Environmental Protection, Ministry of Agriculture, Food and Forests and Ministry of Health and Family. Besides the Commission there is an Assistance Group including representatives of the National Administration “Romanian Waters”, committees of watersheds and some institutes and institutions of specialty which are subordinated, coordinated by the three ministries or under their authority.

- Common Order no. 425/2001 and 105951/2001 of the Minister of Waters and Environmental Protection and Minister of Agriculture, Food and Forests, respectively, regarding the approval of the organization and function rules, tasks and members of Commission and Assistance Group to apply the Action Plan for protection of waters against the pollution caused by nitrates from agricultural sources.
- Order no. 740/2001 of the Minister of Waters and Environmental Protection approving the nominal composition of Commission for application of the Action Plan to protect the waters against pollution caused by nitrates from agricultural sources.

The provisions of this Directive are included in the Action Plan for protection of waters against pollution caused by nitrates from agricultural sources, approved by the Romanian Government Decree no. 964/2000, called hereafter Action Plan.

1.2. Responsibilities

The Ministry of Waters and Environmental Protection (MWEP) has the responsibility to implement the Nitrates Directive in Romania. In this activity, MWEP cooperated with the Ministry of Agriculture, Food and Forests (MAFF) and the Ministry of Health and Family (MHF).

Activity purpose: protection and monitoring of water quality, cadastre of waters affected by pollution with nitrates and location of vulnerable zones.

1.3. Main objectives of Action Plan

The main objectives of Nitrates Directive, included in the Action Plan, are as follows:

- Mitigation of pollution caused or induced by nitrates from agricultural sources;
- Prevention of water pollution caused by nitrates;

- Rationalization and optimization of using the chemical and organic fertilizers.

1.4. Plan to meet the requirements of Directive and Action Plan

A. Main requirements of Action Plan

1. Identification of waters affected by pollution caused by nitrates or susceptible to be exposed to such a pollution and establishment of some adequate monitoring and control programs.
2. Setting up the cadastre of these waters.
3. Location of vulnerable zones.
4. Preparation of a code of good agricultural practices and of some programs to train and inform the farmers in order to promote this code.
5. Elaboration, implementation and practical application of action programs.
6. Other implementation requirements:
 - 6.1. Duties.
 - 6.2. Reports.
 - 6.3. Periodical revisions of Action Plan.
 - 6.4. Elaboration and adaptation of national rules needed for Action Plan implementation.

B. Implementation plan of requirements

1. Identification of waters affected by pollution caused by nitrates or susceptible to be exposed to such pollution and establishment of some adequate monitoring and control programs

a) Summary of objectives

Identification of waters affected by pollution caused by nitrates or susceptible to be exposed to such a pollution, especially of the surface, ground or eutrophic waters.

The Action Plan emphasizes the importance of monitoring the concentrations of nitrates in all the water categories establishing also a graph of this monitoring operation, the water presenting an eutrophic state included. The basic criteria to identify the waters affected by pollution with nitrates and the waters susceptible to be exposed to such a pollution are provided in the Action Plan. When these criteria are applied, the physical, chemical and biological characteristics of water and soil, the present condition of impact of nitrogen compounds on environment and the present situation of the applied measures are also taken into account.

As concerns the requirements of Nitrates Directive, which are identical with those of the Action Plan, a distinction should be considered between two different monitoring types:

- That has in view the identification of polluted waters being in danger to be polluted and on basis of which the vulnerable zones are located;
- That which is performed to evaluate the efficiency of action programs.

The first monitoring type, fulfilled by surveillance and control, within a monitoring program, covers the whole Romania's territory. The monitoring of the concentrations of nitrates in fresh waters is performed along the whole year, at least every month or more frequently during the rainy or flooding periods in the control sections for the surface waters, and at the regular intervals for the control sections representative for aquifers. Eutrophic conditions of fresh waters and coastal water is checked every four years.

The factors enabled to carry out this monitoring submit, every four years, to the Ministry of Waters and Environment Protection reports on the results of these activities, excepting when the concentration of nitrates in previous samples, collected from the control sections, were less than 25 mg/l and no new factor of a probable increase of nitrate content occurred. In this case, the monitoring program will be carried out every eight years.

The other monitoring type refers only to the vulnerable zones and it will be applied to the polluted waters or the waters threatened by pollution, identified by the first monitoring type. Besides the monitoring of nitrates in water, it is also necessary to establish the inputs of nitrates and their levels in soil, and the contamination degree.

In this view, it is necessary to design a project containing sets of measures to implement the Action Plan which will include also the procedures and instructions for the surveillance and monitoring systems and for both the monitoring types.

b) Identification of implementation stages. Preparing implementation stage.

- Analysis of present condition of water according to the Plan Action requirements.
- Identification of necessary data (qualitative parameters of waters and points of collecting the water samples).
- Collecting the needed data regarding the quality of waters.
- Preparing the methods for water quality evaluation taking into account the sources of pollution caused by nitrogen of agricultural origin.
- Evaluation of data regarding the quality of waters.

Implementation stage

- Specification of criteria and methodology to identify the waters affected by pollution caused by nitrates from agricultural sources and the waters susceptible to be exposed to such a pollution.
- Identification of waters affected by pollution caused by nitrates from agricultural sources and of waters susceptible to be exposed to such a pollution and making the cadastre of these waters.

Surveillance and control stage

- Preparation/adjustment of methods.

- Monitoring and control program preparation for the surveillance and monitoring system.
- Procedures, methodologies and instructions for evaluating the monitored data.
- Setting up a Focal Center to monitor the waters polluted with nitrates (within the National Agency “Romanian Waters”), and of a Focal Center to monitor the soil pollution caused by nitrates (within the Research Institute for Soil Science and Agrochemistry - RISSA) having the mission to collect, store, evaluate and report the data supplied by the periodical monitoring networks.
- Periodical presentation (every four years) to the Commission for application of Action Plan for protection of waters against pollution caused by nitrates from agricultural sources of report on the results of monitoring activity in order to establish and/or revise and complete the list of vulnerable zones.
- Periodical revision of cadastre of waters affected by pollution caused by nitrates from agricultural sources and waters susceptible to be exposed to such a pollution.

II. Designation of vulnerable zones which drain in waters affected by pollution caused by nitrates or are susceptible to be exposed to such a pollution and which contribute to their pollution

a) Summary of objectives

The provisions and procedures for designating the vulnerable zones which drain in waters affected by pollution caused by nitrates or which are susceptible to be exposed to such a pollution and contribute to their pollution, as well as their revision are specified in Article 3 of the Action Plan. In this view, within two years from coming into force of the Action Plan, MWEF together with MAFF will designate the list including the vulnerable zones that drain into the waters affected by pollution caused by nitrates or susceptible to be exposed to such a pollution and which contribute to their pollution.

MWEF and MAFF will revise and/or complete, every four years, the list including the vulnerable zones, analyzing and taking into consideration the changes and factors unforeseen when the list was made.

The Commission for application of the Action Plan for protection of waters against the pollution caused by nitrates from the agricultural sources will be, within three months since the operation time, informed on any change or modification in the list of the vulnerable zones.

b) Identification of individual stages

Preparatory stages of implementation

- Identification of data needed for designation of vulnerable zones. Setting up a Geographic Information System for designating the vulnerable zone.
- Preparation of methodologies for designating the vulnerable zones.
- Evaluation of data for designation.
- Designation of vulnerable zones and execution of cadastre and maps regarding these zones.

Implementation stage

- Detailed designation and statement to revise the vulnerable zones.
- Revision stage.
- Setting up the periodical monitoring network and factors that will collect, store, evaluate and report the obtained data to the Commission for application of the Action Plan for the protection of waters against pollution caused by nitrates from agricultural sources in order to revise the cadastre and maps of vulnerable zones.
- Periodical revision of vulnerable zones.
- Preparation/adjustment of methodologies to revise the vulnerable zones.

Application

- Information of public (especially farmers) on the designation of vulnerable zones and their revision.

III. Elaboration of a code of good agricultural practices

a) Summary of objectives

The code of good agricultural practices includes a set of requirements for agricultural management methods that can avoid excessive loading of surface and ground waters and agricultural lands with polluting substances from agricultural, especially nutrients. The main purpose of this code is to ensure a general level of protection of surface and ground waters against pollution.

The provisions of code will be adopted and applied by farmers voluntarily and without financial compensation, excepting some areas in the vulnerable zones where they will be applied with the assistance of local authorities and other implicated organizations.

The code will be updated according to the occurrence of new agricultural technologies and practices with low impact on environment.

The code refers to the problems generated by the inadequate management of animal dejecta and organic and inorganic fertilizers, agricultural lands, associated with the soil erosion problems, compaction and soil structure degradation, that have unfavorable implications on the quality of water bodies. To solve these problems, the recommendations and procedures included in the code for each of the above mentioned aspects should take into consideration the specific conditions of the country. Therefore, these recommendations and procedures should be elaborated on the basis of the experience and be effective and proper for application in all the areas.

When it is necessary, the code of good agricultural practices will be promoted by information programs and training of farmers.

The funding for code preparation and printing will be supported by the GEF Agricultural Pollution Control project, a project that is coordinated by MWEP.

b) Identification of implementation stages

Preparatory of implementation stage

- Evaluation of agricultural works and harmonization of objectives with the acceptability of measures by farmers.
- Elaboration of a preliminary draft of the code of good agricultural practices.
- Preparation and publication of the code of good agricultural practices.

Revision stage

- Revision of the code of the good agricultural practices.
- Periodical monitoring of code implementation.

Application

- Achievement of program for awareness, information and professional training of farmers.
- Establishment of measures and instruments to implement the code of good agricultural practices.
- Awareness, information and professional training of farmers.

IV. Establishment, implementation and putting into force the Action Plan

a) Summary of objectives

The articles 6 and 7, as well as the ANNEX no. 4 in the Action Plan contain provisions for establishing and implementing the action programs referring to the vulnerable zones. Thus, in term of two years since the designation of vulnerable zones and, respectively, in term of maximum one year since the modification or

completion of list of the vulnerable zones, the Commission of Action Plan application for the protection of waters against pollution caused by nitrates from agricultural sources will establish action programs referring to the vulnerable zones. The action programs are established for all the vulnerable zones in the country, as well as different programs for certain vulnerable zones or parts of vulnerable zones, if it is necessary.

The action programs will be established for a period of at least four years and they will include the measures stipulated in the code of good agricultural practices, as well as those stipulated in ANNEX no. 4 of the Action Plan. Also, they will take into account the available scientific and technical data, first of all those referring to the input of nitrates from the agricultural sources and other sources, as well as the environment conditions in the respective regions.

In order to implement the action programs, the Commission for application of Action Plan for the protection of waters against pollution caused by nitrates from agricultural sources will take supplementary measures, at least every four years, depending on the modifications occurred in the cadastre of waters affected due to the pollution caused by nitrates and in the list of the vulnerable zones.

b) Identification of implementation stages

- Analysis of present situation of legislative measures regarding the agricultural management.
- Preparation of some preliminary projects of Action Plan.
- Pilot project in the potentially vulnerable zone (predominantly agricultural and animal husbandry sector).
- Identification of soil survey and soil testing data in zone and of water quality.
- Collecting the needed data regarding the agricultural management and natural conditions of zone.

- Elaboration of list of the measures for decreasing the water contamination with nitrates in zone.
- Elaboration of methods for evaluation of data regarding the agricultural management and natural conditions in zone.

Implementation stage

- Harmonization of objectives with the acceptability of measures by farmers.
- Elaboration of action programs (identification of measures specific to the vulnerable zones).
- Adaptation of action programs.
- Implementation of action programs.

Revision stage

- Periodical collecting, storage and evaluation of data regarding the agricultural management and environment conditions in zones declared vulnerable.
- Periodical collecting, storage and evaluation of soil survey and soil testing data of agricultural lands and of water quality data in zones declared vulnerable.
- Periodical revision of action programs.
- Implementation of revised action programs

Application

- Utilization of instruments established for implementation of objectives.
- Establishment and implementation of application measures according to the action programs.
- Awareness and professional training of farmers

2. Costs associated with implementation plan of Nitrates Directive in Romania

The costs associated with implementation plan of Nitrates Directive should better be presented in a large perspective including the evaluation of direct and indirect costs and of benefits. In this view, the analysis of evaluation regarding the impact of decreasing the pollution caused by nitrates should also include the economic value obtained by increasing employment due to the improved management of manure. These costs are not included in the analysis of this project stage.

The main costs of investments needed for the implementation of the Nitrates Directive are those referring to develop the platforms for manure storage and to get the equipment for manure distribution in zones vulnerable to pollution caused by nitrates from agricultural sources. The estimation of costs were made taking into account two options of Nitrates Directive implementation (Annex 1).

In case the whole country is declared a vulnerable zone (“a” option), the costs for this chapter amount to 1, 116,130, 570 E.

In case the zones vulnerable to nitrates are established according to the local conditions (sources, transmitting the flow of pollutants towards the ground aquifers and surface waters - “b” option), the needed funds for this chapter amount to 140, 669, 000 €

- Costs to provide the rural communities in vulnerable zones with equipment for spreading the manure on the surface of the land: it is considered that, at the level of each locality, at least an equipment is necessary spreading the manure.

Therefore, the results are:

- first option (a): $13,000 \text{ localities} \times 3,000 \text{ E/equipment} = 39,000,000 \text{ E}$
- second option (b): $750 \text{ localities} \times 3,000 \text{ E/equipment} = 2,250,000 \text{ E}$
- Operation costs to monitor the aquifers and surface waters: the network to monitor the quality of the aquifers includes 2172 drillings of which 500 drillings are located in the vulnerable zone established according to the “b” option in Annex A1. As compared to the distribution of the present drillings for collecting the water samples from aquifers, it is considered that, on the basis of the potentially vulnerable zone established in the Annex A1 - Figure 1, the present network for monitoring should be supplemented with about 500 new drillings. Therefore, the costs to ensure the measurement of the nitrates in ground waters twice a year will be:
 - in the first case (“a” option), when all the country is declared vulnerable: $(2172 + 500 \text{ drillings}) \times 300 \text{ E / drilling} \times 3 \text{ measurements a year} = 2,404,800 \text{ E};$
 - in the second case, when only some land areas are designated as being vulnerable $(500 + 500 \text{ drillings}) \times 300 \text{ E/drilling} \times 4 \text{ measurement a year} = 1,200,000 \text{ E}.$ These costs are increased by the costs necessary to monitor once a year the drillings located beyond the vulnerable zones, that is $1,672 \text{ drillings} \times 300 \text{ E / drilling} = 501,600 \text{ E}.$ Therefore, the total costs in this case represent $1,701,600 \text{ E}.$

The costs for building up 500 new drillings in the vulnerable zones: $500 \text{ drillings} \times 3,000 \text{ E / drillings} = 1,500,000 \text{ E}.$

The costs to monitor the surface waters regarding the nitrate content are evaluated to $1,000,000 \text{ E / year}.$

The operation costs to monitor the soil, vegetation and organic residues in zones vulnerable to pollution caused by nitrates from agricultural sources were evaluated for the two designation options of the vulnerable zones thus:

- “a” option presumes the establishment of a network for monitoring the soil in each locality (13,000 localities), depending on the local soil/land characteristics. The preliminary estimations lead to a necessity of two profiles/locality. The year cost of soil monitoring in one place is of 400 E, hence, the total operation costs regarding this chapter are: $13,000 \times 400 \times 2 \text{ profile} = 10,400,000 \text{ E/year}$.

- “b” option presumes an intensive program (4 profiles/locality) for the monitoring in the vulnerable zone (750 villages in 250 communes) and a background monitoring (1 profile/locality) in the other localities (12,250 localities). The costs needed for this monitoring are: $\{(750 \text{ localities} \times 4 \text{ profiles/locality}) = 12,250 \text{ localities} \times 1 \text{ profile/locality}\} \times 400 \text{ E/profile} = 6,100,000 \text{ E/year}$.

- Supplying the mobile laboratories to collect and analyze the water samples (1 laboratory/direction): $11 \text{ directions} \times 100,000 \text{ E/mobile laboratory} = 1,100,000 \text{ E}$.
- Supplying the mobile laboratories to collect and analyze the samples of soil, plant and residues from animal husbandry (2 laboratories): 300,000 E.
- Supplies (measurement equipment, logistics, biotics office furniture) for the Focal Centre monitoring the waters polluted with nitrates: 1,000,000 E.
- Operational costs for the activities of the Focal Centre monitoring the waters polluted with nitrates: 150,000 E.
- Supplies (measurement equipment, logistics, biotics, office furniture) for the Focal Centre monitoring the soil pollution caused by nitrates: 1,000,000 E.
- Operational costs for the activities of the Focal Centre monitoring the soils polluted with nitrates: 120,000 E.

- Costs need to accredit the laboratories for monitoring pollution of soil/waters caused by nitrates: 4,000,000 E.
- Supplying land cars for the local factors (Water Directions, Country Soil Survey and Soil Testing Offices) involved in monitoring the pollution caused by nitrates: 40 land cars x 30,000 = 1,200,000 E.
- Operational costs for Country Soil Survey and Soil Testing Offices (CSSSTO): 10,000 E x 38 CSSTO = 380,000 E.
- Operational costs for Water Directions: 10,000 x 11 Water Directions = 110,000 E.
- Elaboration of operational methodologies for soil and water monitoring: 100,000 E.
- Personnel (staff) costs (Focal Centres, Water Directions and CSSSTO) = 5,000,000 E/year.
- Investment costs for Watershed Directions regarding the laboratory apparatus needed to analyze the nitrates in waters: 350,000 E x 11 Watershed Directions = 3,850,000 E.
- Costs of investments for laboratory apparatus to analyze the nitrates in soil and plant for CSSSTO: 350,000 E x 39 CSSSTO = 13,300,000 E.
- Development of logistics needed to develop/integrate the Geographic Information Systems: 500,000 E.
- Development/implementation of Decision Support Systems for the management of the animal husbandry farms at the level of the Vulnerable Zones and Watershed Basins: 500,000 E.
- Costs of training the specialists: 550,000 E.
- Estimation of costs for the activities of training/awareness, etc. was made considering the “a” option - the whole country is vulnerable, taking into account (1,900 training sessions at the communal level (1,900 x 1,000

E/session = 1,900,000 E) and 50 trainings for trainers (50 x 1,500 E/training = 75,000 E)}. In the case of this option, the total cost amounts to 1,975,000 E.

In case only some vulnerable zones are declared, it is necessary to have only 250 training sessions at the communal level (250 x 1,000/training = 250,000 E) and 20 trainings for trainers (20 x 1,500 E/training = 30,000 E). For this chapter in the “b” option, the cost amounts to a total of 280,000 E .

Costs needed to apply the Nitrates Directive in urban zones are estimated, in a first approximation, having in view the case study for the region regarding the Bucharest municipality (see Annex 2): 300,000 E. Taking into account the weight of this municipality in the total urban areas of Romania, it results, as a first estimation about 10,000,000 E for the application of the Nitrates Directive in the urban zones of Romania.

The centralised costs (investments, operations and training), under the two options, regarding the designation of the vulnerable zones (all the country and only certain zones depending on the pollution sources and the transmission characteristics towards the ground and surface waters) are presented in Tables 1 and 2.

The option of designing the vulnerable zones corresponding the best to the present situation and medium term predictions in Romania is the “b” option which designs approximately 10 per cent of the country’s territory as vulnerable zones to pollution caused by nitrates (see Annex A1).

Tables 3 and 4 present the cost needed to implement the Nitrates Directive in the two variants of declaring the vulnerable zones in the case of considering that the use of some laboratory equipments/tools corresponds to a moderate technology.

Having in view the costs implicated in each analyzed variant, Romania should adopt the “b” option of declaring the vulnerable zones (only some areas in

the country's territory are declared vulnerable depending on the inputs of nitrates from animal husbandry sector and the transfer conditions of nitrates towards the ground waters, aquifers and surface waters).

Table 1. Centralization of costs to implement Nitrates Directive considering the option by which all the country is designated as a vulnerable zone and the equipment of a modern technology (Euro).

Activity	Costs for:		
	Investments	Operations	Training
Storage platforms	1,116,130,570		
Equipment for manure spreading	39,000,000		
Ground water monitoring		2,404,800/year	
Surface water monitoring		1,000,000/year	
Monitoring of soil, vegetation and animal husbandry residues		6,100,000/year	
New drillings in vulnerable zones	1,500,000		
Mobile laboratories	1,400,000		
Focal Centre - water	1,000,000		
Focal Centre - soil	1,000,000		
Land cars	1,200,000		
Laboratory equipment-CSSSTO	13,300,000		
Laboratory equipment - Water Directions	3,850,000		

Logistics GIS	500,000		
Operation costs – CSSSTO, Water Directions		760,000/year	
GIS operation		500,000/year	
Elaboration of methodologies		100,000	
Accreditation		4,000,000	
Salaries		5,000,000/year	
Training of specialists			550,000
Local trainings			1,975,000
Urban zones		10,000,000	
TOTAL	1,178,880,570	16,034,800/year +14,100,000	2,525,000

Table 2. Centralization of costs to implement Nitrates Directive considering the option “b” (only some zones of the country are declared vulnerable) and the equipment of a modern technology (Euro).

	Costs for:		
Activity	Investments	Operations	Training
Storage platforms	140,669,900		
Equipment for manure spreading	2,250,000		
Ground water monitoring		1,701,600/year	
Surface water monitoring		1,000,000/year	
Monitoring of soil, vegetation and		6,100,000/year	

animal husbandry residues			
New drillings in vulnerable zones	1,500,000		
Mobile laboratories	1,400,000		
Focal Centre - water	1,000,000	150,000/year	
Focal Centre - soil	1,000,000	120,000/year	
Land cars	1,200,000		
Laboratory equipment-CSSSTO	13,300,000		
Laboratory equipment - Water Directions	3,850,000		
Logistics GIS	500,000		
Operation costs – CSSSTO, Water Directions		760,000/year	
GIS operation		500,000/year	
Elaboration of methodologies		100,000	
Accreditation		4,000,000	
Salaries		5,000,000/year	
Training of specialists			550,000
Local trainings			280,000
Urban zones		10,000,000	
TOTAL	166,669,900	15,331,600/year +14,100,000	830,000

Table 3. Centralization of costs to implement Nitrates Directive considering the option by which all the country is designated as a vulnerable zone and the equipment of a moderate technology (Euro).

	Costs for:		
Activity	Investments	Operations	Training
Storage platforms	1,116,130,570		
Equipment for manure spreading	23,400,000		
Ground water monitoring		1,923,840/year	
Surface water monitoring		1,000,000/year	
Monitoring of soil, vegetation and animal husbandry residues		4,575,000/year	
New drillings in vulnerable zones	1,500,000		
Mobile laboratories	910,000		
Focal Centre – water	850,000	150,000/year	
Focal Centre – soil	850,000	120,000/year	
Land cars	800,000		
Laboratory equipment-CSSSTO	9,500,000		
Laboratory equipment - Water Directions	2,750,000		
Logistics GIS	500,000		
Operation costs – CSSSTO, Water Directions		760,000/year	
GIS operation		500,000/year	
Elaboration of methodologies		100,000	
Accreditation		4,000,000	
Salaries		5,000,000/year	
Training of specialists			550,000
Local trainings			1,975,00

			0
Urban zones		10,000,000	
TOTAL	1,154,715,570	14,028,840/year +14,100,000	2,525,000

Table 4. Centralization of costs to implement Nitrates Directive considering the option “b” (only some zones of the country are the declared vulnerable) and the equipment of a moderate technology (Euro).

	Costs for:		
Activity	Investments	Operations	Trainin g
Storage platforms	140,669,900		
Equipment for manure spreading	1,350,000		
Ground water monitoring		1,361,280/year	
Surface water monitoring		1,000,000/year	
Monitoring of soil, vegetation and animal husbandry residues		4,575,000/year	
New drillings in vulnerable zones	1,500,000		
Mobile laboratories	910,000		
Focal Centre – water	850,000	150,000/year	
Focal Centre – soil	850,000	120,000/year	
Land cars	800,000		
Laboratory equipment – CSSSTO	9.500,000		

Laboratory equipment - Water Directions	2,750,000		
Logistics GIS	500,000		
Operation costs – CSSSTO, Water Directions		760,000/year	
GIS operation		500,000/year	
Elaboration of methodologies		100,000	
Accreditation		4,000,000	
Salaries		5,000,000/year	
Training of specialists			550,000
Local trainings			280,000
Urban zones		10,000,000	
TOTAL	159,679,900	13,466,280/year +14,100,000	830,000

Calculation of costs to implement Nitrates Directive for developing the manure storage platforms

This estimation has in view the costs to implement a system of managing the rural domestic wastes and manure at the level of communes and farms in zones vulnerable or potentially vulnerable to pollution caused by nitrates from agricultural sources, a system whose major purpose is to reduce the level of nutrients and pollutants of agricultural and rural origin entering the soil and implicitly the water bodies. To evaluate a maximum level regarding the costs of this measure, the estimation was made considering the most expensive method – building on of some communal garbage storage platforms. The methods specific for each rural zone (adapted to local nutrient flows and socio-economic conditions specific to each rural community) are going to be developed in the framework of the implementation plans of Nitrates Directive in the vulnerable zones.

The implementation of Nitrates Directive in Romania can be carried out by two ways:

a) definition of the whole Romania's territory as a vulnerable zone (option adopted by some European countries: Germany, Austria, Denmark, Finland, Luxembourg, Holland); and

b) definition of vulnerable zones according to the sources of pollution caused by nitrates and the characteristics of soil/unsaturated zone to transmit the nitrates towards the ground aquifers, ground waters and/or surface waters.

Table A1-1 presents the situation designing the zones vulnerable to pollution caused by nitrates in the UE countries with the potential evaluation of UE Commission.

Table A1.1. Designation of zones vulnerable to pollution caused by nitrates in UE countries

Member State	Total area (x 1000 km ²)	Area NVZ		Additional area NVZ			
			%	Drafted by Member States	%	EC assessment potential Areas**	%
Belgium	31	2.7	9	2.9	9	15.9	51
Denmark	43	43	100*				
Germany	356	356	100*				
Greece	132	13.9	11			9.0	7
Spain	504	32	6			70.6	14
France	539	240.9	48			37.1	7
Ireland	69	0	0			6.5	9
Italy	301	5.8	2			88.7	29
Luxembourg	3	3	100*				
Netherlands	37	37	100*				
Austria	84	84	100*				
Portugal	91	0.9	1			12.2	13
Finland	334	334	100*				
Sweden	448	41	9			43.7	10

When the establishment of zones vulnerable and potentially vulnerable to pollution caused by nitrates from agricultural sources is made according to the “b” way, the Methodology concerning the pollution of surface and ground waters caused by nitrates, prepared by the National Institute for Hydrology and Water

Management (NIHWM) in cooperation with the Research Institute for Soil Science and Agrochemistry (RISSA) is used.

Figure 1 represents the potentially vulnerable zones in Romania.

The land area of these zones is:

(A) - potentially vulnerable zones as a result of conveying the nitrates towards the surface water bodies by run-off on the slope lands: 5,050 km², that is, 2.37 per cent of the country territory and 3.82 per cent of the agricultural area;

(B) - potentially vulnerable zones (moderate risk of vulnerability) by percolation of nitrates below the soil profile towards the free aquifers: 13,759 km², that is, 5.77 per cent of the country territory and 9.30 per cent of the agricultural area, respectively;

(C) - zones with high risk of vulnerability to the nitrates percolation below the soil profile towards the free aquifers: 1,200 km², that is, 0.50 per cent of the country territory and 0.81 per cent of the agricultural area, respectively.

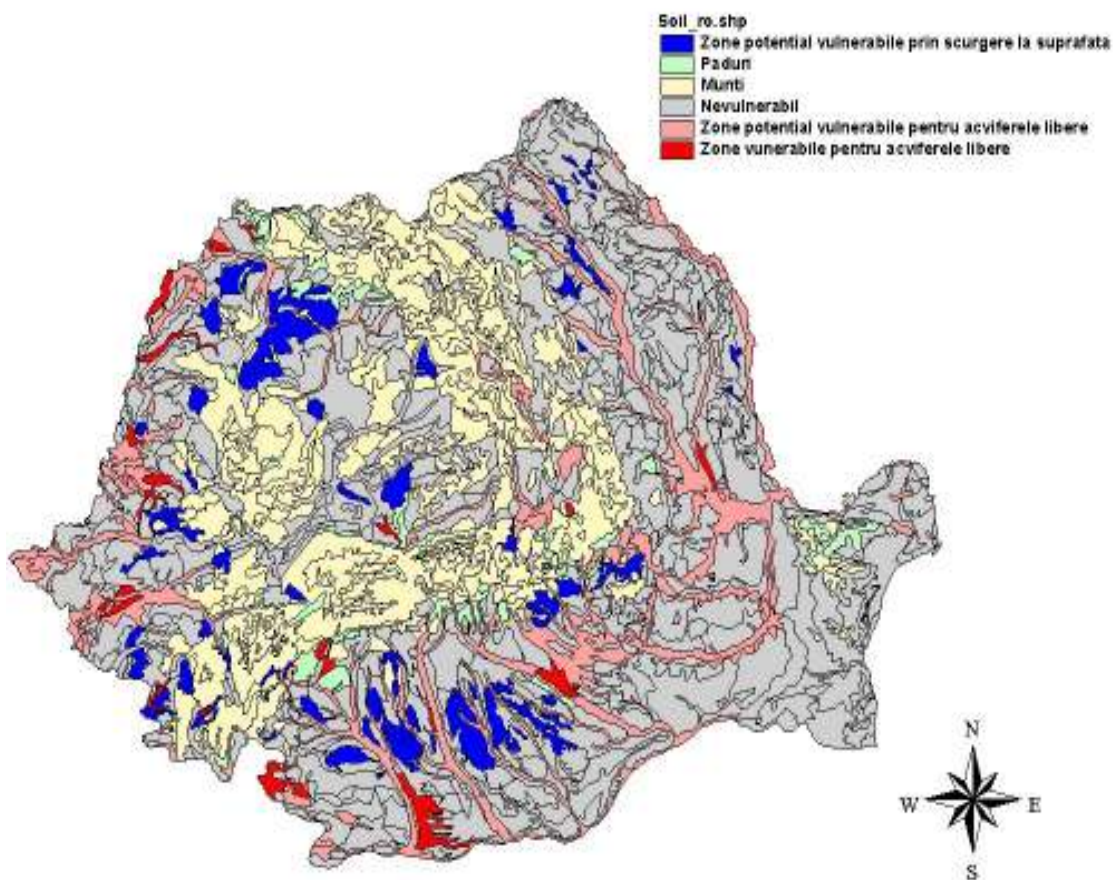


Figure 1. Zones vulnerable to pollution caused by nitrates from agricultural sources (Legend: ■ Zones potentially vulnerable to run-off; ■ Forests; ■ Mountains; ■ Non-vulnerable; ■ Zones potentially vulnerable for free aquifers; ■ Zones vulnerable for free aquifers).

In a Geographic Information System, the map of potentially vulnerable zone can be overlaid on map of nitrate inputs/outputs at the level of communes and on the map of nitrate flow towards the surface/ground waters established according to the number of animals in commune, cultivated crops, soil type, hydrogeological conditions. Such maps are going to be prepared for the whole country territory.

The first evaluation of these zones leads to the following situation:

- positive balance sheet of nitrates in potentially vulnerable zones of A category: 474, 685 km²;
- positive balance sheet of nitrates in potentially vulnerable zones of B category: 2,511,155 km²;
- The identified zones, at the communal level within the counties, and the classification according to the categories of vulnerable zones, are presented in Table A1.2.

Figure 2. presents the location of communes where the difference between the inputs and outputs of nitrates is higher than the threshold value designated for establishing the vulnerable zones.

Table A.1.2. List of communes where the balance sheet of nitrates exceeds the threshold value for the designated vulnerable zones.

Affected zone Locality	County	NO3 (kg/ha/year) input/output	Land area Km²	Vulnerability category
Francesti	VL	740	30.15	B
Blejoi	PH	516	15.55	B
Frumuseni	CL	515	64.54	B
Lipanesti	PH	361	15.07	B
Baile Govora	VL	305	5.31	B
Bucov	PH	253	28.44	B
Chiscani	BR	247	53.56	B
Gugesti	VR	234	26.39	B
T. Vladimirescu	BR	184	87.72	B
Crevedia	DB	139	45.46	B
Vadeni	BR	121	119.04	B

Babeni	VL	117	24.78	B
Tg. Jiu	GJ	84	60.15	B
Cocorasti Misli	PH	82	11.14	B
Balan	HG	75	0.72	B
Seini	MM	71	39.65	AB
Balesti	GJ	67	56.62	B
Codlea	BV	51	52.25	B
Doicesti	DB	35	6.48	B
Bod	BV	31	29.02	B
Cleja	BC	26	26.09	B
Chiuza	BN	26	26.96	B
Tatarani	DB	15	21.64	B
Ticleni	GJ	13	24.52	B
Saulesti	GJ	12	23.37	B
Sohatu	CL	11	70.35	B
Campina	PH	10	5.67	AB
Bran	BV	6	36.45	ANB
Zimnicea	TR	6	126.15	B
Moieciu	BV	4	23.64	A
Mircesti	IS	4	26.66	B
Chitila	SAI	4	7.83	B
Jebel	TM	4	99.68	B
Periam	TM	1	90.5	B
Botosana	SV	-1	27.52	A
Maliuc	TL	-2	18.17	C
Cosesti	AG	-4	26.82	B
T. Vladimirescu	GL	-4	43.55	C

Tatarusi	IS	-6	32.2	AB
Baia	SV	-6	32.08	B
Gaesti	DB	-7	17.78	C
Bivolari	IS	-7	59.27	B
Danesti	GJ	-7	48.82	B
Solca	SV	-8	25.27	A
Ciurea	IS	-9	26.94	B
Udesti	SV	-10	52.55	AB
Sieut	BN	-10	47.39	B
Salva	BN	-10	30.07	B
Ivesti	GL	-11	64.64	B
Bosanci	SV	-11	45.18	AB
Tismana	GJ	-11	96.36	AB
Fieni	DB	-13	10.62	A
Ipotesti	SV	-13	17.26	A
Moreni	DB	-13	9.57	B
Urziceni	SM	-14	27.42	C
Glogova	GJ	-14	13.78	B
Malini	SV	-14	42.85	AB
Salacea	BH	-15	56	B
Capreni	GJ	-15	27.66	A
Tasnad	SM	-15	93.93	AB
Tamaseni	NT	-16	20.46	B
Turceni	GJ	-17	44.18	B
Macea	AR	-17	66.2	B
Costuleni	IS	-17	43.39	B
Paunesti	VR	-17	41.5	B

Prejmer	BV	-18	53.75	B
Gaiesti	GR	-18	23.45	C
Strehaia	MH	-18	41.63	B
Buhusi	BC	-18	24.81	B
Boldesti - Gradiste	PH	-18	32.45	B
Farcasele	OT	-18	28.69	B
Crucisor	SM	-19	16.5	A
Sintereag	BN	-19	45.27	B
Odobesti	DB	-19	28.57	C
Cracaoani	NT	-19	31.93	A
Cetateni	AG	-20	19.24	B
Caiuti	BC	-20	34.12	B
Pristol	MH	-20	32.69	B
Gheraesti	NT	-20	28.51	AB
Casin	BC	-20	24.82	B
Pucioasa	DB	-20	21.51	A
Aroneanu	IS	-20	29.76	B
Bustuchin	GJ	-20	36.1	A

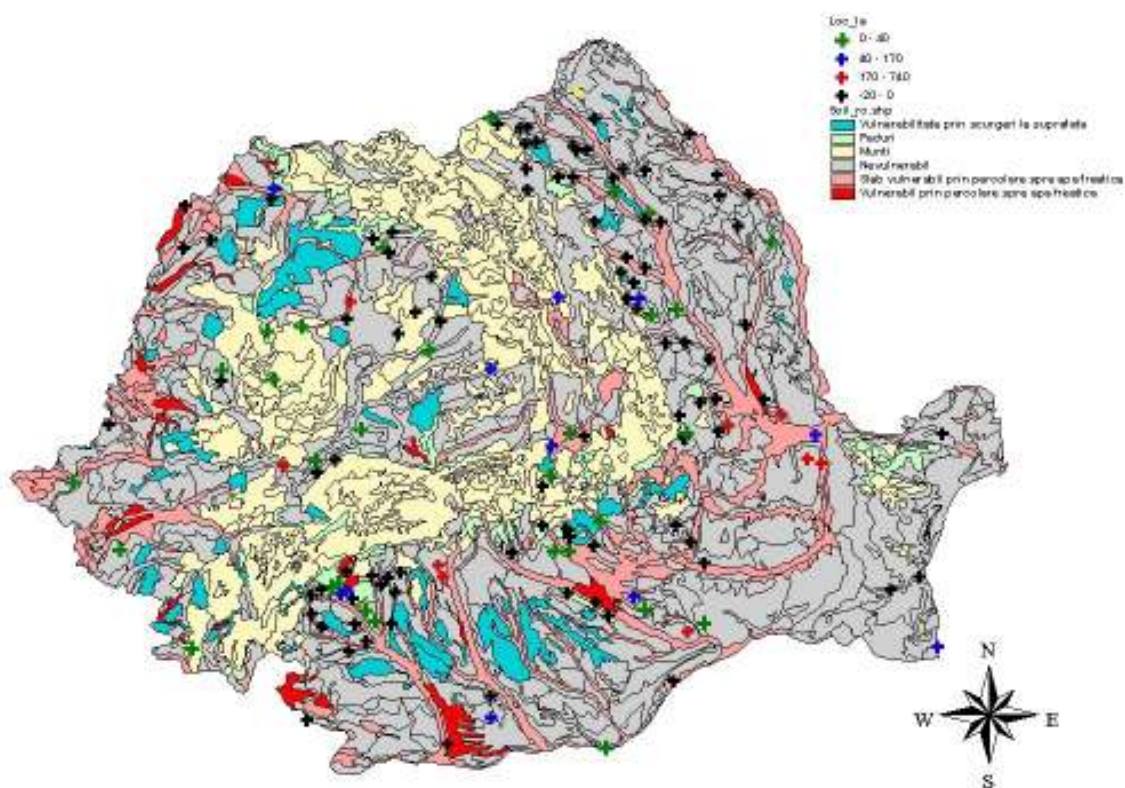


Figure 2. Location of communes where the balance sheet of nitrates exceeds the threshold value for designed vulnerable zones

Figure 1. Zones vulnerable to pollution caused by nitrates from agricultural sources (Legend: □ Zones potentially vulnerable to run-off; □ Forests; □ Mountains; □ Non-vulnerable; □ Zones potentially vulnerable for free aquifers; □ Zones vulnerable for free aquifers).

A1.1. Evaluation of present situation in households of population

At present, the manure administration system is managed together with the administration system of domestic garbage and rubbish which can be characterized as follows:

- the domestic wastes of households in rural zone include plastic, glass, metals, vegetal residues, etc. mixed with manure coming from the animals in households of owners;
- these wastes are accumulated in a deposit directly improvised on soil, inside the yard of each household, before their evacuation;
- urine and liquid part resulted from the decomposition of these wastes are free to infiltrate directly into soil;
- the diffusion phenomenon of these liquids in ground water is amplified in such larger zones by precipitation water;
- the manure manipulation at the level of each household frequently implies two operations, when, in fact, only one operation is possible;
- improvised deposits directly on the soil makes difficult the manipulation and loading of wastes in order to be evacuated;

The presence of maize stalks resulted from animal feeding or bedding makes almost impossible the utilization of fresh manure as fertilizer for agricultural soils, without their previous decay.

The evacuation is performed after the accumulation of a high quantity of such wastes by loading and transporting using a wagon or trailer to the so called communal storage platform, that is also a source of pollution with the following negative aspects concerning the environmental protection:

- non-point pollution with nitrates and other substances in domestic garbage and rubbish;

- administration of wastes accumulated on these platforms, mostly improvised, is at a minimal level, so that they are practically spread on large land areas in a very thin layer;

- irrational spreading of domestic wastes in this way, which can be also accompanied by their application to zones located near some water bodies or conveyance or drainage canals, increases the potential of polluting the ground and surface waters, phenomenon which is also amplified by the large land area collecting the precipitation water;

- mixing the manure with various wastes in household practically makes hardly possible the use of these wastes in agriculture;

- frequently, the unloading of wastes in these improvised platforms is undertaken more years, becoming by accumulation major sources of pollution with nitrates and other polluting agents which are very difficult to be avoided, recycled or stabilized.

A.1.2. Problems regarding the evacuation of solid and liquid wastes at the level of households of population

Urine and slurry resulted by decaying the excreta from cattle and horses in the households are usually collected in unlined ground pits allowing the leaching of nutrients to ground water, especially nitrates. In the case of pigs, this effluent infiltrates directly in soil with no possibility to be collected by any type of canal.

The householder is not able to evaluate the magnitude of slurry accumulation in pit due to the quasipermanent phenomenon of evaporation and infiltration in soil. The soil infiltration is amplified during the wet seasons due to the precipitation which also washes the garbage accumulated on soil and the areas where yard poultry are to freely circulate.

Besides the fact that the householder has not waterproof vessels to deposit the effluent from animals, he also has not the equipment to empty the vessels and apply the effluent to the land.

A.1.3. Evaluation of present situation in animal husbandry farms

Where these farms survived the disintegration of state and cooperative farms, the animals are reared under industrial confined conditions provided with shelters and central canal situated under the floor for collecting the slurry. The slurry is mechanically evacuated either to a place located behind the shelter or loaded directly in trailers by means of conveyors. Then the slurry is transported to the farm platform.

Straw bedding of animals, after use, are transported to the same manure platform. The precipitation water washes the excreta existing on the outside concrete parts, polluting the areas around the farm.

In the pig farms, the excreta collected in the canals provided below the shelter floor are transported by pumping in non-waterproof pits of large sizes, located outside the farm. Efforts to use the manure are made only exceptionally, where there is also a clearing of liquids resulted from the liquid-solid separation using adequate equipment.

In general, the platform in the dairy farm has a typical area (230 m x 30 m). The manure is stockpiled in heaps of 3 m high and left for maturation up to one year. Usually the manure thus composed is used as fertiliser.

A.1.4. Design and implementation of manure storage system at individual household level

The activity of manure management should include the following key elements:

1. Separation of inert and recyclable materials in manure by providing some adequate containers.
2. Building an adequate facility (platform) to allow the rational manure storage in household, on a concrete area, with sufficient capacity to accumulate the manure for a month.
3. Manure transport to the communal platform using the wagon by those having such transport means.
4. Paid manure collecting service for those lacking the adequate transport means.
5. In this way, there is one operation for manure loading from the deposit in household and an other unloading operation to communal platform, thus allowing also the aeration of manure mass.
6. The communal platform will be provided with special containers for the inert materials.
7. At the level of communal platform, the manure will be stockpiled in heaps 3 m high.
8. The manure containing vegetal residues will be stockpiled in heaps for composting.
9. The relatively great height of heaps is necessary to reduce the area that can collect the precipitation water.
10. The communal platform will have such a size to allow the manure deposition for minimum five months, so that the manure can be matured and used as fertilizer.

The system will have in view the following requirements:

- the concrete storage for manure will be near the animal stable, thus the double manure handling will be avoided;
- the storage will have a concrete floor provided with canals draining the effluent towards the waterproof collection basin that has the role to collect the urine, too;
- the manure will be accumulated in heaps;
- the precipitation water will be conveyed outside the storage zone;
- optionally, the facilities needed for composting the accumulated manure mass will be developed;
- the platform will be sufficiently large to ensure the manure accumulation for at least one year.

The size of such a platform will be directly proportional with the number of animals in household, and the height of heaps will be of 1.2 m.

A.1.5. Design and implementation of manure storage system at communal platform level

The communal platforms will fulfil the following conditions:

- the platform structure harmonized with the zone landscape, and provided with:
 - concrete floor;
 - waterproof effluent collecting canal and the collecting basin;
 - containers to store the inert residues of metal, glass and plastic;
- adequately fence enclosing the platform and storage basin
- facilities for the platform staff;
- wells for hydrological observation to monitor the ground water quality in zone.

The manure administration and storage period will be of minimum five months. The best is to empty the store late in the autumn.

A.1.6. Concept of manure storage within animal husbandry farms

For the farms with up to 30 cows and 200 pigs the problem can be addressed similarly with the case of peasant household, excepting the fact that the farmer will use the material resulted after manure storage as fertilizer for his own agricultural lands.

As concerns the farms exceeding the above mentioned figures, the problem can be addressed separately, having in view that the farmer should manage the manure on his own expenses. Anyhow, it is necessary to receive technical assistance regarding the organization of the optimum system of dejecta management.

A.1.7. Proposals of manure storage facilities at the level of individual household and estimation of costs

These estimations are based on the results presented in the “Report on design of system for manure management at communal level, prepared within the framework of the Project “Control of agricultural pollution”, funded by the World Bank in accordance with the Global Environmental Fund (GEF).

In order to calculate the platform capacity at the level of a household, the calculation had taken into account the mean manure volumes generated by such a household dealing with animal husbandry. In most cases, a simple structure, opened in the frontal part, provided with concrete floor and sufficiently high – 1.2 m is enough.

To collect the inert materials resulted at the household level, a small container with a capacity of about 90 dm³ should be separately provided.

The concrete floor, gently sloping through the frontal part, should be provided with a canal for draining the effluent. This canal is discharged into a covered basin, built in excavation with a capacity of 500 litres.

The typical dimensions of such a platform are:

- Volume – 5.4 m³
- Height – 1.2 m
- Area – 4.5 m²
- Length – 2.2 m

This typo-dimension is recommended for all the households dealing with animal husbandry. The householders having more animals will empty the platform more frequently.

The costs were estimated having in view a general sketch of a type platform and they amount to 325 €.

A.1.8. Proposals of manure storage facilities at the level of communal platform and estimation of costs

The platform will be rectangular, provided with walls on the three of the four sides. The frontal part is provided with a threshold to manipulate the equipment. Along the frontal side, a canal with a grill is provided to collect the effluent and which gets also the precipitation water and conveys them in a storage basin. Close to the platform there are three bunkers for collecting the inert materials of metal, glass and plastic.

For a typical rural locality, a capacity of 3,200 or 4,800 t of manure depending on the locality size is recommended. The storage basin for the slurry will have a volume of minimum 76 m³.

The estimated costs are:

- 159,232 € for a platform of 4,800 t;
- 109,200 € for a platform of 3,200 t.

A1.9. Proposals of facilities for the system of manure manipulation and application to land and estimation of costs

In order to manipulate and spread the manure and the resulted liquids on the land, each communal platform needs the following equipment, the acquisition costs being also indicated:

- 1 loading equipment (JBC/WOLA) – 18,819 € ; total 18,819 €;
- 10 loading equipments – 7,425 € ; total 74,250 € ;
- 1 cisterna provided with emptying equipment – 5,566 € ; total 5,566 € ;
- 1 trailler – 3,975 € ; total 3,975 €;
- 2 tractors – 9,275 € ; total 18,550 € ;
- 1 equipment to break up and chop – 3,300 €; total 3,300 €.

In conclusion, the total cost of the equipment for a commune amounts to 124,461 €.

A.1.10. Estimation of costs all over the country corresponding to vulnerable zones

Estimation of costs all over the country was carried out having in view the two ways to establish the considered vulnerable zones (a – all the country, b – only some zones according to the methodology presented in A1.1.)

In the case of “a” variant, the following data are considered:

- number of communes needing platforms: 1,965 of which 1,179 require platforms of 4,800 t;
- number of individual households needing platforms: 1,840,000.

Total costs estimated all over the country, in the case of peasant householding, is $1,840,000 \times 325 = 598,000,000$ €.

Total costs, in the case of one communal platform, are:

- for a platform of 4,800 t:
 $159,232 + 124,461 = 283,692$ €
- for a platform of 3,200 t:
 $109,200 + 124,461 = 233,661$ €

Total costs all over the country, in the case of communal platforms, are:

$$1,179 \times 283,692 + 786 \times 233,661 = 334,473,110 + 183,657,460 = 518,130,570 \text{ €}.$$

Total costs all over country totalizing the cases of platforms in the households of population and communal ones are:

$$598,000,000 \text{ €} + 518,130,570 \text{ €} = 1,482,290,570 \text{ €}.$$

In the case of “b” variant, the following data are considered:

- number of communes needing platforms:
 - 150 requiring platforms of 4,800 t and
 - 100 requiring platforms of 3,200 t.

These data are obtained by the evaluation of animal number corresponding to the standards established by the Code of good agricultural practices for the respective communes:

- number of individual households needing platforms: 230,000

Total costs estimated for the whole country, in the case of peasant households, are:

- for a platform of 4,800 t:

$$150,232 + 124,461 = 283,692 \text{ €};$$

- for a platform of 3,200 t:

$$109,200 + 124,461 = 233,661 \text{ €};$$

Total costs all over the country, in the case of communal platforms, are:

$$150 \times 283,692 + 100 \times 233,661 = 65,919,900 \text{ €} .$$

Total costs all over the country referring to the cases of platforms in the households of population and of communal platforms are:

$$74,750,000 \text{ €} + 65,919,900 \text{ €} = 140,669,900 \text{ €} .$$

Implementation of Nitrates Directive in urban agricultural zones

A2.1. Relevance of urban agriculture activities

Agriculture in intra-, sub- and periurban zone is intimately connected with the ecological, social and economic local and municipal systems, supplying particular benefits to individual farmers and their communities. If it is adequately practised, it has an important contribution both to maintain public health and to reduce some social and environmental factors of risk. Thus, the urban agriculture, besides the fact that it represents a local source of food products, determines also the fertility increase of some marginal soils, “greening” the environment and absorbing a part of wastes that are used as compost and fertilizers. Besides the improved food diet, those involved in urban agriculture enjoy frequently a supplementary income.

Urban agriculture implies a technological and managerial precision higher than that of agriculture practised in rural environment, because it needs in most cases multiple precautions concerning the public health and permanent monitoring of its effects on environment. This type of practices constitute a recent phenomenon only in very few cities. All over the world, there is an old tradition of agricultural practices inside and outside the urban zones. The present systems of urban agriculture were modelled by four major “forces”:

- continuity of traditional practices;
- revolution of industrial type agriculture;
- rapid post-war urbanization;
- expansion of population segment with low incomes.

The first two constitute also the roots of urban agriculture, explaining both the continuity and transformations of agricultural practices. The other two surprise the recent developments: rapid urbanization forced an increased number of residents especially poor people in extending the agricultural activities.

A2.2. Situation of urban agriculture in Central-East Europe

In the most countries of Central-East Europe, the urban agriculture represents a social system of survival integrated into the transition between the main successive economic stages characteristic for the last century: industrialization, socialism and restoration of free market economy. The local food production, frequently operated by food less favored social categories, proved a measure of autonomy and protection facing the productivity and distribution problems specific to the socialist centralism as well the inaccessible prices of some food products and the high unemployment rate characteristic to the assimilation of some marks of market economy.

While the agricultural activities in the intraurban zones or near the big cities are operated by relatively strong commercial companies and units, which constitute the major objectives statistically analyzed by special agricultural departments, the small individual farmers are frequently ignored, helpless and sometimes even threatened.

In some urban zones of the European Central-East countries, severely affected by the phenomenon of environmental pollution, the locally produced food is exposed to toxic contaminations

affecting the health of consumers. The sustainability of the urban food production does not constitute only a local technological problem. The problems are complicated by the negative effects that can affect the environment, public health and food security.

A2.3. Situation of urban agriculture in Romania

The activities included in the sphere of urban agriculture are extremely diversified in Romania. Some of them are largely recognized such as the commercial units in the proximity of cities (especially glasshouses and solaria), units of vegetable research and production, dendrology, fruit-growing and others, operated under the quasianonymy such as gardening on public land between the buildings. Some types of activities are repudiated and forbidden such as the gardening on roofs or pig and poultry raising in urban centers. At the same time, some activities have been only recently initiated having a real development potential such as the biological microfarms.

Agriculture goes on taking upon itself the role of buffer against the unemployment rate increase, and the sub- and periurban zones are the most desired places by the recent urban unemployed workers looking for a survival solution.

The most common form of urban agriculture is the gardening practised in the household yard combined with raising 1-2 pigs and 10-20 poultry. Many of the old suburban outskirts remained unaffected by the land use planning operated in the 80' and have continued the agricultural practices initiated even since the building of houses in the respective households.

A 2.4 Situation of urban agriculture in Bucharest (Bucharest municipality) and Ilfov Agricultural County

The huge market represented by the Bucharest municipality constitutes a determinant factor for the agricultural practice both in the immediate proximity of the city and inside the administrative limits on various areas both as size and ownership type. It is obvious that vegetables, seed peas and potatoes are cultivated especially in the private sector, that may be explained by both the producer's need to ensure his own consumption and his capacity to sell more efficient by the production directly to the free market. This activity as well as the fact that producers can also use their own sources of irrigation explains the increase of area cultivated with vegetables in the last years, as it results from the statistics of the General Direction for Agriculture and Food, Bucharest.

In the Bucharest municipality there are 5,449 ha agricultural land, and in the Ilfov county 113,056 ha (total –118,505 ha agricultural land of which 111,459 ha arable land). The animal loading per hectare is relatively moderate with 20.6 cattle, 127.0 pigs and 1.654 poultry per 100 hectares of agricultural land. Otherwise, while the level of inputs is very low as compared to the national level, it is evidently higher in the sub- and periurban zones of the Bucharest municipality, due to the presence of some intensive commercial units and small producers specialized in producing perishable products, oriented towards the municipal

market. At the level of small producers, there are a series of characterization data (exploratory study on a sample of farmers).

A 2.5. Intraurban zones

The size of parcels used for agriculture frequently ranges between 100 and 400 m², on an average –275 m². The general source of irrigation water is the tap water. The most important crops are tomatoes (87% of the interviewed farmers cultivated this crop), onion (60%), grape vine (60%), garlic (46.7%), fruit trees (40%), flowers (36.7%), strawberries (20%) and root vegetables (16.7%).

About 63 per cent of the lands cultivated by the members of the interviewed households are located in the yards of the households, 20 per cent on public lands, and 17 per cent are in the rural zone. About 71 per cent of the cultivated lands are owned by the users, and 20 per cent have a quasilegal statute.

Only 20 per cent of interviewed persons use (reduced quantities) chemical fertilizers as ammonium nitrate (about 40kg/ha active ingredient – a.i.) or NPK (about 100kg/ha a.i.). About 25 per cent of interviewed persons use reduced amounts of organic fertilizers (usually between 5 and 10 t compost/ha). The crops of grape vine, fruit trees and flowers are not fertilized with chemical or organic fertilizers. The crop rotation is applied by 50 per cent of the interviewed persons.

In general, measures to reduce the negative impact of agricultural activities on neighbours (unpleasant odour, control of rodents, etc.) are not applied.

Only a small segment of interviewed persons rear livestock. About 10 per cent rear poultry, and 6.7 per cent pigs. Those implicated in rearing pigs have 2 or 3-5 pigs, and those implicated in rearing poultry have, on an average, 6-10 hens.

A 2.6. Suburban zones

The mean size of parcels in the household yard, where agriculture is practised, is of 535 m², and the mean size of areas located in opened field is of 12,160 m². The major source of irrigation water for the parcels in the yard of households is the ground water (80% of investigated households). In the field, the crops are irrigated very rarely.

The most important crops are tomatoes (70% of interviewed persons cultivated this species), onion (50%), grape vine (52.2%), pepper (42.5%), maize (32.5%) and garlic (30%).

Only 15 per cent of interviewed persons use chemical fertilizers (especially ammonium nitrate at a rate of 50-200 kg/ha), 70 per cent of those interviewed use reduced quantities of organic fertilizers (usually 5-10 t/ha manure or 1-2 t/ha compost). Fertilizers are used predominantly for vegetables and tomatoes. Grape vine and fruit trees are only sporadically fertilized with organic or chemical fertilizers. About 85 per cent of those interviewed practise the rotation of crops.

Almost two thirds of those interviewed are dealing with animal husbandry. About 64.3 per cent of them rear poultry, 50 per cent - pigs, 11.9 per cent – sheep, and 7.1 per cent – bee keeping. Those keeping swines have 2 (38.1%) or 3-5 pigs (42.9%). Those

implicated in raising poultry have 6-10 hens (44.4%), 11-25 (18.5%) or 3-5 hens (14.8%) and a similar number of chickens with each category. Those implicated in sheep rearing have 2 sheep (40%), 1, 3-5 or 11-25 sheep (20% for each category).

To reduce the negative impact of agricultural activities on the neighbours, 25 per cent of those interviewed do not burn the vegetal residues in their yard, 25 per cent do not chaotically disperse their domestic residues resulted from the consumption of products, 5 per cent shelter the manure or compost, 10 per cent pay attention to the location of shelters for animals and manure platform, 25 per cent periodically clean the animal shelters, 13 per cent apply measures to combat the rodents.

The most important sources of agricultural information for vegetal production (as a first mention) are relatives (42.5%), neighbours/friends (20%) and newspapers (20%). A second mention refers to neighbours/friends (37.5%) and radio-TV programs (17.5%). The most important sources of agricultural information for animal husbandry (as a first mention) are newspapers (22.5%) and relatives (17.5%). The second mention refers to neighbours/friends (22.5%).

Two thirds of interviewed farmers would like to keep their agricultural activities at the present level, 22.5% - to diminish them, 10% - to increase them by agricultural land acquisition. A part of those implicated in animal rearing (27.5%) wish to increase the number of animals, but most of them (60%) did not make a clear decision. About 20 per cent would integrate new activities, but 80 per cent have not decided yet. The main species considered to

increase the effective are the laying hens (54.5% of those who wish to increase the number) and pigs (36.5%). About 25 per cent would like to increase the quantities of chemical fertilizers used at present.

A 2 . 7 . P e r i u r b a n z o n e s (m a x i m u m 2 5 k m f a r f r o m m u n i c i p a l b o r d e r)

The average size of parcels in the household yard, where agriculture is practised, is of 2,213m³, and the average size of parcels in the field is of 18,095m². The main source of irrigation water (100% of interviewed households) for the household parcels is the ground water. In open field, the crops are rarely irrigated.

The most important crops are tomatoes (80,5 % of interviewed people cultivated this species), maize (75.6%) winter wheat (53.7%), grape vine (48.8%), onion (41.5%), pepper (41.5%), flowers (41.1%), cabbage (31.7%) and root vegetables (29%).

About 65 per cent of those interviewed use chemical fertilizers (especially ammonium nitrate at a rate of 100-200kg/ha). About 65 per cent of those interviewed use relatively low quantities of organic fertilizers (usually, 10-20 t/ha manure or about 10 t/ha compost). Fertilizers are predominantly applied to vegetables (chemical and organic fertilizers), but also to small grains (chemical fertilizers). The grape vine is only sporadically fertilized with chemical fertilizers.

About 90% of those interviewed practise the crop rotation and only 14.6 per cent of them incorporate the vegetal residues in soil instead of burning them.

A percentage of 90.2 farmers implicated in animal rearing have poultry, 87.8 per cent – pigs, 19.5 per cent – cattle, 12.2 per cent – rabbits and 9.8 - horses. Those implicated in raising pigs have 2 (47.2%), 1 (25%), 3-5 (19.4%) or even 11-25 pigs (5.6%). Those involved in poultry have 26-50 (35.1%), 11-25 (21.6%), 6-10 (16.2%), over 51 hens (16.2%) and a similar number of chickens of each category. Those implicated in raising cattle have 1 (75%) or 2 (25%) cows.

To reduce the negative impact of agricultural activities on the neighbours, 51 per cent of those interviewed do not burn the vegetal residues in their yard, 41 per cent do not chaotically disperse their domestic residues resulted from the consumption of products, 18 per cent shelter the manure or compost heaps, 38 per cent pay attention to the location of shelters for animals and manure platform, 46 per cent periodically clean the animal shelters, 13 per cent apply measures to combat the rodents.

The most important sources of agricultural information for vegetal production (as a first mention) are radio-TV programs (26.8%), neighbours/friends (24.4%). The second mention refers to neighbours/friends (22%) and relatives (14.6%), and the third mention refers to radio-TV programs (24.4%). The most important sources of agricultural information for animal husbandry (as a first mention) are neighbours/friends (34.1%), radio-TV programs (17.1%) and relatives (14.6%). The second mention refers to relatives (14.6%) and the third- radio-TV programs (19.5%).

A percentage of 51.2 interviewed farmers would like to maintain their agricultural activities at the present level, 7.3 per

cent – to eliminate them, 39.5 per cent to increase them by agricultural land acquisition. A part of those implicated in animal rearing (43.9%) wish to increase the number of animals, but most of them (51.2%) did not make a clear decision in this view, 26.8 per cent would integrate new activities, while others (12.2%) would like to start even activities of product processing. The main species considered for increasing the animal number are pigs (77.8% of those wishing to increase the effective) and laying hens (27.8%). As concerns the future activities regarding fertilization and disease and pest control, most of the interviewed farmers (63.4%) would like to increase the amount of chemical fertilizers used at present.

A2.8 Nitrate content in soil and water within the urban agriculture

In the last years, a series of case studies were carried out in the vegetable periurban zones to determine the nitrate loading in soil, vegetables (edible parts) and ground water.

Statistical parameters of nitrate contents in topsoils, investigated in some communal territories traditionally used for the commercial production of vegetables, reveal a large dispersation of analytical data due to the application of chemical fertilizers at various rates without respecting certain technologies recommended by experts.

Uncontrolled application of chemical nitrogen, phosphorus and potassium fertilizers causes an excess of nitrates that, due to their high solubility, are leached in soil profile down to the ground water table. Loading of ground water with nitrates increases the risk of

pollution caused by nitrates because, in the studied cases, the ground water is used for both the domestic consumption and the irrigation of plants already contaminated by excessive fertilization, determining a permanent flow of nitric nitrogen at toxic levels.

In the aquifers intercepted by wells in the studied zones nitric nitrogen contents were found that in all the cases exceed the maximum allowable limit accepted by the World Health Organization (10mg/l N –NO₃, 45mg/l nitrates, respectively) of 2 up to 11.5 times higher. The statistical parameters of nitric nitrogen contents in the ground water within the territory of studied communes reveal the same ununiformity, an image of a chaotic use of mineral nitrogen fertilizers, as in the case of soil.

As it was expected, the excessive quantities of nitric nitrogen determined in soil and ground water were found also in collected plant samples (vegetables - edible part) with values exceeding the maximum allowable limit with 5-105 per cent in almost all the cases.

Even if the respective studies have a punctual character and refer to the zones intensively used for vegetables (“hot spots”), the recent investigations carried out in the intra-, sub- and periurban agricultural zones, selected according to a relatively uniform spatial distribution, revealed the existence of some nitrogen contents – significant in soil and excessive in the ground waters. In the case of water sample, 80 per cent of the analyzed samples collected from wells exceed sometimes the maximum loading limit up to 3-5 times higher.

However, it is less probable that these high nitrate contents measured in water are exclusively due to the agricultural practices. It should be also considered the inputs from the sewerage system in Bucharest (intraurban zones) and inadequate location and seepage of sanitary infrastructure (mostly improper in the suburban and periurban zones – without sewerage system). Systematic studies regarding the proportional contribution of each factor, determining the high level of nitrates in ground water in the respective zones, were not carried out.

Analytical determinations of nitrate concentration in deep aquifers are not available. The nitrate concentrations in these deep aquifers are not probably higher than the maximum allowable limit.

A2.9 Conclusions on urban agriculture

The urban agriculture is a common phenomenon inside and near the municipal borders. Chemical and organic fertilization of agricultural crops in the intraurban zones is applied at a low level and it is assigned to vegetable crops. The traditional application of some technological components of organic agriculture looks like being a common phenomenon, especially in suburban sites. In the periurban zones, sites of intensive agriculture were identified provided with a high level of inputs, commercially oriented through the municipal selling markets. The tendency of these farmers is to go on increasing the level of fertilization and chemical plant protection.

The loading of animals on the agricultural land is relatively moderate, but it is observed a low perception of urban farmers

regarding the environmental problems. For instance, the regarding of the wastes in the household is at a low level.

The main sources of information on agricultural problems are based on relatives, neighbours and friends, and less on newspapers and radio-TV programs. Extension services have recorded an insignificant impact so far.

In the ground waters intercepted by wells, nitric nitrogen contents were constantly determined exceeding the maximum allowable limit sometimes at dramatic levels. However, it is little probable that these high nitrate contents in water are exclusively due to the agricultural practices.

A2.10 Evaluation of costs for designing the Bucharest region (Bucharest municipality, Ilfov County) as a zone vulnerable to pollution caused by nitrates – Case study

A2.10.1. Characteristics

Total land area: 182,115 ha, of which:

- total agricultural area: 118,505 ha, of which:
- total arable area: 111,459 ha.

Climate: temperate - continental (mean annual temperature is 11⁰C, with a mean annual amplitude of 25.2⁰C, mean annual precipitation 589 mm)

Soil: Reddish Brown soils, Argilluvial soils, Cambic Chernozems on loesslike deposits (medium texture).

Relief: relative plane, slopes at transition between terraces and flood plains of the Colentina, Dimbovita, Ciorogarla, Arges and Pasarea rivers.

Depth of ground water table: large variation between 0-3 m near the flood plain of rivers and 10-20 cm on terraces (maximum, significant, respectively, risk of contamination and pollution caused by nitrates).

Structure of localities: 1 municipality (capital of Romania), 2 cities, 17 communes, 102 villages.

Population: 2,462,300.

A2. 10.2. Problem of pollution caused by nitrates from agricultural activities with agricultural activities according to provisions of Nitrates Directive

While the consumption of fertilizers and pesticides has a relatively low level, the proximity of a municipal market generated opportunities to organize some agricultural sites intensively specialized in perishable products that require excessive agricultural inputs (commercial units and small specialized producers).

A precise inventory of these "hot spots" does not exist and it is less probable that these farmers will easily give up a present profitable management that has an old tradition and whose propagation was fully by the agricultural research institutes in this region sustained between 79' and 80'.

An instrument able to mitigate the excessive use of chemical fertilizers could be that provided in the 2.3. agro-environmental

measure of SAPARD that stipulates financial calculations on the basis of income losses.

As concerns the loading of animals per hectare, the situation is rather similar, in a smaller proportion, with the situation of households or commercial units having a significant number of animals (especially pigs and poultry) relatively isolated in the territory. The limitation of animal density is questionable. Compulsory rules can be stipulated in order to limit the losses of nitrates from manure and forage silo due to leakage by collecting the slurry into adequate containers corresponding to the number of animals and to eliminate the leaching into the ground water.

Most of the urban agricultural households face the shortage of capital and inputs, but also an inadequate management of wastes (both domestic wastes and those coming from the vegetal residues, manure and sanitary facilities). The contribution of the latter to the high level of nitrate content in the ground water should be estimated by special investigations, and the procedure to collect the water sample in the territory should be systematized. Both in the suburban and periurban zones, it is observed the existence of some heaps of domestic wastes at the peripheral areas of residential zones, including non-selected wastes under different stages of decay.

Likewise, the small producers face an acute shortage of contact with the professional information sources, public and administration institutions and do not have a managerial record of their activities in the household. The ground water sources contaminated with nitrates in sub- and periurban zones are

constantly used for drinking, hygiene and irrigation. There are no use restrictions for the two latter situations.

In the usual structure of crops, the vegetable growing activities (both for the household consumption and marketing) cannot be the object of some changes regarding the farm plan, crop rotation or a conversion to other crops, excepting the regime of inputs and the limitation of organic fertilization period (interdiction of organic fertilization in late autumn - winter period, on snow, when the nitrate washing is particularly high). Organic fertilization of vegetables during summer cannot be required due to the risk of contamination of products with pathogens, even if, under the temperate - continental, climatic conditions, the leaching of nitrates in soil profile is low, and, on the contrary, there is an ascendent flow in dry periods.

The field crops can constitute the object of improving the balance sheet between the row crops and small grain crops (especially winter cereals). The crop rotation plans should include vegetables in a limited proportion, the nitrate leaching rates for these crops being high. The organic fertilization can be restricted immediately after harvesting the winter crops (on stubble). The slope lands can be cultivated with gramineous crops. The interdiction of fertilization on the slope lands is a questionable option (on slope lands through) the river valleys there are Erodisol, generally poorly supplied with nutrients). Anyhow, the problem of slope lands has not a significant importance in the considered zone.

In this area, the grape vine, particularly exposed on nitrate washing, is fertilized only slightly and sporadically. It should be forbidden the abandonment of agricultural land without a reasonable motivation; the nitrate washing reaches significant rates on noncultivated lands.

Chemical and organic fertilizations should be made according to a plan including environmentally optimum application rates, application period and correct distribution on land, and the inputs of fertilizers should be recorded in the farm book. Chemical fertilization options with products based on nitrogen with low release of active ingredient in soil solution can be included.

A2.10.3. Objectives and priorities to Implement Nitrates Directive

It is less necessary (having in view the present data) that the action program may provide a decrease of present animal density and even a consistent reduction of chemical and organic fertilizer application level on farmers. The action program should be directed towards the local management measures, compulsory in "hot spots" and voluntary in the rest of the territory, based on prophylactic measures. To develop an action program, the following specific objectives are identified, the priorities being established according to a logic scheme of implementation:

Objective 1: Collecting the needed information in the territory

- Study of soil and water resources in the implementation zone.

It is necessary to have a soil survey (accompanied by a hydrologic study) at a 1:25,000 scale to identify and evaluate the edaphic and hydrologic resources. The study will be carried out by updating existent data and completing the "white spots" (suburban sites).

- Identification and location of "hot spots" of pollution caused by nitrates from agricultural activities.

According to the present data recorded by the General Departments of Agriculture and Offices of Agricultural Consultation, and to the field examinations, the respective points and areas (farm with large number of animals, commercial intensive agricultural units, sites of individual farms or commercially associated units) will be mapped to realize a spatial image on the problem and to organize and implement the monitoring network.

Objective 2: Establishment of network for monitoring and controlling the water quality in the implementation zone

- Organization of network for monitoring the water quality

Since Bucharest Municipality is located in the middle of the implementation zone, the network cannot have a regular configuration. It is suggested to select, from the existent wells used for water supply (or, eventually, irrigation) in the Ilfov county, 6 sectorial points for monitoring inside the municipal boundaries and maximum 2 point on cardinal coordinates (a total of maximum 8). The network for monitoring the quality of surface waters is doubled by a parallel network for monitoring the water quality in the deep aquifers, on long term, by installing a piezometric line with 4 sampling points on the cardinal NW-SE axis of the territory (general movement direction of rivers crossing the territory). Fixed

points for sampling surface waters will be established according to the fulfilled hydrologic inventory.

- Collecting water samples and analyzing the nitrate content of water

In the first year (at most the second after the notification of Nitrates Directive), the surface water samples are collected every month, ground water samples - every three months, and deep aquifers - every two years. The monitoring program is repeated after 4 years, excepting the zones where the nitrate concentration determined in the first year was constantly stable below 25 mg.l, and later contamination risks did not occur according to Art. 6.1.6. in Nitrates Directive.

Objective 3 Elimination of points of pollution caused by nitrates in "hot points".

- Elimination of points of pollution caused by nitrates in animal husbandry farms.

The actions have in view the units with high and moderate number of animals (over 300 UV, between 100 and 300 UV). According to Art 5.4 and Annex III in Nitrates Directives , the actions include the establishment of facilities to store, handle and apply the manure (specifying the necessities regarding the application areas).The funding of actions for environmental protection will be preceded by an economic analysis on the profitability of units by implementing the expected environmental measures.

- Elimination of points of pollution caused by nitrates in sites of intensive agriculture.

Another important component of the actions has in view the sites of intensive agriculture commercially oriented towards the municipal market, subject to a special plan of agro-environmental conversion, on the basis of elaborating some economic scenarios of conversion, a study regarding the opportunities of municipal ecological market and a Financial Support Plan (similar to the component 3.3 in the SAPARD Program) for conversion of these farms.

This type of actions may be included in the objective referring to special programs.

Objective 4: Elaboration of management measures at the level of individual micro-farms.

- Establishing the fertilization plans

A recommended organically/chemically alternative plan is elaborated for the main crops in the implementation zone, differentiated according to the microzones (taking into account the soil and relief conditions), according to the provisions in the Code of Good Practices, the estimation of nitrogen necessity for crops, the establishment of a viable crop rotation system and the provision of the quantitative and seasonal limitations regarding the fertilization application, according to Annex III in the Nitrates Directive.

Objective 5: Training

- Training of personnel involved in monitoring water quality.

The training of units involved in monitoring water quality and measurement of nitrates has in view the observance of provisions of

Directive 75/440/EEC (monitoring of surface waters), Directive 80/778/EEC (monitoring of ground waters), Commission Directive 77/535/EEC completed with Directive 89/519/EEC (determination of components with nitrogen in fertilizers), Council Directive 77/795/EEC completed by Decision 86/574/EEC (common procedure of information exchange on surface water quality).

- Training of farmers

The training actions have in view to cover both the necessities to increase the education level of individual small farmers and their degree of contact with the administrative and public authorities, and the largest part of measures to prevent the contamination caused by nitrates in agriculture. The trainings should be focused on measures stipulated in the Code of Good Practices without including some important investments at the farm level, and the administration of trainings can be structured on the line of selecting the local leaders of farmers – creation of dissemination nucleus – farmer to farmer propagation.

Objective 6. Special collateral programs

- Identification and management of waste heaps

The actions have in view to identify and eliminate the heaps of non-selected wastes located near the agricultural and residential (suburban) sites. Some of the respective waste heaps can be used in agriculture after a detailed study on composition and their recycling feasibility. The actions should be correlated with development of some programs to minimize the environmental impact of waste heaps.

Also, the implementation of Nitrates Directive should be coordinated with the implementation of Council Directive on Urban Waste Water Treatment no. 91/271/EEC, improved by Commission Directive no. 98/15/EC and Council Directive on the Landfill of Waste no.99/31/EC. The effects of reduction of pollution caused by nitrates from agriculture are perceptible only after the elimination of pollution sources in urban agglomerations.

Achievement plan and estimated budget to apply Nitrates Directive in Bucharest urban region

[illegible]