# COSTS AND REGULATIONS IN THE PIG PRODUCTION

***R. Pérez***
*Economics Research Institute, Universidad Nacional Autónoma de México (UNAM), Torre 2 de Humanidades 1er piso, Ciudad Universitaria, Coyoacán 04510, México D.F.*
*espejo@servidor.unam.mx*

## ABSTRACT

Environmental policy in Mexico aims at stopping the environment deterioration and to promote sustainable development. An implicit objective is to internalize the environmental cost of productive activities and services through the regulatory approach or "command and control" approach expressed in the elaboration of standards. The goal of the study is to estimate the environmental cost in the pig production, represented by the standard on wastewaters to national waters (NOM-001 SEMARNAT 1996[1]), through the investment in treatment systems and/or the payment of rights when the standard is not achieved. The study was carried on in La Piedad, Mexico, one of the most important pig zones in Mexico and one of the most polluted basins of the country. Standard NOM 001 has maximum permissible limits for 20 parameters and it's based on a cost benefit study in order to demonstrate that the standard is economically viable with a secondary treatment. Big farmers invested in treatment systems an average of 7.7 USD per Animal Production Unit (APU=100 Kg. live weight); medium farmers 8.6 USD and small ones, about 10.6. All farms in the survey surpass one or more parameters of the standard; pig production requires tertiary treatments to achieve the standard. So, the standard is more expensive for this activity than for others.
***Keywords:*** *Environmental standards-pig production-costs.*

## INTRODUCTION

The 2000 OECD Report on the impact of trade liberalization on the environment (OECD, 2000a) and the Report on the production and trade effects of agri-environment measures (OECD, 2000b), conclude that "more research should be done in order to asses the impact of trade liberalization on issues like concentration of livestock herd that have been identified as potential environmental problem hot-spots" (OECD, 2000b). The pig sector was chosen as initial study for this aim (OECD, 2003). In this study, Mexico was considered among the countries where the risk of contamination by nitrogen from pig wastes is low at the national scale, but as high as the countries with the higher risk, at the regional level. Within the OECD countries, measures specifically addressed to pig production are scarce and proceeds from local or regional initiatives and in some cases, from international environmental agreements. In Mexico, agriculture is not environmentally regulated; however, activities which generate pointed discharges as pig farms, should comply with a generic regulation (Standard-001) which establishes the Maximum Permissible Limits (MPL) of pollutants in wastewaters (WW) discharged to national waters. It was published in January 1997 and is the instrument used in this paper to estimate the internalization of the environmental cost of pig farms. Standard 001 regulates five receptor bodies (rivers, natural and artificial dams, coastal waters, natural watersheds and land), the subsequent use of water (irrigation, urban consumption and conservation of aquatic life); it establishes MPL for 20 pollutants, it is gradual and it is based on a cost benefit study to demonstrate its economic viability.

[1] *Standard-001*

## METHODOLOGY

The internalization of the environmental cost was considered as the Standard-001 costs that could be estimated: 1) As investment in a treatment system that allows discharging an effluent that complies with regulations standards; 2) As investment and right payment when the treatment system does not meet the standard and, 3) Only as a right payment when there is no treatment system. Information was obtained form a survey in 33 farms and from the results of the analysis of WW. The questionnaire was oriented to know the features of the treatment systems, the investment represented in those systems and the operation costs involved. Twelve of the 20 pollutants regulated by the Standard-001 were analyzed: hydrogen potential, temperature, grease and oils, total suspended solids, biochemical oxygen demand, total nitrogen, total phosphorus, arsenic, cupper, lead, zinc and fecal coliformes. A multiple regression model and a logistic model were tested to determine associations between the amount of the investment as a dependent variable and the size of the farm, it's modality, the receptor body and the number of unitary operations of the treatment system.

## RESULTS AND DISCUSSION

At present, 67% of the farms investigated are full-cycle, that is farrow to finish, 15% are fattening and 18% are multi-site farms. The trend towards the concentration of production is well established with 2 commercial farms having 25% of the 241 thousand pigs of the survey. There are still many small farms operating in the traditional way. Genetics, feeding systems and waste management practiced in La Piedad are practically the same as in other parts of the country but the most outstanding feature is the great heterogeneity among them: 1) The number of pigs per farm ranges from 300 to 23,000. 2) The amount of discharged wastewater ranges from 4.5 cubic meters per day ($m^3$/day) to 230 $m^3$/day per farm. 3) It is estimated that the investment made in lagoons for the treatment of the wastewater ranges from USD $0.06 to $7 per pig. 4) The total farm value was estimated between $38 thousand and $5.5 million. 5) Land area ranges from less than half hectare to over 130 hectares. 6) The earliest farm was built in 1950; the latest in 1994. 7) There are farms that employ workers and profession stall but the majority are run by the owners with no outside help. 8) The extraction rates range from 10 porkers marketed per sow per year (M/S*y) to 22 porkers (M/S*y).

**Standard costs**

**a) Investment in treatment systems**

The estimate of the total investment included the value of pits, lagoons, fences around the lagoons, digesters, decanting tanks, pumps, separators and other equipment. Table 1 shows the total amount of investment in treatment systems, the average amount and the average amount per animal production unit per farm size. In small farms the investment in treatment systems in relative terms such as per APU is 38% higher than in the big ones; in medium farms it is 26% higher. In terms of the number of units in a treatment plant, all the big farms had three or more treatment units: an intake shaft, a mechanical separator of solids and one or more facultative lagoons. In contrast, 11% of small farms did not have any treatment; 66% had only one unit, mostly a simple sedimentation lagoon. Half of the medium farms had two treatment units: a solids separator and a lagoon. In big farms, waste treatment as a proportion of the total investment in the farm ranged between 1.5 and 2.3%, in medium farms between 0.8 and 9.1% and in the small ones between 0.1 and 11.8%. The average investment in treatment systems represents only 2.1% of the total investment.

***Table 1.*** *Investment on treatment systems (total, average and investment per APU).*

| FARM SIZE | TITS (USD) | AVERAGE TITS (USD) | TITS/APU (USD/APU) | % |
|---|---|---|---|---|
| Big | 194,789 | 97,395 | 8.2 | 100.0 |
| Medium | 258,747 | 28750 | 9.1 | 111.7 |
| Small | 173,465 | 10,842 | 11.3 | 123.6 |
| Total | 627002 | 23,222 | 9.3 | |

*TITS: Total investment on treatment systems; APU: Animal Production Unit (100 kg live weight)*
*Source: survey*

**b) Investment and right payment**

Since WW discharges from pig farms require a tertiary treatment to comply with the regulations and the treatment systems are occasionally not well designed, all the farms -except those with "zero" discharge (only three in the survey met this criterion)- exceeded the standard's MPL and, as a result, they have to pay a right. The amount of the right and the procedures to calculate it are established in section 278 of the Federal Law of Rights in Connection with Water based on the type of receptor body, the volume of water discharged and pollutants thrown that exceed the MPL as established by the standard and the Law. Section 278-A of the Federal Law includes a long list of receptor bodies classified as "B" type such as the section of the Lerma river bordering La Piedad. Table 2 contains the elements that are involved in the calculation of the payment of a right: the farm size, the receptor body, the treatment system, the pollutant over which a right is paid and its amount and the annual environmental cost per APU. From the above mentioned we may conclude: 1) The cost of the standard for farms with "zero" discharge is represented by the operational cost of its treatment systems plus its depreciation; except in big farm, the cost of the other two is very low because of the obsolescence of the depreciated systems. The important thing in any case is that farms do not discharge to water bodies. 2) For farms that discharge into croplands, the basic parameters BOD, TSS, N and P (on which the Law imposes a higher payment), are not applied, but they pay over the amount of WW used and the

***Table 2****. Quarterly rights payment per receptor body (USD).*

| Farm Size | Receptor body | Unitary operations | Rights payment per pollutant based On law (FLRCW) | | | |
|---|---|---|---|---|---|---|
| | | | Pollutant | USD | Pollutant | USD |
| B | Zero discharge | 3 | | | | |
| M | Zero discharge | 3 | | | | |
| M | Zero discharge | 2 | | | | |
| S | Crop land | 1 | CF | 322.77 | | |
| M | Crop land | 3 | CF | 264.57 | | |
| M* | Crop land | 3 | CF | 264.04 | N | 636.70 |
| B* | Crop land | 1 | CF | 55.43 | SST | 1,118.30 |
| B* | Lagoon and drain | 2 | CF | 115.43 | N | 620.00 |
| M | Drain | 3 | SST | 8,229.68 | | |
| M | River | 1 | SST | 4,478.30 | | |
| S | River | 3 | DBO | 25,173.83 | | |
| M | Creek | 2 | DBO | 7023.51 | | |

*FLRCW: Federal Law of Rights in Connection with Water*
**Discharging to crop land but eventually to receptor body*
*B: big; M: medium; S: small; FC: Fecal coliforms*
*TSS: Total Suspended Solids; BOD: Biochemical Oxygen Demand; N: nitrogen*

content of fecal coliforms. 3) The highest cost is to farms that have a treatment system, exceed the MPL of the standard 001 and discharge to a water body. Not taking into account an atypical farm, the farms in this case would have to pay between a maximum of 10.55 USD per APU and a minimum of 5.48 USD per APU. 4) The right payment is based on a wastewater analysis, which varies enormously and is based on quality derived not from long-term composite samples but on sample taken at in that very moment. The payment of the base pollutant parameter was in some cases BOD, in others TSS or N.

**c) Payment of a right when there is no treatment system**

In contravention of the provisions of the Law of National Waters and its regulations, two farms in the survey, a small one and a medium one, discharged non-treated waste water to water bodies. The medium farm will have to pay annual rights of $ 8.8 USD per APU for exceeding the TSS and the small one $ 38 USD per APU for exceeding the BOD.

## CONCLUSIONS

1) No one of the two models tested showed statistically significance, except for the variable size of the farm. The other variables considered were not linearly related.

2) For many reasons, the STD-001 published in January 1997 turned out to be an extremely confusing and complex mechanism for the producers. Water analyses are expensive and their results do not represent a fair basis to charge a right. The strategy of basing the right payment on the results of a wastewater sample (measured in concentrations) is inappropriate in activities subjected to the uncertainties of nature.

3) The standard 001 is regressive because, in relative terms, small pig producers pay more than medium and big ones. Since it is generic, it is also unfair because it is more expensive for pig production, an activity that produces food, than for other industries.

4) The regulatory approach, exemplified by the standard 001, can work in countries where it is supported by subsidies, financing and other economic instruments designed to facilitate compliance and where institutions are properly developed so enforce compliance.

Pig production must have a specific standard that is part of an integral environmental program for intensive animal agriculture.

## REFERENCES

Federal Law of Rights in Connection with Water. 1999.

Law of National Waters

Organization for Economic Co-Operation and Development. 2003. Agriculture, trade and the environment. The Pig Sector.

Perez, R. 2002 Economic and Environmental Issues of Livestock in Mexico: Pig Production in La Piedad, Michoacan. PhD thesis. FMVZ. National Autonomous University of Mexico (UNAM).