Improving Waste Management by Providing Audit Capability to the Waste Declaration System

T. Pilevneli[1], E. Kucuk[2], U. Yetis[2]

[1]Water Management Institute, Ankara University, Ankara, 06135, Turkey

[2]Department of Environmental Engineering, Middle East Technical University, Ankara, 06800, Turkey

Presenting author email: tpilevneli@ankara.edu.tr

Waste management is a comprehensive field, which considers the control of waste generation, transfer, storage, and disposal. Waste generation and declaration constitute the first steps of waste management. Therefore, the regulatory and supervisory authorities are required to verify that the type and quantity of waste declared is in accordance with the waste generated from each industrial activity. Waste declarations in Turkey are made via an online system, which tracks the waste codes and quantities declared by a waste generator. Within this online system, the waste generators annually declare their generated waste based on the NACE Rev2 codes for their activities. Unlike the EU, Turkey uses a 6-digit NACE classification system, which further divides the 4 digit classes into multiple sub-classes. Six digit NACE codes enable more detailed industrial sector classification, which in return allows more accurate monitoring of sector-specific waste type and quantity. However, some waste generators fail to declare their waste codes according to their industry-specific waste catalog, and in some cases, even the six-digit NACE classification does not allow the identification of process-specific waste codes (Table 1). In addition, the current online system depends highly on the declarations of the waste generators. This situation leads to the misdeclaration of the generated wastes in terms of both type and quantity. During the declaration process, the regulatory and supervisory authority does not have a significant impact on the system.

Table 1. Example statistical classification of economic activities (NACE Rev. 2) and sub-class

Division	Group	Class	Sub-class (TR)	Description
20	20.1			Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
		20.13		Manufacture of other inorganic basic chemicals
			20.13.90	Manufacturing of Chemical Elements, Inorganic Acids and Compounds Not Elsewhere Classified (Metalloids such as Chlorine, Iodine, Fluorine, Boron, Silicon, Phosphorus, Arsenic, Scandium, Mercury, Oxides, Hydroxides, Hydrogen Chloride etc.)

All these issues cause inaccurate and incomplete industrial waste declarations from a statistical perspective, which also prevents the proper management of industrial wastes. To this end, the aim of this

study was to establish a more effective waste management system by simplifying the waste declaration system for waste generators, and by adding auditing capability for regulatory and supervisory authorities.

Within the scope of this study, data obtained from the waste declaration system representing the period 2014-2018 and the sub-classes of the NACE codes in between 10 and 39 were examined in detail. A total of 774 unique six-digit NACE classifications and 648,979 waste declarations were reviewed during this study. Since the determination of sector-specific waste generation factors for all NACE classes is a demanding work, a prioritization study was conducted to determine the NACE classes for which comprehensive process analysis should be performed. After the prioritization study, in order to identify sector-specific waste codes and waste generation factors, literature reviews and field studies were carried out. Detailed process analysis validated by literature reviews and field works revealed the waste types and quantities specific to each production activity.

Comprehensive process analyses were carried out for 66 different NACE sub-classes. These sub-classes represent 172 different industrial activities, covering more than 78% of the total waste generated annually. In addition, at least one sub-class was covered in each NACE division (the two-digit NACE codes), representing at least 65% of the total wastes in that division. After detailed process analysis, in order to provide a control mechanism to the online waste declaration system, two different waste categories were created to avoid inaccurate type and quantity of waste declarations. The first waste category was "Mandatory Waste Codes", which must be declared each year by the corresponding sectors. The second category was "Expected Waste Codes" which are known to be generated from the sector-specific processes but are not expected to occur every year. For mandatory waste codes, lower and upper limits were set after applying a statistical approach and integrated into the online waste declaration system. This integration enables a two-stage control mechanism for the regulatory and supervisory authorities. First, the system does not allow the waste declaration if the waste generator does not report the mandatory wastes. Second, the regulatory and supervisory authorities receive a notification when the declared waste quantities are out of the predefined limits. The improved waste declaration system equipped with audit capability will provide accurate and consistent waste declarations, which will facilitate the management of industrial wastes eventually.