

NITRIC ACID INDUSTRY

SYNOPSIS SHEET

PREPARED IN THE FRAMEWORK OF EGTEI

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1 Activity description and EGTEI contribution – summary

It is roughly estimated that fertilizer use represents about 65% of the world nitric acid market. Another important sector are explosives. The world nitric acid production today amounts to about 50 million tons. Nitric acid is mainly used in the form of **Weak nitric acid**, with the production of *Highly concentrated acid* accounting for only 10 % of the total production [1].

This sector was already considered as an individual sector in the previous NO_x and SO₂ version of RAINS [3, 4], but not in the PM module [5]. **EGTEI has been able to develop an approach for representing this sector and to estimate costs of reduction techniques. The content of the background document has neither be assessed nor validated by the European Nitric Acid Association or any of its national members.** It has been elaborated in close cooperation with expert of ADEME.

The representative unit used is the ton of nitric acid produced (t of HNO₃ 100%). One reference installation (RI) has been defined.

EGTEI defines different abatement measures. The main air pollutant from nitric acid is NO_x. As NO_x abatement measures, **two SCRs** allowing to achieve different abatement emission levels have been defined. EGTEI provides default emission factors (EF) with abatement efficiencies, investments and variable and fixed operating costs (OC) as well as unit costs (€/t pollutant abated and €/activity unit) for the different abatement measures.

National experts only need to collect **4 country specific parameters** (wages, electricity, ammonia price, catalyst cost,) and **2 country and sector specific parameters** (activity level and NO_x pollutant emissions for the years 2000 until 2020). EGTEI provides default costs for country and specific parameters which can be used if no better data exist. Knowing the two sector specific parameters then allows to properly describe the sector and to calculate the application rate of each abatement technique.

Before starting fundamental structure adaptation in the different RAINS modules, additional country specific data are required (for a larger number of countries) and the validation by the European association is needed. In future however, new technological developments should be considered by EGTEI to continuously update the background document and hence the representation of the sector.

2 Representation of the sector in RAINS¹

In the RAINS NO_x and SO₂ modules [3, 4], the sector "PR_NIAC" represents the production of acid nitric. In the PM module [5], the sector is not considered.

3 Status of EGTEI

EGTEI has developed an approach for representing the acid nitric sector and estimating costs of reduction techniques. The content of the background document has neither be assessed nor validated by the European Nitric Acid Association or any of its national members. It has been elaborated in close cooperation with expert of ADEME.

4 Methodology developed within EGTEI to represent the sector

4.1 Definition of reference installations

[General remark: The representation of the nitric acid sector is based on a significantly simplified approach (compromise) - for modelling purposes only. Data proposed for pollutant concentrations or emission factors or any other value are not supposed to be presented as regulatory or limit values.]

With regard to the economic assessment and the availability of data [2], only one reference installation has been defined.

¹The latest modified versions of the RAINS modules have not been considered. Here we refer to the RAINS model of the year 2003

Table 4.1: Reference Installation

Reference Code	Technique	Capacity [t/d]	Plant factor [h/a]
01	Average capacity installation	650	5,908

4.2 Definition of emission abatement techniques and proposed techno-economic data

4.2.1 Dust abatement techniques

No abatement technique has been defined.

Table 4.2.1.1: Abatement Measures for dust

Secondary Measure Code	Description	Lifetime (a)	Emission factor TSP (mg/Nm ³)	Emission factor TSP (g/t of acid nitric produced)	Emission factor PM10 (mg/Nm ³)	Emission factor PM2.5 (mg/Nm ³)
00	None	-	0	0	0	0

Remark: the dust particles size is smaller than 2.5 µm.

4.2.2 NOx abatement techniques

For NOx abatement measures, two SCRs allowing to achieve different abatement emission levels have been defined.

Table 4.2.2.1: NOx abatement measures

Description	Efficiency (%)	Emission factor (kg/t of HNO ₃ 100%)
None	-	7
SCR 80%	80	1.4
SCR 94%	94	0.42

Table 4.2.2.2: Investments and Operating costs for NOx abatement measures

Description	Investment (k€)	Fixed Operating costs (%/a)	Variable Operating costs (€/t)	Total Operating costs (€/t)	Cost per tonne of NOx abated (€/t) ⁽¹⁾	Cost per tonne of nitric acid produced (€/t) ⁽¹⁾
None	-	-	-	-	-	-
SCR 80%	900	4	0.933	0.297	324	1.82
SCR 94%	1,200	4	1.20	0.378	580	2.39

⁽¹⁾: Case of France

4.2.3 SO₂ abatement techniques

No abatement technique has been defined.

Table 4.2.3.1: SO₂ abatement measures

Measure Code	Abatement technique	Efficiency (%)	Emission factor (mg/Nm ³)	Emission factor (kg/t)
00	-	-	0	0

5 Country specific data to be collected

Different types of country specific data have to be collected to give a clear picture of the situation in each Party. EGTEI proposes default values for the economic parameters which can be modified by the national expert if better data are available.

For the nitric acid activity, country specific economic parameters are used to calculate variable operating costs. They are presented in table 5.1 as default costs proposed by EGTEI (these costs are entered only once in the ECODAT database tool).

Table 5.1: Country specific costs

Parameters	Default costs provided by EGTEI	Country specific costs
Electricity [€/kWh]	0.0569	To be provided by national experts
Wages [€/h]	37,234	To be provided by national experts
Ammonia price [€/t _{NH₃}]	400	To be provided by national experts
Catalyst cost [k€/m ³]	15	To be provided by national experts

Default data have been used to calculate variable and annual abatement costs presented in table; 4.2.2.2. Information concerning activity levels from 2000 to 2020 as well as the description of the control strategy is also necessary (these data can be directly entered in the database ECODAT). A full specification of the work to be done by national experts is provided in the general EGTEI methodology.

Table 5.2: Activity level for Reference Installation (t HNO₃ 100% / year)

RIC	2000	2005	2010	2015	2020
01					

National experts can also modify - in a range of ± 10% - the default unabated emission factor proposed by EGTEI to represent the reference situation of the nitric acid industry for all Parties.

Table 5.3: Unabated emission factor [kg/ t HNO₃ 100%]

Pollutants	Default data mean	User input mean
EF NO _x	7	To be provided by national expert
EF PM _{TSP}	0	To be provided by national expert
EF SO ₂	0	To be provided by national expert

6 Application rate and applicability of each abatement technique

The national experts are kindly asked to provide for each abatement technique its application rate and its applicability in 2000, 2005, 2010, 2015, 2020. If a national expert has this information at hand, he can fill in the table 6.2.

If not, a methodology is described in the background document [6].

Table 6.1: Input parameter needed to calculate application rates

PARAMETER	2000	2005	2010	2015	2020
E _{NO_x} Emission of NO _x [t]					
Activity level for RI (t HNO ₃ 100%)					

Table 6.2: Application rate and applicability for NO_x abatement measures

Description	Application rate in 2000 [%]	Application rate in 2005 [%]	Applicability [%]	Application rate in 2010 [%]	Applicability [%]	Application rate in 2015 [%]	Applicability [%]	Application rate in 2020 [%]	Applicability [%]
None									

SCR 80%			100		100		100		100
SCR 94%			100		100		100		100

7 Relevance of EGTEI information for Integrated Assessment Modelling (IAM)

In the RAINS NO_x and SO₂ modules [3, 4], the sector "PR_NIAC" represents the production of acid nitric. In the PM module [5], the sector is not considered. EGTEI has developed an approach for representing the acid nitric sector and estimating costs of reduction techniques. All these information are available for IAM but need to be validated by the European association.

8 Perspective for the future

Before starting fundamental structure adaptation in the different RAINS modules, additional country specific data are required (for a larger number of countries) and the validation by the European association is needed. In future however, new technological developments should be considered by EGTEI to continuously update the background document and hence the representation of the sector.

9 Bibliography

- [1] Wiesenberger, H.: State-of-the-art for the Production of Nitric Acid with regard to the IPPC Directive, UBA, Wien, 2001
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- [5] Modelling Particulate Emissions in Europe, A framework to Estimate Reduction Potential and Control Costs, IIASA, 2002. <http://www.iiasa.ac.at/rains/reports/ir-02-076.pdf>
- [6] Background document on the sector of the nitric acid industry prepared in the framework of EGTEI

ANNEXE: Example of data collection and use of EGTEI data – Case of France

A. Country specific data collection and scenarios developed

Contacts with the French Nitric Acid Association need to be taken in order to collect the different information. But, at the moment, the background document has not been validated by the European Nitric Acid Association.