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FINAL REPORT ON EXPERT EVALUATION OF TIER 2 ACCURACY LEVEL NATIONAL ACCOUNTING OF POLLUTANTS EMITTED INTO THE ATMOSPEHRE IN OTHER SECTORS OF LITHUANIAN ECONOMY

Final report

2020

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**ABBREVIATIONS**

|  |  |
| --- | --- |
| AAA / EPA | Aplinkos apsaugos agentūra / Environment Protection Agency |
| AB / JSC | Akcinė bendrovė / Joint Stock Company |
| CEPMEIP | Coordinated European Particulate Matter Emission Inventory Program |
| EB / EC | Europos Bendrija / European Community |
| EIA | Environmental Impact Assessment |
| EMEP/EEA 2013 | European Monitoring and Evaluation Programme / European Environmental Agency air emission technical guide 2013 m. |
| EMEP/EEA 2016 | European Monitoring and Evaluation Programme / European Environmental Agency air emission technical guide 2016 m. |
| EU | European Union |
| IĮ | Individuali įmonė / Individual enterprise |
| PM | Particulate matter |
| LGT | Lietuvos geologijos tarnyba / Lithuanian Geological Council |
| LR | Republic of Lithuania |
| LRATCA | Lietuvos regioninių atliekų tvarkymo centrų asociacija / Association of Lithuanian Regional Waste Management Centers |
| MB | Mažoji bendrija / Small partnership |
| N/D | No data |
| NO | Not occurring |
| PCBs | Polychlorinated biphenyls |
| POPs/POT | Persistent organic pollutants |
| RAAD | Regioninis aplinkos apsaugos departamentas / Regional Department of Environmental Protection |
| RATC | Regioninis atliekų tvarkymo centras / Regional Waste Management Center |
| GHG | Greenhouse gas |
| IPPC | Integrated Pollution Prevention and Control |
| UAB / LLC | Uždaroji akcinė bendrovė / Limited Liability Company |
| VMT | Valstybinė miškų tarnyba / State Forest Service |
| VAT | Value added tax |

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# Introduction

The data and information presented in this report are intended to increase the level of accounting for emissions in the other sectors of economy. The purpose of the Data Collection Report is to separate the sources of input data, methodologies and required data used, and to provide all data collected.

In order to decrease the amount of repeating data as well as comments provided by the purchasing organization, only new or updated chapters of previous report are presented in this report. Final report of the project shall contain all newest versions of chapters. New or updated text is marked with yellow highlight. According, the MS Excel file attached to this report contains only new or updated data.

The data presented in the interim report of National Accounts, completed in Tier 2 accuracy, on pollutants released into the air in the agriculture sectors in Lithuania, includes other economic sectors (1.B.1.a, 2.A.5.a, 2.A.5.b, 2.A.5.c, 2.C.7.d, 2.K, 5.B.1). Data was collected from publicly available sources: companies‘ web pages, IPPC permits, online environmental impact assessment (EIA) documents, screening conclusions on environmental impact assessment, relevant articles, annual activity reports, online data services (LGT) and in consultation with representatives of businesses or institutions.

In order to collect information on the coal storing technologies and quarry operating companies a survey was conducted in 2019.

In 2019 a survey of coal storing and quarry operating companies was conducted. Due to very low response rate from respondents the survey is not repeated this year.

Also, in 2019 new version of Guidebook was published. An analysis of changes in methodology[[1]](#footnote-1) was conducted which showed that the only relevant changes are in NFR 2.A.5.a. The detailed analysis and recommendations are provided in the relevant chapter.

In order to evaluate if any relevant changes (that might affect the emission calculations) in legal environment have occurred online database[[2]](#footnote-2) on legal documents was analysed. Scope of the analysis – legal acts that came into force in 2019 and were valid during the preparation of this report as well as are associated with the following Eurovoc[[3]](#footnote-3) terms[[4]](#footnote-4):

* MT 5206 environmental policy (576 legal acts);
* NT environmental protection (298 legal acts);
* MT 6406 production (51 legal acts).

Out of the legal acts analyzed 14 were deemed as relevant to activities evaluated in this report and hence analyzed further. However, the legal acts analyzed did not contain any clauses that may affect the emission calculations.

**During the preparation of this report, the following main data collection activities have been carried out:**

* Supplemented with data provided in the annual reports of the Geological Survey of Lithuania;
* Supplemented with data from the GHG Report 2019;
* Supplemented by data provided by the Lithuanian Association of Regional Waste Management Centers;
* Verified abatement technologies are specified in the IPPC applications and permits[[5]](#footnote-5) filed in 2019-2020 (7 relevant permits or request for changes were found, out of which 2 contained relevant information about use of abatement technologies);
* In order to further clarify the scope of the report, chapters added for NFRs where activities are not occurring or the emissions should be calculated at Tier 1 level;
* 2.A.5.a chapter has been updated with recommendations regarding Guidebook 2019 methodology update;
* 2.A.5.b chapter was updated with data and estimations required to evaluate emission from construction of new roads;
* Analysis of change in legal environment in 2019 was conducted in order to analyse the potential effects on the emission calculations;
* Chapters missing data for Tier 2 calculation were supplemented by descriptions of research and budgets required to gather unavailable data.

Activity data collected with respect to the subsectors, types of economic activities, and pollution abatement technologies provided in the Technical Guide are provided in the Microsoft Office Excel document (see MS EXCEL file Other\_sectors\_Collected\_data\_1990-2019\_EN.xlsX). This document is considered an integral part of this report.

# Manufacture of solid fuels and other energy industries (NFR 1.A.1.c)

Tier 2 level methodology is applied only to production of coke. Coke production in Lithuania is not occurring. There is a possibility to apply Tier 2 level methodology for other types of fuel and other energy industries by applying Tier 1 EF.

# Fugitive emission from solid fuels (NFR 1.B.1)

## Fugitive emission from solid fuels: Coal mining and handling (NFR 1.B.1.a)

Input data for 2000-2019 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section **1.B.1.a Fugitive emissions from solid fuels: Coal mining and handling Table 3-4 Tier 2 emission factors for source category 1.B.1.a Coal Mining and Handling, Storage of coal, uncontrolled**.

**Brief description of the process:** In Lithuania,companies using coal as fuel or companies selling coal, have two kinds of coal – washed and unwashed. Washed charcoal has less dust than unwashed coal, so storage of washed carbon, unlike the storage of non-washed carbon, is attributed to *controlled coal storage*. On the other hand, companies storing unwashed coal are classified as uncontrolled carbon storage companies. An assessment of coal-controlled and uncontrolled storage is carried out when there is no available specific information on the measures used by companies to reduce air pollution.

**Unwashed carbon storage area:** In Lithuania, Grasta Ltd, Viljosinda Ltd, Hufa Ltd, Vaimanta Ltd, Vivalsa Ltd, and Kėdainių JSC dump (JSC) sell (store) washed coal. “Akmenės cementas“ used washed coal only. No specific data on the trade (storage) of unwashed carbon in Lithuania has been found, it is only mentioned that such coal is traded in Lithuania. The main suppliers of coal to Lithuania are Russia and Ukraine.

Input data for 2000-2019 Required Emission Factor for Adaptation of EMEP / EEA Technical Manual (Version - 2016) Section **"Table 3-5 Tier 2 emission factors for source category 1.B.1.a Coal Mining and Handling".**

**Brief description of the process:** In Lithuania,companies using coal as fuel or companies selling coal, have two kinds of coal – washed and unwashed. Washed charcoal has less dust than unwashed coal, so storage of washed carbon, unlike the storage of non-washed carbon, is attributed to controlled coal storage.

The biggest company in this sector that uses coal is Akmenės Cementas, the largest companies trading in coal are - Dameta, Grasta Ltd, Vilkasta Ltd and Andeta Ltd.

**Washed carbon storage area:** Dameta Ltd**[[6]](#footnote-6)** is one of the largest companies trading in coal in Lithuania. The company receives already washed coal from Russia, therefore, it does not cleanse the raw materials again, but specializes in sorting, relocation, transportation, warehousing and trading of coal. This company has its own fuel depots (warehouses) throughout Lithuania: Vilnius, Naujoji Vilnia, Kaunas, Garliava, Marijampolė, Šiauliai, Vilkaviškis, Kėdainiai, Mauručiai and Tauragė.

Based on the Ministry of Environment of the Republic of Lithuania, Marijampolė Regional Environmental Protection Department, 9th October, 2012 recommendation on the environmental impact assessment of the proposed economic activity, the company planned to reload / store about 17,000 tonnes of washed coal per year in Marijampolė. The transhipment site (sifting area) was intended to be covered with tarpaulin (tarpaulin tent), which would significantly reduce carbon dust under unfavorable weather conditions. According to data of 2016, Dameta Ltd, provides cargo storage service in Marijampolė railway station, the size of the area defined in their contract is 896 m2**.**

One of the largest Lithuanian companies supplying hard coal to Lithuanian customers is **UAB Grasta Ltd.** **[[7]](#footnote-7), [[8]](#footnote-8)**. The company was founded in 1997 and only sells washed coal they receive from Russia. The extracted coal is washed and sieved in Russia in special factories. Carbon is lighter than primer, sand or stones, so water separates these impurities, and sifting process divides coal into different groups, according to their size. According to Grasta Lt Webside, washed coal is better unwashed, as it burns completely, and there are no rock residues left in the boiler, which can be up to 25% in unwashed coal. Washed charcoal not only emits more heat, but also burns better, and rarely needs to be cleaned. The representatives of Grasta Ltd went to their coal suppliers in Russia, Figure 1 shows a photo of coal washing.

Figure 1 „Grasta“ Ltd Cool rinsing



Source: UAB „Grasta“

Grasta has 21 warehouses in Lithuania: Kaunas, Jonava, Prienai, Alytus, Marijampolė, Jurbarkas, Kaišiadorys, Pagėgiai, Kretinga, Vidukla. Coal is sold in pre-packed bags of 25 kg and 40 kg, as well as big bags of 1000 kg and also loose. Although there are no publicly available data on areas and quantities of carbon stored in the litter, a picture of the open coal site is presented (Figure 2). The above-mentioned picture shows that the open-stacked coal piles are about 3-3.5 meters high. It is assumed that coal is stacked in piles of 3-3.5 meters high in all coal storage areas stored in Lithuania.

Figure 2 Grasta Ltd loose coal storage area



Source: UAB „Grasta“

In Lithuania, coal is supplied by the following companies[[9]](#footnote-9):

* **Viljosinda Ltd[[10]](#footnote-10)** – registered in 1994, various types of coal from Kuzbas (Russia).
* **Hufa Ltd[[11]](#footnote-11)** – founded in 1995, in 1998 established a shopping center in Vilnius and started participating in retail. It sells washed, sorted coal.
* **Vaimanta Ltd[[12]](#footnote-12)** – trades Kuzbas washed coal.
* **Vivalsa Ltd[[13]](#footnote-13)** – sells solid fuel since 2011 and is the most solid fuel selling company in Elektrėnai, Trakai, Širvintos area. Now also supplies fuel in Vilnius and its surroundings. It only sells high quality kinds of braided shredded coal.

**Kėdainiai krovimo aikštelė Ltd[[14]](#footnote-14)** – founded in 2002, provides warehousing, storage and handling services for its clients. It also provides storage of carbon on podons with awnings in protected area with lightning. At the same time, the company can store up to 3000 tons of product in bags. Kėdainių krovimo aikštelė Ltd also has a field - about 1 ha of warehouse, which it plans to expand to 1.5 ha. Origin of washed coal is Russia, where coal is packed from wagon to big-bags that hold from 0.5 kg to 1 tone of coal.

* UAB „Baltijos anglis“.

There is no more publicly available information on coal storage areas or quantities. It can be seen from the reviewed companies that currently washed coal the most popular in Lithuania. No specific data on the trade in unwashed carbon in Lithuania has been found, it is only stated that such coal is traded in Lithuania. The main suppliers of coal to Lithuania are Russia and Ukraine.

**Washed carbon storage area Akmenės Cementas[[15]](#footnote-15):** One of the largest coal consumers in the industry is Akmenės Cementas. Coal is supplied to the company by Hanner Ltd and Nerinda Ltd (Russia). Akmenės Cementas uses washed coal fuel to burn clinker in furnaces during cement production. Before it is ready to be used, coal is treated in two coal mills, one of them started operating in 2002 and the other in 2006. Both coal mills are equipped with modern sleeve filters. Aspiration systems are equipped with separate sleeve filters and draft fans. The mills are equipped with an aspiration system to break dusty air from intermediate bunkers, ground carbon bunkers, screw conveyors, and overfill. Thus, in the process of coal treatment, the company is subject to air pollution abatement measures. In sector 1B1a, based on 2016 EMEP / EEA Technical Manual only emission factors for unclean / uncontrolled coal are reported, and all coal treatment processes in AB Akmenės Cementas are carried out by means of air pollution abatement measures, therefore emissions of carbon treatment processes are not calculated without national emission factors.

The air purification system installed in the carbon warehouse draws air from the feeders, the transfer unit and the carbon sieve. Almost all coal is stored in closed warehouses. Only part of the coal (reserve quantity) is stored in the open field. Coal stored in coal is quite damp (~ 10%) and is compressed. Coal is transported in closed systems: belt conveyors in galleries, screw conveyors, pipelines. The dust generated in the material transfer units is captured in the sleeve filters.

2014 The Integrated Pollution Prevention and Control Document of the Company provides information on the capacity of the tanks of the coal / fuel compartment:

* coal tank fuel tanks, 3 x 50 m3;
* the existing capacity of the coal storage area, **1 x 200 m3**;
* capacity of the coal compartment, **1 x 200 m3**.

The indicative quantities of coal consumed in the IPPC permit (2013-2018) are provided (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 1.B.1.A).

The IPPC permit contains information on the used abatement measures for storage and coal processing in the plant, but does not provide specific information on the carbon stock in storage

**Results of company survey**

In the previous reports, 8 companies[[16]](#footnote-16) handling coal in their operations were identified. All of these companies were sent a data request, as well as were contacted by phone in order to explain goal of the survey and encourage respondents to provide data. Only one company provided data upon request.

Survey collected data about handling of 8 353 tons of washed coal over the period of 2005-2018 (or the average of 597 tons per year). The collected data is provided (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 1.B.1.A). The data collected during the survey can be used for the accounting purposes, but not for drawing conclusions about the entire sector.

Due to the aforementioned low response rate, the survey was not repeated in 2020.

## Fugitive emission from solid fuels: Solid fuel transformation (NFR 1.B.1.b)

Not occurring in Lithuania.

## Other fugitive emissions from solid fuels (NFR 1.B.1.c)

Not occurring in Lithuania.

## Other fugitive emissions from energy production (NFR 1.B.1.D)

Not occurring in Lithuania.

# Quarrying and mining of minerals other than coal (NFR 2.A.5.a)

Based on 2016 Technical Guidance, emissions from this sector are insignificant, as their contribution to total national emissions is less than 1% of any pollutant. Although emissions from the sector are significant at local level, emissions at national level are relatively low and only relevant for relatively particulate fractions.

Input data for 2000-2017 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section „2.A.5.a Quarrying and mining of minerals other than coal” for the use of table „Table 3.2 Tier 2 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal; low to medium emission level”.

**Brief description of the process:** In the course of quarrying, digging and handling excavated minerals (e.g. sifting, shredding) and transferring them, solid particles are emitted to the atmosphere. According to the Technical Manual 2016 Particulate Control, this process also includes watering and process coverings. In Lithuania, when treating quarries or excavated minerals, equipment is not covered by hoods or similar materials. The equipment is not covered for several reasons, e.g. it is difficult to visually see and inspect the production; in some cases, such as rock shredding, a high concentration of explosive dust may form under the hood, and the equipment often sparks when shredding such materials, resulting in a high probability of explosion. Because of the security measures and easier visual inspection of the production, hoods and similar coverings for quarries are discarded.

The Technical Manual (version - 2016) emphasizes that there is no general rule for setting low and high emission levels. The guide provides an example of Visschedijk, Pacyna, Pulles, Zandveld and Denier van der Gon report on Coordinated European Particulate Matter Emission Inventory Program (CEPMEIP), that describes low-emission companies as those with well-maintained equipment and emission reductions and high emission levels include companies that do not take care of low emission equipment; also old companies with old equipment.

Individual quarries have Environmental Impact Assessment (EIA) documents, which may also provide information on low and high emission levels based on the Technical Guide (2016).

Based on what the Technical Guide suggests, low and high emission levels have also been used by business operators to find useful information on Integrated Pollution Prevention and Control. In addition, when determining emission levels, one can consider whether the company has implemented a certified environmental management standard ISO 14001. The main objective of ISO 14001 is to promote environmental protection and pollution prevention in response to socio-economic needs. So, if you have doubts about the level of emissions, you can consider whether the company has an environmental management standard and in what year it has been implemented.

## Application of guidebook 2019 methodology

According to 2016 02 18 order of minister of environment no. D1-111, in order to improve the national accounting of emissions, Guidebook Tier 2 methodologies should be applied, but only in the cases where it is within means of the country.

After the evaluation of Guidebook 2019 methodology we, as the experts of the field, conclude that Lithuania cannot applied Guidebook 2019 methodology for 2.A. “Mineral products” sector and especially 2.A.5.a sector, because of the following:

There is not possibility to gather the following data:

* Percentage of the material extracted from the deposit with a moisture content below or equal to 1.3% (%);
* Percentage of the material extracted from the deposit with a moisture content above 1.3% (%);
* Abatement factor (%), depending on the reduction technology implemented on the crushers (cru), screeners (sc) and transfer points (TP). Furthermore, no methodology for calculation of this indicator is provided;
* Total distance travelled by dumpers on unpaved road (km/year);
* Dumper Silt load of the paved road (g/m2) weight (on average) (t);
* Moisture content of the stockpile material (in %);
* Quantity of stockpile material handled (t/year);
* Number of stockpiles;
* Stockpiles height;
* Angle of repose (angle made by the material with the ground when it is in a conical stockpile);
* Silt loading of stockpiles (%) (where silt <75 µm);
* Exposed surface area of stockpiles;
* And others.

Environmental protection documents (IPPC permits, environmental impact assessments and etc.) suggested previously or company surveys are not suitable methods of data gathering in this case. None of the aforementioned documents provide data required for the calculations, this is seen in the previous analysis of the aforementioned documents. Surveys have also failed to provide representative data for the calculations.

According EU Environmental Protection Agency, countries are not permitted from using methodologies from the older versions of the Guidebook Tier 2 methodologies. Furthermore, it is not permitted to use country’s own calculation methodology or well supported methodology developed by other country.

Currently Lithuania have already gathered all the data required for Tier 2 level calculations based on Guidebook 2016 methodology, hence the country can move from Tier 1 to Tier 2 based on Guidebook 2016 methodology but cannot and will not in near future be able to apply Guidebook 2019 Tier 2.

It should be noted that companies in Lithuania do not gather required for Tier 2 calculations. Furthermore, the meteorological data required must be processed first and additional calculations should be done before using the data.

Based on the arguments above, we recommend to calculate emissions for 2.A.5.a sector with Guidebook 2016 Tier 2 methodology. Currently Lithuania already gathered representative data needed for Tier 2 calculations and now provide more accurate emission calculations than before.

In order to apply Guidebook 2019 Tier 2 methodology, it is recommended to conduct a research to determine the required indicators. The proposed methodology for the following research:

* Determine a list quarry operators that cumulatively would represent ~80% of the quantity of minerals extracted;
* Conduct inspections of the selected quarries (drones with LiDAR or photogrammetric sensors can be used to take precise measurements);
* Conduct interviews with representatives of the companies operating the quarries;
* Aggregate the data gathered and extrapolate the data to represent the whole quarry sector in Lithuania.

The price of such research, based on current market prices, is estimated at 50 000 – 60 000 euros (not incl. VAT). Furthermore, arrangements should be made Institute of meteorology so the required meteorological data would be gathered. In case companies would refuse to cooperate for research purposes, possibility to require the companies to provided needed data should be established in the environmental documents supplied to EPA or yearly reports. It must be stressed that the latter option would increase administrative burden for businesses, therefore conducting the research is the preferred method of data collection.

## The proportion of minerals excavated in quarries "Low to medium emission level" each year

### Dolomite

Figure 3 shows how the largest dolomite-producing companies are distributed in Lithuania according to their market share.

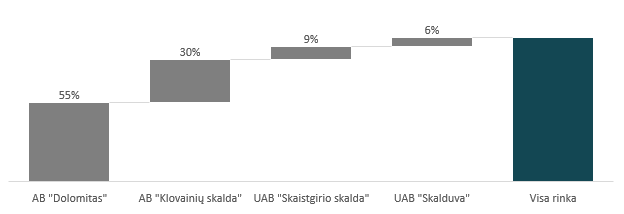
The figure shows that the majority of the market is held by AB Dolomitas, the second is AB Klovainiu skalda.

Figure 1 Distribution of the largest producer of dolomite chips in 2014 (Vitkus And AB Klovainiai skalda 2014

**AB Dolomitas** was established in 1995 after the privatization of the state-owned Petrašiūnai factory. Since its launch, the company has been operating the Petrašiūnai II dolomite reservoir, and since 2012 it has been also operating the Petrašiūnai III dolomite pool. Dolomite excavation is about 1 million. m3 per year for Petrašiūnų II and 500 thousand m3 per year for Petrašiūnų III[[17]](#footnote-17). The company is constantly investing in new equipment, mining machinery. In 2016, a new dolomite crushing production line was launched, which is important for setting emission levels. Based on 2017 Report on the Environmental Impact Assessment of the Planned Activities of the Expansion of the Area of ​​the Dolomite Field by Petrašiūnai II, dust in the quarry can only be founded on roads that were previously part of a quarry[[18]](#footnote-18). To avoid this, during the drought all quarries of Petrašiūnai II are watered, so there is no dust due to transport movement, although some atmospheric dust pollution can be caused by the explosive work being carried out. However, these actions are episodic and instantaneous, as the deck is only blown several times (3-4) per month. That creates some dust in the local area, that is heavy (2890 kg / m3 volumetric) and settles quickly far in the deep pit. Explosive decomposition products, as evidenced by years of experience, do not spread beyond the quarry. Due to the use of water deposition means (watering), modernization and maintenance of the used PM, and taking into account other aspects such as rapid deposition of heavy dust particles, Dolomitas in Petrašiūnai II is classified as ‚low to medium emission level‘ level. The 2019 application for IPPC permit change states that the gravel is produced wet (washed with water), which reduces the dust. Furthermore, it is stated that during transport tarps are used to cover the trucks.

**Klovainiu skalda[[19]](#footnote-19)** was established in 1995. after the privatization of the state enterprise Klovainiai skalda. Since 2009, when the company was given a mining site, this company operates a Klovain dolomite pool. Report ‘Information about the decision made on the assimilation of the expanded area of ​​the Klovainiai dolomite deposit from the perspective of the permissible environmental impact of the planned activity‘ states that mineral extraction will continue in the expanded Klovain dolomite pool using the same mining technology as the existing quarry. Everything will be done in the same way as the extraction area will move in the south. The average annual production of dolomite raw material, as before, will amount to over 300,000. m3. The abovementioned report on the decision (concerning the PEA) states that dust, the highest concentrations of which can be generated by the explosion of dolomite, is the main source of environmental pollution. The effect is instantaneous and is rarely repeated (1-2 times per month). Transport dust only occurs during drought, inside the quarry, and they are eliminated by watering roads, so transport pollution will not be significant. Furthermore, according to IPPC permit update (2019), companies gravel production lines have 5 cyclone filters installed to reduce particulate matter. As it was mentioned in the plan to expand the dolomite career, the activity described will be the same as it was so far, that means that the road irrigation tool has been applied since 2009. Based on the PM deposition measures since 2009, the quantities of dolomite excavated by Klovainiu skalda are classified as low to medium emission level.

**Skaistgirio skalda Ltd** was founded in 2004, it operates the Skaistgiris dolomite quarry and since 2012 it has been also operating the Petrašiūnai III. According to the report on ‘the decision taken regarding the permissibility of the planned activities of the Pakruojis district Petrašiūnai‘ the extraction of dolomite by Skaistgiris Skalda Ltd is estimated at 200 thousand m3 per year. As there is no actual publicly available data on the dolomite produced by this company, it is assumed that the company has harvested up to 200,000 m3 per year. On 3rd of November, 2011, a permission was granted to use Petrašiūnai III dolomite reservoir on condition that transport dust are reduced. It was decided that watering of the roads is necessary to achieve this. As the dust extraction is reduced by watering during dolomite extraction process, the conditions for operating a quarry are fulfilled and emissions are classified as low to medium emission levels.

**Skalduva Ltd[[20]](#footnote-20)** was established in 1997 in Pakruojis. In 2009 Skalduva has started to use Krivaičiai quarry. In the 2006 decision ‘On the Permissibility of the Use of the Krivaičiai Dolomite Pool‘ in the Environmental Impact Assessment[[21]](#footnote-21), it is mentioned that the planned annual mining volume is about 200 thousand m3 of dolomite. The actual data on mining volumes are not publicly available or published, therefore the data provided by the EIA are used for the assessment. In addition, when planning the use of the Krivaičiai dolomite deposit, it was planned to add up to 10 m of cover stacks for dust protection at the edge of the quarry, and up to 3 m of soil embankments. Such measures would not allow the dust to spread beyond the quarry, so most of them would settle in the quarry. The current website of Skalduva Ltd states that “the production of dolomite chips is carried out by the most modern equipment and tools used for such activities”. The website and Figure 2.2 show photos of the equipment supporting these statements.

Figure 2 Skalduva Ltd Krivaičiai equipment used in dolomite quarry



Source: www.skalduva.com

The equipment is not worn out or rusty and is visually tidy. Based on the condition of the equipment and information about the used embankments, the minerals extracted by Skalduva Ltd are classified as “Low to medium emission level”.

### Limestone

One of the largest limestone producers in Lithuania is **AB Kalcitas**, which was founded in 1995, although it has been operating as a separate company since 1977. Kalcitas has started to operate the Karpėnai limestone quarry in 1977, when it was still trading under a different name of Akmenės gamybinis kombinatas. Until then, this quarry was operated by Akmenė cement-slate producer[[22]](#footnote-22).

Kalcitas is the main raw material supplier and partner of Akmenės Cementas. According Akmenės Cementas article, in the ‘recent‘ year (the article was written – on 20th of May, 2010, therefore it is assumed it was referred to 2009 data) Kalcitas dug out about 1 million tons of limestone (~ 370, 37 thousand m3). A. Rimkus, director of Kalcitas, stated that the excavator park in the quarries is worn out. He also mentioned that the factories in Russia, where the company's employees buy spare parts for their technicians, are surprised that such old machinery is still used [[23]](#footnote-23).

No more freely available information on quarrying activities, used PM emission reduction measures and quarries were found. Taking into account the above information and the fact that the amount of limestone extracted by AB “Kalcitas” covers half or almost all the amount of mineral extracted in Lithuania (2000-2017), it is assumed that all amounts of limestone extracted in Lithuania during the period 2000-2017 are medium to high. emission level.

### Clay

Clay is sedimentary rocks, mainly composed of crystalline hydrosilicate minerals. The structure of the clay allows it to retain dissolved salts, metal compounds and water molecules on the surface. The adsorption of salts and water on particles gives the clay a special plasticity. Characteristics of clay properties (plasticity, bonding) is defined by clay substance - fine particles of less than 0.005 mm crystalline particles. Clay is stickly and shiny, it absorbs water and gas, so it has a specific smell when wet. Each piece of plastic clay dough is covered with a water film[[24]](#footnote-24).

Due to its properties the clay found in Lithuanian nature is usually wet. This is confirmed in the Environmental Impact Assessment Documents created for companies operating clay. For example, in the 2018 EIA selection document[[25]](#footnote-25), the ADI Keramika Ltd states that clay mined in quarry is damp enough and does create any dust. The only airborne contamination of particulates is the transport of raw materials from quarries to warehouses, as transportation takes place on a gravel road. However, the gravel road is not part of the quarry area and is therefore not watered and dustiness depends only on gravel road wear, weather conditions and traffic intensity (only the people who use the quarry are using the road). No solid particles are present during the extraction of clay, and therefore emissions from the operation of clay quarries should not be counted. This is confirmed by emissions from this sector from other EU countries. There are no calculated clay extraction emissions, so clay extraction emissions in this sector in Lithuania should not be calculated either, no KD pollution is formed.

### Sapropel

In geology, sapropel is defined as: non-structural, of the colloidal combination, the sediment can be liquid, dense, plastic or fluffy, containing at least 10-15% of organic material. According to Lithuanian lakes and wetlands researchers A. Garunkš, A. Seibutis and J. Jarošiute, Lithuanian lakes can have around 5.76 billion m3 of sapropel and about 4.5 billion m3 of sapropel can be found in Lithuanian swamps. Sapropel is found only in lakes and swamps, so it does not dust during extraction process. Sapropeli is rare in Lithuania - according to 2014 data, 6 permits were issued for the use of sapropel deposits. The extraction of the sapropel in the Paežerė Lake (Silale district) ceased as soon as the problems with the realization of the sapropel were realized. The company operating the sapropel of Medžialenkė lake (Mažeikiai district) went bankrupt and production stopped, the permit was canceled. Lake Gervinis and Lake Midulis (Zarasai district) are still in operation (Juozapavičius and Kuzavinienė 2014). Based on where the sapropel is extracted and that it is moist at the time of extraction, no dust is generated[[26]](#footnote-26).

Therefore, it is not necessary to calculate emissions from sapropel extraction.

### Sand-Gravel

**Gasta Ltd[[27]](#footnote-27)** has been operating the Gariūnai gravel-sand deposit since 1994. The foundation of the company's production base was created by its predecessors (it is the Board of Industrial Materials Vilnius quarry, Vilnius Non-Ferrous Building Materials Factory, Production Association of Trakai Stainless Building Materials - Gariūnai Workshop, Nesta AB, State Enterprise Gastau) since 1952, and this base is constantly improving. The company owns over 25 technical units (excavators, bulldozers, trucks, dumpers, loaders, etc.). The sand and gravel sorting technology line, which was relocated and reconstructed in 2000, is outdated and obsolete. Also, other equipment used by the company excavator and sand sorting device (Figure 5) is worn, rusty.

Figure 3 Gasta LTD part of worn sand sorting machine



Source: UAB „Gasta“

Because of the large equipment wear and tear, the company has implemented the project "Modernization of Technological Equipment to Improve Resource Utilization and Reduce Environmental Impact".

The company dries the quarry area, runways and raw material for the dry season with a special spray drum and other tools to reduce particulate matter release. Based on the use of worn-out technology in the quarry but also the use of particulate sedimentation (watering), it is difficult to quantify the quarried minerals for any emission level (low or high). However, irrigation is a more efficient particle deposition tool that can reduce particulate matter (dustiness) by up to 90% than the use of technically correct mechanisms. For this reason, the quantities of minerals mined by Gasta Ltd are attributed to “Low to medium emission level”.

Since the actual amounts of extracted minerals are not known, according to the updated Gasta Ltd IPPC permit for 2012, Figure 6 presents the quantities of sand-gravel planned / produced at that time.

Figure 4 Gasta Ltd Production

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Planned produce from 2012 tons/year | Density, t/m3 | Planned produce from 2012 m3/year |
| Sand Gravel Mix | 100 000 | 1,42 | 70 422,53 |
| Gravel Chippings | 50 000 | 1,58 | 31 645,57 |
| Gravel Shingles | 60 000 | 1,32 | 45 454,54 |
| Crushed Stone | 10 000 | 1,65 | 6 060,61 |
| Concrete Sand | 125 000 | 1,64 | 76 219,51 |
| Sand | 100 000 | 1,62 | 61 728,40 |
| Quarry sand | 100 000 | 1,45 | 68 965,52 |

Šaltinis: 2012 m. TIPK Nr. VR-4.7-V-02-113

**Plot II of Alekniškės Gravel and Sand Field was planned to be operated by the company Litgravel Ltd.** According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, 2013 recommendations on environmental impact assessment of the use of the area in Alekniškės[[28]](#footnote-28) , planned amount of exploited resources was 20 thousand m3 per year. 3 m height of dirt embankment was also planned for protection against air pollutants. Watterng of quarries and gravel roads was also recommended. Depending on the use of the proposed measures, quarries are quantified as low to medium emissions.

**Resin sand and gravel Operation of Turto Plėtra companies** was planned in 2012. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, 2012 recommendations on the assessment of the impact of the gravel and sand extraction on the environment[[29]](#footnote-29) , planned amount of excavated sand and gravel was 50 thousand m3. All resources, according to the planned volume of mining, would be excavated within 3 years (around 2015). Planned measures to reduce air pollution in the course of the career included moving the soil along the northern and southern part of the quarry and watering the roads during drought. To reduce the technogenic load, efficient modern machinery is used for digging, loading and transporting significantly less diesel fuel per unit of ground volume. When assessing the use of air pollution measures, the quantity of exploited resources excavated during operation is classified as 'Low to medium emission level'.

**Vieteikiiai gravel and sand Reservoir is operated by Statva Ltd,** approved by 1984 project of the use of resources. In 2011, a new resource use agreement was concluded. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, 2012 recommendations regarding the new environmental impact assessmen[[30]](#footnote-30) of 5,4138 ha of Uteikiai gravel and sand deposit in Utena district, defines further quarry extractions - about 50 thousand. m3 per year. It also provides information on expected air pollution abatement measures: at the edges of the used area along the outer contour of the mining sky pole, a soil embankment of up to 3 m will be pushed to create a barrier to dust dispersion and deposition. Since the same quarry has been operated in the past, it is assumed that the same measures have been taken in previous quarries. Depending on the use of the air pollution abatement measure, the amount of sand and gravel extracted in the quarry is classified as 'Low to medium emission level'.

**Kiauliupis III gravel and sand reservoir** The new area was planned to be operated by Utenos gelžbetonis Ltd. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, 2012 recommendations regarding the environmental impact assessment[[31]](#footnote-31) of a 0.51-hectare reservoir, defined planned gravel extractions are 50 thousand m3. It is also planned to water the quarries and gravel roads during the drought season. 3 m high embankments will be built to limit the release of dust into the environment, at the borders of the area along the outer contour of the mining sky path. Taking into account the use of the planned measures, the useful resources of the Kiauliupis III pool are attributed to the low to medium emission level.

**Kiauliupis gravel and sand reservoi II** was planned to be operated by Šilinė Ltd. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, 2012 recommendations regarding the environmental impact assessment[[32]](#footnote-32) of a 10.77-hectare reservoir, defined planned gravel extractions are 50 thousand m3. Planned air pollution abatement measures are no different from those discussed earlier: watering of the roads and dredging of dirt soils up to 3 m high at the border of the area used along the outer contour of the mining sky, limiting the spread of dust into the environment. According to the information provided, the amount of gravel and sand extracted in the quarry falls into the Low to medium emission level.

**Prūdupis sand and gravel reservoir** expansion was planned by Keldeva in 2016. According to the company's environmental impact assessment documents, the planned amount of useful resources excavated per year was 30 thousand m3. The documents also state that sand-gravel in quarries that is later loaded onto trucks has enough natural moisture, so dusting is expected to be minimal during both loading and transport. Most of the reservoir‘s resources are wet or damp, resulting in no dust at the time of digging. The average speed of a vehicle moving in the quarry will be about 10-20 km / h. At such speeds, roads are minimally dirty, and in the drought quarries and access roads will be watered. In addition, another protection measures to reduce air pollution - the quarry will be surrounded by a 3 m high barrier, which will be pushed along the edge of the mining area and will be covered by grass. Equipment will be used before the barrier, preventing dust spreading. After evaluating the above information, quarry extraction level is attributed to the low to medium emission level.

**Kantvainiai sand and gravel reservoir** was planned to be operated by Orgstatyba, based on 11th November, 2011 recommendations of Environmental Protection Department of Klaipeda Region of the Ministry of Environment of the Republic of Lithuania[[33]](#footnote-33). Defined planned gravel extractions are 100 thousand m3. In order to reduce dust during the dry season, it was planned to water the quarry paths with water, and to limit the speed of road transport on the roads of the quarry to 10 - 20 km / h. According to the information provided since 2012 Quantities of resources extracted are classified as 'Low to medium emission level'.

**Kvesčai sand gravel quarry** has been operated since 1999, and Rizgoniai sand gravel quarry has been operated since 1977 (both by Rizgonys Ltd)[[34]](#footnote-34). In 2008, the total productivity of both quarries was 2 million tonnes per year. After 2009 the market has been declining and the quantities extracted now amount to 1100-1200 thousand tonnes per year. After the restoration of independence, the company acquired advanced equipment that reduced energy consumption and thus emissions into the air. The company's website contains photos of equipment showing that the equipment is maintained in good condition (Figure 7).

Figure 5 Rizgonys Ltd equipment used in gravel-sand quarries



Source: UAB „Rizgonys“

The company has also implemented the ISO 14001: 2004 environmental management system certificate, which means that the company in its internal work system pursues its own environmental goals, ensures compliance with environmental laws and norms. Assessed against this information, it is assumed that the amount of gravel and sand extracted by the company during the period considered (since 2000) is at the low to medium emission level.

Simuva Ltd was established in 2006. The company operates a total of 8 sand gravel deposits: **Agluonėnai, Gelžiniai II, Pozingiai, Pozingiai II, Šnaukštai II, Spengiai, Birbinčė, Šnaukštai V. According** to 2013 the final conclusion "on the environmental impact assessment of the operation of the sand and gravel site in Pozingiu II"[[35]](#footnote-35) at the time anticipated production volume was 80 thousand m3 a year (assumed to have remained until now, as the quarry is in operation). The conclusion also provides for the irrigation of raw materials for the removal of roads and gravel roads along the farmstead.

According to 2010 conclusion of the report "on the use of Gelžiniai II gravel and sand deposit, in Gelžiniai village, Klaipėda district‘, the production volume was estimated to be about 70 thousand m3 of minerals per year. It is anticipated that the quarry will be surrounded by a 3-meter-high embankment that protects against the spread of dust to surrounding areas.

Assessing that the two quarries operated by the company include measures to reduce air pollution, it can be assumed that other measures are also being applied. The use of the abatement measures to extract the extracted resources in these quarries is considered to be a low to medium emission level.

**Birbinčiai gravel-sand** reservoir was planned to be operated by Vakarų verslo projektai Ltd. Based on Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania, 6th of May, 2010 report ‘on the use of Birbinčiai gravel and sand reservoir, Birbinčiai village, Klaipėda district, environmental impact assessment[[36]](#footnote-36), ‘ planned extractions were 50 thousand m3 of minerals. It was also recommended to surround the quarry by a 3-meter-high embankment that protects against the spread of dust to surrounding areas. Sand and gravel excavated in the quarry are attributed to the low to medium emission level due to the embankment installation.

**Šnaukštai 2 gravel and sand** reservoir was planned to be operated by Šnaukštų karjeras. According to the Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania in 2012 January 11 Conclusion ‘on the Environmental Impact Assessment of the Use of the New Area of Gravel and Sand Scale in Šnaukštai 2‘[[37]](#footnote-37) planned extractions are 70 thousand m3. The following recommendations were also included: (a) The quarry will be surrounded by a 3 m high soil embankment that protects against dust spreading to surrounding areas; (b) 200 m of the closest road will be watered to reduce dustiness; speed limit for quarry and gravel road vehicles. The resources used in quarries are attributed to the low to medium emission level.

### Sand

**Rasiai I reservoir** was planned to be operated by EPT transportas Ltd from 2015. According to ‘The special use plan for the share of sand resources of the Vilkaviškis district Rasiai I**‘**[[38]](#footnote-38) the company planned to extract 50 thousand m3 and operation duration was 6 years. The special use plan also states that the extracted sand from the natural moisture does not create dust, and that quarries would be watered during droughts. The amount of sand that is used in quarries is attributed to the low to medium emission level..

**Saliniai II sand reservoir** was planned to be operated by Turto plėtra from 2012. According to the Ministry of Environment of the Republic of Lithuania Utena Region Environmental Protection Department in 2012 conclusion[[39]](#footnote-39) the amount of extractions per year is estimated to be 50 thousand m3. Planned Quarry Operation was 1-2 Years (2013-2014). Recommendation was provided on reducing the impact of the proposed economic activity on the air: protective embankment around the quarry, watering the roads during drought. To reduce the technogenic load, efficient modern machinery is used for digging, loading and transporting significantly less diesel fuel per unit of ground volume. Taking into account the planned measures, the amount of sand extracted in this pool by Turto Plėtra Ltd is assigned to the low to medium emission level.

### Gravel

In the decision 2012 Julmesta Ltd decision ‘on the Opportunities for Planned Activities in the Kalnėnai III Gravel Field of Jurbarkas Municipality‘[[40]](#footnote-40), planned extractions of gravel were 30 thousand m3. The decision also states that gravel that is loaded with directly into cars has enough natural moisture and therefore does not dust. The average speed of the vehicles in the quarry was limited to 10-20 km / h, resulting in no dust caused by moving vehicles. It was also recommended to water the quarries during drought. The quarry would also be surrounded by a 3 m high soil embankment that will be pushed along the outer edge of the mining site. The heavier particles that have been released into the air do not spread outside the quarry but settle after a while. Having assessed all the measures presented in the decision, it can be stated that the amount of gravel excavated by Jurmelsta Ltd is attributed to “Low to medium emission level” for the whole operating period (from 2012)).

**Didžiasalis gravel reservoir** was planned to be operated by Švenčionėlių keramika from 2014. According to the Ministry of Environment of the Republic of Lithuania Utena Region Environmental Protection Department conclusions on environmental impact of reservoir in 2014[[41]](#footnote-41) the amount of gravel to be extracted per year is estimated at 150 thousand m3. The assessment also provided planned measures to reduce the impact of economic activity: 3 m embankment and watering of the roads. Planned activities have been accepted since 2014 and taking into account the anticipated measures to reduce air pollution, excavated gravel quantities are classified as "Low to medium emission level".

UAB Melingos keliai planned to operate **Nadūnai gravel field** in 2014. According to the conclusion of the selection of Utena Region Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania "On the Impact Assessment of the Use of a Part of Nadūnai Gravel Field in Zarasai District Zarasai District" [[42]](#footnote-42) estimated annual gravel extraction - 50 thousand m3. The conclusion was the following: watering of quarry's inland and production roads according to the need during drought and the use of heavy-duty vehicles to transport products, thereby reducing the intensity and dustiness of transport movements.

**Derviniai II gravel reservoir** was planned to be operated by Turto plėtra from 2013. According to the conclusion of the Ministry of Environment of Utena Region Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania "On the Environmental Impact Assessment of the Use of Derviniai II Gravel Field in Zarasai District[[43]](#footnote-43) the company has planned to dig 50 thousand tons of gravel per year. It also provided recommendations of adapting the roads for heavy vehicles and also watering them during dry periods. It is also expected that all resources, according to the planned volume of mining, will be excavated within 4 years (until 2017-2018). Depending on the planned measures, the amount of gravel excavated by the company from the reserve is attributed to the Low to medium emission level.

**Kylie gravel reservoir** was planned to be operated by Prima Parte from 2013. According to the recommendations of the Ministry of Environment of Utena Regional Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania ‘On the Environmental Impact Assessment of 17.74 ha of Utena District Quarry Gravel Reservoir‘[[44]](#footnote-44), the company planned to dig 50 thousand m3 gravel. According to the recommendations, 3-meter-high embankment would be formed around the gravel field, to reduce the potential emission of air pollutants to the surrounding areas. It was also planned to use modern equipment and mechanisms with internal combustion engines complying with EURO III emission standard. Heavy-duty dumpers would be used to transport raw materials, which would reduce emissions to the air, and lower number of trips would reduce the amount of dust that can be caused. Roads would be watered during draughts to reduce dust; transported produce would also be covered by tents. All sifting and crushing equipment are planned to be used in the quarry with dust extraction through the filtering equipment, which would ensure minimal emissions into the air. Finally, it was anticipated that the speed of transport in the area and its access will be limited to 20 km / h. After considering all planned air pollution abatement measures and accepting that the company implements them, the excavated gravel quantities are classified as “Low to medium emission level”.

**UAB „Kurklių karjeras“** in 2013 has planned to start exploiting a gravel quarry in Kurkiai district of Anykščiai district. According to the conclusion of the Ministry of Environment of Utena Region Environmental Protection Department of the Ministry of Environment of the Republic of Lithuania “on the assessment of the impact of the construction and operation of gravel quarry of UAB “Kurklių karjeras”[[45]](#footnote-45) on the 5.9780 ha land plot, the amount of gravel planned to be excavated per year - 100 thousand. m3. Quarry roads were planned to be watered during drought protection during drought. At the edges of the used area along the outer contour of the mining sky path, it was planned to move up to 3 m height of dirt embankments, which would also limit the spread of dust to the environment. Depending on the intended use and assuming that they are being used in the course of their career, gravel quantities extracted from 2013-2014 are classified as 'Low to medium emission level'.

**Gravel reservoir in Anykščiai,** Antanuvka was planned to be operated by Kazys Daškevičius. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania. August 24 the conclusion of the assessment ‘regarding the installation and operation of the gravel quarry on the 1.19 ha of land in the Antanuvka district of Anykščiai district., Environmental Impact Assessment (EIA)[[46]](#footnote-46) estimated the amount of useful resources to be extracted per year - 20 thousand m3. It was planned to excavate the quarry for 5 years (approx. Until 2016-2017). Air pollution abatement measures are the same as for other sand-gravel quarries: irrigation of quarry roads during drought and formation of soil dykes at the borders of the area used for limiting dust dispersion. The quantities of gravel extracted from these planned measures are classified as 'Low to medium emission level'.

Most of the surveyed companies that use sand and gravel deposits are applying air pollution abatement measures (in many cases identical: embankment formation and watering), therefore it is assumed that all extracted sand and gravel quantities in Lithuania, except for Medium to high emission level in this section is a low to medium emission level (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.a).

### Peat

It is an organic sedimentary rock that is formed from marsh vegetation residues (lichens, rushes, chimneys, etc.) and is a highly flammable substance. Peat builds up in swamps, where surplus water collects, and is extracted by draining.

Peat, both after suction from the surface of the wetlands and after drying on the field, usually contains 45-50% moisture. This is a wet material, so it creates minimal dusting. Specifically, swamps or larvae are not watered for dust deposition, they are dehydrated to produce peat. Thus, the level of emissions in peat extraction can only be determined by evaluating the following aspects: drainage of peat from gravel roads, wear of used equipment, introduction of environmental management systems or application of other measures (prohibition of stacking in case of strong wind).

**Black Peat Pond (Rokiškis area)** According to Nereta Ltd 2016 planned activity EIA report[[47]](#footnote-47), , the raw material in the reservoir is 45-55% moist and should not dust the report also states that the separate sections of gravel roads used for peat transportation are expected to be regularly watered to reduce dust. Watering will reduce dust by up to 90%. According to the report, it was planned to use an advanced technique adapted to work in peat quarries. Taking into account the humidity of peat, irrigation of gravel roads and the use of good quality equipment, the amount of peat extracted by Nereta Ltd is classified as “Low to medium emission level”. Actual quantities of the extracted material are not known, however, the EIA report recommended 100 thousand m3 excavations per year.

**JSC „Rėkyva“** is one of the oldest and largest Lithuanian peat industry companies, operates Rėkyva (since 1964) and Degesynė peatlands[[48]](#footnote-48). Ltd "Rėkyva" uses two production methods – *crumb* and *lump*. Rėkyva JSC crushed peat is collected from April to September with a 1-2 cm layer of sludge from the surface of peat bog. The 2 cm thick layer of peat that has been teared off before the deck is turned over and dried several times until only 45-50% moisture is left in the layer. Then the Pneumatic Pumps PPF-5 are used and peat are poured into stacks. The stacking operation is performed by stacking machines OF-8. Stacking is forbidden in the case of strong winds, as this would result in high peat losses. At the same time, avoiding stacking in strong wind also reduces emissions.

The company provides information on the constantly renovated, upgraded equipment on its official website, so it is understood that the equipment used is not worn out, maintained and does not increase PM emissions.

According to the data of the year 2015 JSC Rėkyva produces 400-500 thousand m3 of peat. According to 2014 data for peat extraction development, in 2014-2016 the company expected to increase peat production to 700-800 thousand m3 per year.

Having assessed the peat extraction activities of AB Rėkyva from publicly available information, it is assumed that the amount of peat extracted by the company during the whole period of 2000-2017 is assigned to “Low to medium emission level”.

Another large group of companies participating in peat extraction industry in Lithuania is **Klasmann-Deilmann Ltd**. The group has 5 companies in Lithuania. The Group of companies operates peatlands in Šilutė, Tauragė, Marijampolė, Kaunas and Skuodas districts. Klasmann-Deilmann Ltd Fuel peat is transported from the fields to the loading areas by local rail (not a gravel road that should be watered). Fuel peat is stored in stacks covered with film. The film helps to reduce peat loss and PM emissions due to wind. Peat extraction equipment, excavators used by the group of companies are in good condition, not worn out and well-maintained (Figure 8).

Figure 6 Klasmann-Deilmann Ltd group peat extraction equipment



Source: UAB „Klasmann-Deilmann“ 2014

According to 2014 The Peat Pollution Prevention and Permission Department of Klaipeda recommendations ‘on the use of Šilutė District Municipality Aukštumala peat field part, Kintai, Šilutė district environmental impact assessment‘[[49]](#footnote-49) Klasmann-Deilmann Šilutė Ltd planned annual amount of peat was defined as 57 thousand. m3.

Klasmann-Deilmann Gedrimai Ltd is a different part of the group that has been operating Gedrimai peatland since 2005. In 1975, 300 thousand tons of peat were extracted in the peatland. Such peat extraction volumes (up to 300 thousand m3 per year) remained the same in later years. According to the company‘s website, the extraction of light peat has been decreasing in recent years, while the depth of peat bog decreases with the operation of the Gedrimai reservoir. Part of the production fields are being prepared for recultivation.

All quantities of peat produced by Klasmann-Deilmann Ltd within the period 2000-2017 are classified as "Low to medium emission level", due to the good condition of the used equipment, the transport of film-coated storage stacks and peat on local railways (non-gravel roads).

**Butkai peat reservoir[[50]](#footnote-50)** is located in the southern part of Telšiai district, 17 km south of Telšiai and 1.3 km east of Žarėnai town center. Digging started in the top part of the peat bog in 1965. The peatland was thoroughly cleaned in 2002, and since then it has been operated by Arūnas Adrijauskas company. About 50-60 thousand m3 of peat is extracted from the land every year. In the company, peat is collected by pneumatic peat collection equipment, pressed into big bags on pallets (big bales) containing 5.5 m³ of peat each. One big bag weigh about 700-1000 kg. Peat moisture in big bags is no more than 50%. The company's pictures from 2011 show that peat extraction equipment is not worn out and is still in good condition (Figure 9).

Figure 7 The equipment used by A. Adrijauskas in Butkus peatland



Source: Butkų durpynas.

There is no more publicly available information about the state of the existing equipment or the use of PM reduction measures in A. Adrijauskas' Butkai peat bog. However, from the information collected on the operation of the Butkus peatland, it can be assumed that the quantities extracted are classified as 'Low to medium emission level'.

**Ežerėlis peatland II** was planned to be operated by Aloyzas Blaževičius. This was approved by the decision of the regional environmental protection department of Kaunas region, 2009-02-19 No.KR12-482 / 14[[51]](#footnote-51). Planned amount of peat produced in each year was set to 45 thousand m3. Also, peat will be excavated directly from the bed, and its humidity will be around 80%. According to the report, transported peats have high degree of humidity, and the products transported during the drought will have to be covered with tarpaulins that protects the produce from the dust.

Based on the above information, it is assumed that the amount of peat extracted will be “Low to medium emission level.

**Bajorai peat reservoir** was planned to be operated by Gavyba Ltd from 2014. According to the Environmental Protection Agency's Department of Pollution Prevention and Permit Vilnius Division in 2014 Assessment Conclusion “On the Environmental Impact Assessment of the Use of Resources in the Bay of Bajoras (148 ha)[[52]](#footnote-52) it is planned to achieve an annual peat extraction of 100 thousand m3. The production was planned to be transported using the local gravel road. The entire production was planned to be transported during the autumn, when the surface of gravel roads is damp and do not dust. According to the assessment, 50 m distance was recommended from each farmstead, which is about 20-24 m from the gravel road, speed limit was also defined as 30 km / h. Vehicles transporting the peat would also be covered by tarpaulins. These planned measures would reduce dustiness. The amount of peat extracted from Gavyba Tad in Bajorai from 2014 onwards was considered to be 'Low to medium emission level'.

**Naujienos peatland** is in Vilnius area, Trakai district, 20 km south of Trakai, Paluknio area, 0.5 km southwest of Madžiūnai village. Quarry was planned to be operated by Ferta Ltd. According to the Environmental Protection Agency's Integrated Pollution Prevention and Authorization Department of Vilnius, the assessment ‘on the environmental impact[[53]](#footnote-53) of the use of the Naujienos peatland (138.48 ha)‘ annual amount of extracted peat was set to 100 thousand m3. The assessment also states that peat would be collected as soon as it has dried, so it would practically not dust on the surface of the peatland. The peatland is surrounded by large forests on all sides, so there are no strong winds. Peat stacks will be pushed at the edges, polyethylene film would also be covered to reduce dust, as well as vehicles transporting the produce. Based on the planned air pollution abatement measures and assuming that such measures were used after the commissioning of the pool, it is assessed that all the Ferta peat extracted from the Naujienos are at the low to medium emission level.

In 2014, UAB legal planned to start exploitation of **Zalūbiškio Peat Pool**. According to the Panevėžys Division of the Pollution Prevention and Permission Department of the Environmental Protection Agency in 2014 The conclusion of the selection “due to the environmental impact assessment[[54]](#footnote-54) of the Zalūbiškis peat pool in Rokiškis district” provides for the amount of peat extracted per year - 30 thousand. m3. It is assumed that this amount of peat has been extracted from this company since 2015. The conclusion mentions that the extracted peat will be transported to the customer's production base during the autumn and winter months. Although it is not mentioned whether the exit route is asphalted or gravelly, leaving the production during the autumn-winter months due to the natural humidity of the seasons reduces the dustiness of the road, rather than leaving during the dry season - spring-summer. For this reason, the amount of peat extracted (planned to be extracted) from the Zalūbiškis peat field is attributed to “Low to medium emission level”.

**Paraisčių peat field** is exploited since 2003 by the company UAB Poraistė. According to the Department of Environmental Protection of the Department of Pollution Prevention and Permit of Utena, the conclusion of the selection "regarding the environmental impact assessment of expansion of the extraction areas of Paraisčiai peat field in Anykščiai district" was to extract 30 thousand. m3 of peat per year. It is also said that the peat extraction season will begin in mid-May and last until the end of August. Only after the end of the peat extraction season (after the end of the dry season) will the peat from the stacks be transported to a production facility where it will be packed. Due to the fact that the peat was to be transported only after the end of the production period, when the dry season ended, the dust rising due to the transportation is reduced, therefore the amount of peat extracted from the Paraisčiai peatland UAB “Poraistės” since the commencement of operation in 2003[[55]](#footnote-55) (30 thousand m3 accepted) are classified as low to medium emission level.

The majority of the surveyed companies operating peat fields use air pollution abatement measures; therefore, it is assumed that all quantities of peat extracted in Lithuania, except for the “Medium to high emission level” assigned in this chapter are “Low to medium emission level”.

### Aplinkos vadybos sertifikatai

Some companies in Lithuania that have been operating quarries have a certificate of the environmental management system standard ISO 14001. The models indicate what elements of the management system the company has to implement in order to achieve the environmental objectives. This certificate means that the company must ensure its own environmental policy, ensure compliance with environmental laws and legal norms. It can be assumed that companies with these standards use air pollution measures in their careers and in pursuit of their environmental goals. Quantities of such companies can be attributed to the low-medium emission level. Some quarrying companies in Lithuania that have the ISO 14001 environmental management standard[[56]](#footnote-56):

* Ltd „Hidrosta“[[57]](#footnote-57);
* Ltd „Rizgonys“;
* Ltd „Kamesta“[[58]](#footnote-58);
* Ltd „Arunta ir Ko“[[59]](#footnote-59);
* Ltd „Kauno keliai“[[60]](#footnote-60);
* Ltd „Kauno tiltai“, nuo 2007 metų[[61]](#footnote-61);
* Ltd „Edrija“[[62]](#footnote-62);
* Ltd „Alkesta“ nuo 2018 m. gegužės[[63]](#footnote-63).

## The proportion of minerals excavated in quarries " Medium high to high emission level" each year

Input data for 2000-2017 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section „**2.A.5.a Quarrying and mining of minerals other than coal”** tables **„Table 3.3 Tier 2 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal; medium to high emission level”.**

**Brief description of the process:** Publicly available information on the use of air pollution abatement measures is not always available. Where specific information on the operation of company quarries has been found but no information has been provided on the use of air pollution abatement measures, the quantities of resources extracted are assigned to the Medium to high emission level. The absence of the following air pollution abatement measures means that the emission level is Medium to high:

* Watering quarries and gravel roads;
* A 3 m high embankment (for limiting the spread of dust) is installed around the quarry);
* Using tents to cover transporting vehicles;
* Transporting produce after draught periods ends (applicable for peats);
* Good quality equipment;
* No stacking in strong winds (relevant for peats);
* Other causes or reasons for the absence of dust (e.g., sufficiently humidity in minerals).

### Chalk marl

Chalk is a carbonate rock made up of calcite, dolomite and clay, where its quantity is ranging from 30 to 50%. It is usually found in Jurbarkas, Varėna, Vilnius, Kaunas and Šalčininkai districts [[64]](#footnote-64). In 1997 two reservoirs with small resources were explored - about 5 million t. In 2006 there were already seven of these deposits [[65]](#footnote-65). Juodžių Telkinys (Vilnius district) was also exploited until 2002, its chalk was used for acid soils [[66]](#footnote-66). However, the chalk marl currently is not mined.

Chalk marl and Limestone reservoirs are not used because their area of application is the same as limestone reservoir in Akmene district. Resource from this reservoir is considered to be of lower quality[[67]](#footnote-67).

In Lithuania, chalk marl was exploited only in 1999, 2001 and 2007 - 0.55 thousand was excavated each time (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.a) from Juodžių Telkinys. No publicly available information on quarry equipment, its wear or applied particle deposition measures has been found, therefore the quantities of minerals extracted during that year can only be attributed to the medium to high emission level.

### Žvyras

**Adomava gravel reservoir** is operated by Zarasai ST since 2011. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania 2013 assessment of the change of the equipment in Adomava reservoir and its impact on the environment[[68]](#footnote-68) the early amount of excavations was set to 50 thousand m3. It is understood that the same amount has been exploited since the start of excavations in 2011. There was no change in the amount of resource exploited, however the equipment was updated since. As no information is provided on dust deposition measures, the gravel quantities excavated in Adomava are classified as “Medium to high emission level”.

### Sand

**Juodbaliai sand pool** was planned to be operated by Kupiškio plytų gamykla Ltd from 2013. According to the conclusion of the Ministry of Environment of the Republic of Lithuania, Utena Region Environmental Protection Department assessment on the environmental impact the new area (1.8 ha) of the Juodbaliai pool in Anykščiai district[[69]](#footnote-69), the company planned to dig 30 thousand tons of sand. It is also mentioned that the pool will be operated for 5 years. However, there is no publicly available information on the air pollution measures used, and the amount of sand produced by this company is classified as 'Medium to high emission level'.

**Vidugiris sand pool** Excavations of this pool were started by Vigantas Stipinis in 2012. According to the final assessment of the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania, on the Environmental Impact of the use of the Vidugiris Sand pool in Anykščiai District[[70]](#footnote-70) , the amount of sand exploited is expected to be 30 thousand m3 per year. The assessment also mentions that the production will be transported using gravel roads, but there is no information of how particulate matter emissions would be reduced. As a result, the amount of sand extracted from Vigantas Stipinis sand pool is attributed to ‘medium to high emission level‘.

### Peat

**Degutinė peat pool** is exploited by Poraistė Ltd (company was established in 1995) since 2003. According to the Environmental Protection Agency Pollution Prevention and Permit Department of Vilnius District assessment on the environmental impact of the replacement of equipment used in Degutine peat pool, the estimated volume of peat extraction per year is 40 thousand m3 (the number has not changed since 2003). The assesment states that the transportation of dried peat from the exploitation field to the production site would take place from mid-May to the end of August, which means it would be completed during the dry season. There is no information on air pollution abatement measures. In the production base, peat is stacked into stacks or warehouses, later packed and then packaged for transportation, using regional road with gravel cover. Taking into account that there is no information on air pollution abatement measures for the transportation of peat to the production base and watering of gravel roads, and that peat is transported during the dry period when the amount of dust increases, it is assumed that the amount of peat extracted from the pool is ‘medium to high emission level‘.

**Imbradas peat pool** was planned to be exploited by Turto Plėtra from 2014. According to the Environmental Protection Department of Utena Region of the Ministry of Environment of the Republic of Lithuania in 2014 assessment of environmental of the use of the Zarasai district Imbradas peat pool[[71]](#footnote-71) , expected produce of peat is 40 thousand tons per year. The assessment also states that dried peat would be transported to a production base (3 km away from the pool) using local gravel roads. As there is no information about the used tarpaulins, watering of gravel roads or the season when the peat will be transported, it is assumed that the amount of peat extracted would be at the ‘medium to high emission level‘..

## Total quantity of minerals excavated in quarries

Total quantities (according to the Geological Survey annual reports[[72]](#footnote-72), [[73]](#footnote-73), [[74]](#footnote-74), [[75]](#footnote-75), [[76]](#footnote-76)) of excavated minerals falling into low to medium and high level of emissions are given in the attached document (see MS EXCEL FILE OTHER ECONOMIC SECTORS) 2019 11.XLSX, SHEET 2.A.5.A).

Since the emissions of minerals are in units of weight (Mg or otherwise), when converting to volumetric units, density of minerals is required. Table 2.3 shows the approximate density of the minerals in question[[77]](#footnote-77) (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.a).

Due to low response rate of survey respondents, the survey was not repeated in 2020.

## Results of the surveys

In the previous reports, 47 companies for the survey were identified, however only 22[[78]](#footnote-78) (or 47%) had their contacts publicly available. All of these companies were sent a data request, as well as follow-up email to encourage respondents to provide data. 2 respondents provided data upon request.

The survey collected data about 321 thousand m3 of gravel and 8 318 thousand m3 of dolomite excavation over the period of 2005-2018 (or the average of 48 and 594 thousand m3 per year, accordingly). Collected data is provided (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.a). The data collected during the survey can be used for the accounting purposes, but not for drawing conclusions about the entire sector.

# Construction and demolition (NFR 2.A.5.b)

According to 2016 Technical Guide, it is recognized that the construction of infrastructure and buildings is a significant source of particulate matter (PM). In most cases, environmental concentrations of PM10 increase in and around the construction site. The majority of the construction activity takes place in urban and other densely populated areas. In Lithuania, most of the construction also takes place in the largest expanding cities: Vilnius, Kaunas and other.

Input data for 2000-2017 Emission factor required from EMEP / EEA Technical Manual (version - 2016) **„2.A.5.b Construction and demolition”** to use the tables below:

* „Table 3-1 Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition –Construction of houses”,
* „Table 3.2 Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Construction of apartment buildings“
* „Table 3.3 Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Non-residential construction“
* „Table 3.4 Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Road construction“

**Brief process description:** Soil and meteorological data required for this sector are available at the Lithuanian Hydrometeorological Service and the Lithuanian Geological Survey.

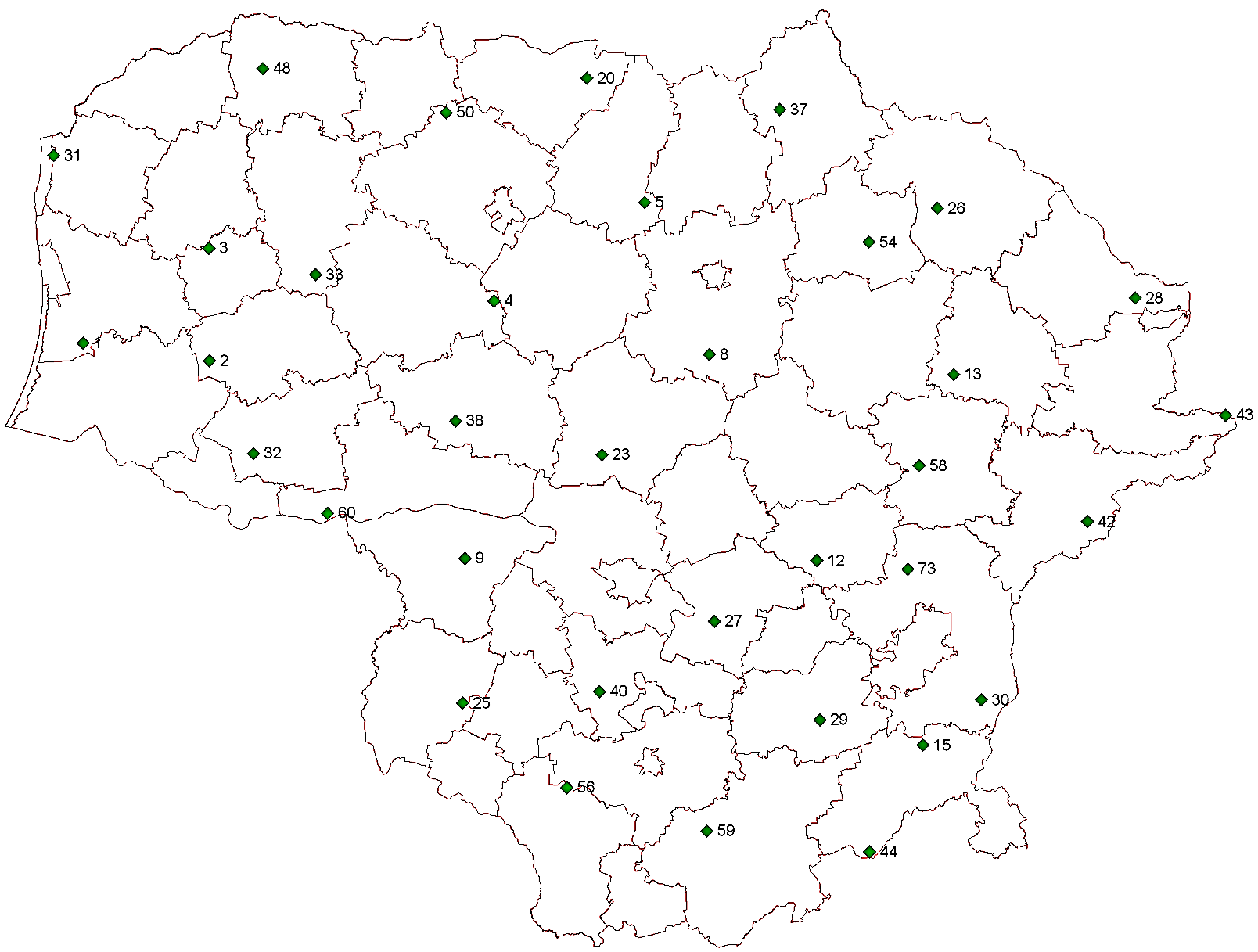
**Average ‘Soil silt content, %‘ in Lithuania:** Average soil silt content can be calculated using soil monitoring data provided in the Lithuanian Geological Survey. The following data is kept in the archives of the Lithuanian Geological Survey: State Field Soil Monitoring (2011-2017 Program) / Gregorauskiene V .; Lithuanian Geological Survey. - Vilnius, 2015. - 203 + CD: Figure 13. - (LGT Foundation; No 1990)[[79]](#footnote-79).

Results of soil biometric analysis from 2011 and 2012 are presented in .

Although the aforementioned presents only the data of the samples for 2011-2012, according to Virgilija Gregorauskienė, the Chief Specialist of the Pollution Impact Assessment of the Lithuanian Geological Survey, ‘soil parameters change very slowly, so the 10-year period for soil monitoring is normal practice‘. As there is no newer or older data on soil dust, data for the years 2011-2012 can be used for calculating emissions for the entire period of 2000-2017.

The excavation samples covered the whole territory of Lithuania during the monitoring. Their location in Lithuania is presented in Figure 10 and Figure 11.

Figure 8 Lithuanian Field Monitoring in 2011-2012 Locations



Source: Lithuanian Geological Service

Figure 9 2011-2012 monitoring bores coordinates and municipalities

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Bore No.** | **Bore coordinates** | **Municipality** |
| 1. | 10 | 463511.44, 6060620.29 | Marijampolės |
| 2. | 11 | 552392.94, 6149452.64 | Anykščių rajono |
| 3. | 14 | 547282.78, 6023914.44 | Varėnos rajono |
| 4. | 16 | 345455.46, 6131642.44 | Šilutės rajono |
| 5. | 17 | 344060.36, 6202831.7 | Kretingos rajono |
| 6. | 19 | 412201.4, 6214518.58 | Telšių rajono |
| 7. | 24 | 459319.49, 6108930 | Jurbarko rajono |
| 8. | 34 | 427613.68, 6202151.19 | Jurbarko rajono |
| 9. | 35 | 487671.73, 6183953.09 | Radviliškio rajono |
| 10. | 36 | 522826.98, 6209667.22 | Pasvalio rajono |

Source: Lithuanian Geological Service

Monitoring Data, consulting measures, Lithuanian Geological Survey Specialist Reviews Virgilija Gregorauskienė emails are attached in the annex.

Figure 10 Results of Soil Granulometry Study (2011-2012) [[80]](#footnote-80)



Source: Lithuanian Geological Service

According to the Technical Manual (version - 2016), the average soil dust during construction damaged area can be found between the natural undamaged soil dust and sand dust, as sand is the most commonly used in construction. The amount of sand dust in silt content is about 12%. Based on the Technical manual (2016 version), soil dust contains 0.002-0.078 mm (or 0.063 mm according to ISO definition) of particles, therefore amounts of all surface dust are summed up appropriately. The total average soil silt in Lithuania is obtained by calculating the arithmetic mean of 10 surface soil samples, the results are given in MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.b.

Then, the average soil dust soil silt content in Lithuania is:

%. (1)

**Average yearly „Thornthwaite precipitation-evaporation index“ in Lithuania:** the formula given in the Technical Guide (version - 2016), requires two types of meteorological data:

* monthly average rainfall of the whole territory of Lithuania, mm (2000–2017 years);
* monthly average temperature of the whole territory of Lithuania, ℃ (period 2000–2017)).

These meteorological data have been transmitted directly to the Environmental Protection Agency and are not published in this data collection report because it is considered to be a commercial secret.

**Road construction data**. According to Guidebook 2019, this category includes emissions from road construction. Data required for calculations include length of newly built roads and average width of the road. Based on these indicators the total area affected is calculated.

Statistics of newly constructed roads is published by Department of Statistics. Length of newly built roads can be calculated as difference between the total length of current and previous year. It should be noted that in case where classification of road changes, negative values occur. In the emission calculation these instances should be regarded as 0 (no new roads were built).

Average width of the road. Factual data on road width is not publicly available. Law on roads[[81]](#footnote-81) of Lithuania states the minimal requirements for lanes, which can be used as an estimate of road width. The aforementioned law classifies the roads into categories, however, there is no available data on the length of the roads, by categories (Department of Statistics provides different disaggregation of road length). It is accordingly suggested that average road width would be calculated based on category requirements for national roads and local roads. Estimates of average road width are provided below.

Figure Minimum width of the lane by category of road, in meters

|  |  |  |
| --- | --- | --- |
| **Kategorija** | **Valstybinės reikšmės keliai** | **Vietinės reikšmės keliai** |
| I kategorija (įskaitant automagistrales) | 39.00 | 15 |
| II kategorija | 28.00 | 12 |
| III kategorija | 22.00 | 10 |
| IV kategorija | 19.00 | 8 |
| V kategorija | 18.00 | N/A |
| **Vidurkis** | **25.20** | **11.25** |

Based on the calculations provided above, it is recommended to apply 25,2 meter average width for national roads and 11,25 meters for local roads. In case such data is not available, Guidebook 2019 is suggesting to use data from Germany – an average width of 36 meters. Taking into account different level of infrastructure development in these two countries, the estimated averages seem reasonable.

**City street and bicycle track construction**. It also suggested to include new city streets and bicycle tracks. This data published by Department of statistics since 2008. Length of newly built streets and tracks can be calculated as difference between the total length of current and previous year. It should be noted that in case where classification of streets or track changes, negative values occur. In the emission calculation these instances should be regarded as 0 (no new streets or tracks were built).

Average width of streets and tracks. Factual data on street and track width is not publicly available. Construction technical regulation[[82]](#footnote-82) of Lithuania states the minimal requirements for streets and tracks, which can be used as an estimate of the width. The aforementioned law classifies the streets and tracks into categories, however, there is no available data on the length of the streets and tracks, by categories (Department of Statistics provides just the total length of streets and tracks). It is accordingly suggested that average streets and tracks width would be calculated based on category requirements for streets and tracks. Estimates of average streets and tracks width are provided below. Based on the calculations provided in Figure, it is recommended to apply an average width of a city street as 27,4 meters and average width of bicycle tracks as 6 meters.

Figure minimal width requirements for city streets and bicycle tracks, meters

|  |  |  |
| --- | --- | --- |
| **Category** | **Main purpose** | **Minimal distance between the rL[[83]](#footnote-83) of the street** |
| 1. Motor traffic | 1.1. Fast traffic streets | 70.00 |
| 1.2. Main streets | 30.00 |
| 1.3. Servicing streets | 20.00 |
| 1.4. Support streets | 12.00 |
| 1.5. Urbanized, densely built territories and old towns. | 5.00 |
| 2. Non-motor traffic | 2.1. Main pedestrian and bicycle streets and tracks | 7.00 |
| 2.2. Support pedestrian and bicycle tracks | 5.00 |
| **Average city street width** | | **27.40** |
| **Average bicycle track width** | | **6.00** |

Average street, track and road width estimations are provided in file attached (see MS EXCEL FILE OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.XLSX, SHEET 2.A.5.b),

# Storage, handling and transport of mineral products (NFR 2.A.5.c)

Input data for 2000-2017 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section „2.A.5.c Storage, handling and transport of mineral products” for table „Table 3.2 Tier 2 emission factors for source category 2.A.5.c Storage, handling and transport of mineral products, uncontrolled storage“.

**Brief description of the process:** The largest Lithuanian manufacturer of ceramic products are Dvarčionių Keramika Ltd (production since 1888, got bankrupt in 2016), AB Palemono Keramika (production since 1923),Rokų Keramika Ltd. There is no publicly available information on the storage of the products, the quantities produced or the means used to reduce air pollution. The largest stone wool companies in Lithuania are Paroc Ltd(1997), Rockwoll Ltd (1995), Saint-Gobain JSC Construction Products, all publicly available information is presented below.

**Total area of ​​mineral products** (clay or ceramics, stone wool, silicate bricks and blocks) **stored without applying any air pollution abatement measures; ha:** From the data of Lithuanian companies below, it can be seen that all of them pack their production the majority is packed in plastic impermeable packaging, so the dispersion of the four particles is minimized. Where packing is tight, air pollution during storage is close to 0. In addition, the products are usually stored indoors, not in open areas, so that the production is not affected by unfavorable weather: rain, wind, snow and so on. Indoor storage helps reducing dust dispersion. Taking all of these aspects into account, it is assumed that storage of stone wool products and ceramics products of companies belonging to sector 2.A.5.c in Lithuania, is controlled by air pollution abatement measures. Thus, emission factors in Table 2.A.5.c are not used for emission calculations

Input data for 2000-2017 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section **2.A.5.c Storage, handling and transport of mineral products Table 3.3 Tier 2 emission factors for source category 2.A.5.c Storage, handling and transport of mineral products, controlled storage**:

**Brief description of the process**: The largest Lithuanian manufacturer of ceramic products are Dvarčionių Keramika Ltd (production since 1888, got bankrupt in 2016), AB Palemono Keramika (production since 1923),Rokų Keramika Ltd. There is no publicly available information on the storage of the products, the quantities produced or the means used to reduce air pollution. The largest stone wool companies in Lithuania are: Paroc Ltd(1997), Rockwoll Ltd (1995), Saint-Gobain JSC Construction Products, all publicly available information is presented below.

Total area of mineral products (clay or ceramics, stone wool, silicate bricks and blocks) stored with air pollution abatement measures, if:

**Ltd „Paroc“**. Information below discusses the activities of one of Lithuania's largest stone wool company Paroc Ltd, however there is no data on the storage of stone wool available in the company's IPPC permit[[84]](#footnote-84) The IPPC permit states that the stored stone wool is packaged, which means that storage is controlled - sealed packaging is one of the measures to reduce air pollution. In addition, Paroc Ltd has implemented an environmental management system ISO 14001, which applies to all activities of the company: purchasing, manufacturing and selling stone wool products. Environmental management system is integrated with ISO 9001 quality management system.

The management of the company has established and documented an environmental policy, which corresponds to the nature, scale and impact of the company's production, includes obligations for improvement and prevention of pollution, compliance with environmental laws and other normative documents. Every employee is introduced to the policy. PAROC produces 45,600 t / year of stone wool products (L1 works since 1997) , 45,600 t / year of stone wool products (L2 works since 2005) and 15120 t / year of et wool.

There is a picture on Paroc Ltd website of a factory warehouse in Sweden (Figure 13), which shows that one type of stone wool is packed in 12 pieces (each 3 pieces of stone wool mats) on pallets, and at least two pallets one on the other. It is assumed that stone wool is stored in Lithuania on the same principle.

From the picture above, it can be seen that the stored product is likely to be PAROC Hvac Fire Mat AluCoat LT mats[[85]](#footnote-85), with a density of 80 kg / m3. These are non-flammable wire mesh stone wool mats with reinforced aluminum foil coating (Figure 13). The dimensions of this product are provided in MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.A.5.C).

Figure 13 Picture of Ltd Paroc Swedish warehouse, product PAROC Hvac Fire Mat AluCoat LT



Source: UAB „Paroc“ 2019

The product dimensions of each company are listed on its website, but there is no more publicly available information about the storage of the product or the storage area.

**UAB „Rockwoll Lietuva“** one of the largest stone wool manufacturers in Lithuania. The company was established in Vilnius in 1995. The company's website provides information that some of the company's affiliates have chosen and installed certified environmental management systems ISO 14001 and EMAS. ROCKWOOL Group has developed its own environmental standards by providing safety procedures, liability and assessment methods. When a newly acquired plant is upgraded and adapted to the environmental standards of the group of companies, energy consumption and emissions per unit of insulation product are often reduced by 50%. Under its environmental policy, ROCKWOOL Group companies (including UAB Rochwool Lietuva) undertake[[86]](#footnote-86):

* Implement and continuously improve the environmental management system defining responsibility and management procedures.
* Ensure that the company's factories do not cause more serious problems to their neighbours than they do in the area, as well as in the housing sector.
* Observe the conditions set by the regulatory authorities. If this is not the case in at least one of these areas, companies must immediately inform the authorities and take action to ensure compliance with the conditions.
* To maintain an open dialogue with stakeholders: consumers, regulators, investors, employees, suppliers and neighbours - to ensure that relevant interests and requirements related to environmental issues are respected.
* Conduct an audit in the factories through the environmental unit of the group to contribute to the environmental performance of manufacturing companies.

Specific information on the areas of stored stone wool products is not publicly available, but there is a photograph of the company's warehouse (Figure 14), which shows that the production is packed in plastic packaging, which reduces the dustiness of production. It can also be observed that the production is stored in a closed warehouse, which reduces the spread of particulate matter compared to storing the production on the open ground.

Figure 14 Rockwool UAB Stored in Stone Wool



Source: Construction News. 2016

Depending on the information provided above, it can be assumed that Rockwool UAB's stone wool products are stored with air pollution control, controlled. However, there is no publicly available information on the areas or quantities stored in this company's production.

**UAB „Jašiūnų keramika“** In 1995 started to carry out economic activities - glazed and non-glazed tiles for fireplaces and furnaces, restoration bricks, tile and tile production - 141 t / year. Company IPPC[[87]](#footnote-87) mentions that ceramic products are packed (sealed packaging is an air pollution abatement measure) and removed. No information is available on the storage or storage area of ceramic products. The aforementioned permit also states that the company has not implemented the environmental management system ISO 14001.

Input data for 2000-2017 Emission factor required from EMEP / EEA Technical Manual (version - 2016) section **„2.A.5.c Storage, handling and transport of mineral products”** Tables **„Table 3.4 Tier 2 emission factors for source category 2.A.5.c Storage, handling and transport of mineral products, uncontrolled handling”** for application:

**A brief description of the process:** The Technical Guide (version - 2016) contains emission factors for uncontrolled decomposition only, emissions from controlled treatment are not calculated.

In Lithuania, the distribution of mineral products (ceramics, glass wool, silicate bricks) takes place indoors, usually dust extraction systems, air purification devices, which significantly (up to 99%) reduce emissions to the atmosphere from the room. However, in the absence of emission factors in the Technical Manual (version - 2016) and in the absence of national emission factors, emissions are not calculated for controlled mineral processing.

Total amount of mineral products (clay products or ceramics, stone wool, silicate bricks and blocks) treated uncontrolled (without anti-pollution measures):

**Ltd „PAROC“** is one of the largest stone wool manufacturers in Lithuania. Production has been carried out since 1997 by the L1 line and since 2005 by the L2 line. JSC "PAROC" design capacity: stone wool products (L1) - 45600 t / year, stone wool products (L2) - 45,600 t / year. Wet wool - 15120 t / year[[88]](#footnote-88). The combustion products on both lines are cleaned in the following ways: the gas is cleaned of dust by passing through a dry filter first. The gas then enters the burner, where the carbon monoxide burns, and the purification of the sulphur dioxide is carried out by the scrubber tower, with the addition of the substance - NaOH solution. After cleaning, the cleaned gas is discharged through an 80-meter-high chimney.

The melt from the bottom furnace through the ducts enters the centrifuge shafts where it is leached. The air stream is directed to the precipitation drum. At the same time, the fibers are sprayed with a binder and a dust binder. This creates a layer of stone wool. The gas-air mixture after precipitation is cleaned on a stone wool plate filter.

The stone wool layer continues to enter the required thickness of the conveyor system, from where it is sent to the heat treatment chamber. Here the binder polycondensates by blowing hot air. Outgoing gas from the polycondensation chamber is cleaned in the combustion system. Part of the purified gas-air mixture returns to the technology for heating the lamella of the heat treatment chamber.

After the heat treatment, the carpet reaches the cooling zone, where it is cooled by blowing air in the fan. Used air is cleaned with stone wool plate frame filters. The carpet is then cut to the required dimensions. Cut-off cuts are shredded and returned to production. The products are packed and transported to the finished warehouse.

Thus, air pollution abatement equipment is used during the production and processing of UAB Paroc stone wool, which means that the treatment is controlled and the emissions are not calculated due to the absence of emission factors.

**Ltd „Jašiūnų keramika“** is in the production and processing of ceramics for the purpose of reducing particulate matter emissions, an air purifier - cyclone - is used. Therefore, ceramic processing in this company is "controlled" and emissions cannot be calculated using 2016. The emission factor of Table 3.4 of this Technical Manual.

**Ltd „Rockwoll Lietuva“** one of the largest stone wool manufacturers in Lithuania. The company was established in Vilnius in 1995. On its website, the company provides information on the cleaning of fumes and gases produced during the production, processing before the discard[[89]](#footnote-89). Using filters means that stone wool processing has been controlled, so emissions are not counted.

According to the data of the reviewed companies, it can be concluded that all companies producing and treating stone wool or ceramic products in Lithuania use means of reducing air pollution. Therefore, emissions from uncontrolled handling should not be counted in sector 2.A.5.c.

# Other mineral products (NFR 2.A.6)

Activity not occurring in Lithuania.

# Storage, handling and transport of chemical pro-ducts (NFR 2.B.10.B)

Currently there is no possibility to apply Tier 2 and Tier 3 level methodologies. In order to apply Guidebook 2019 methodology, a separate research is needed. The goal of the research is to gather or estimate data required. The proposed methodology of said research:

* Based on the volumes handles, comprising a list of companies representing ~80% of chemical products stored;
* Conduct interviews with the representatives of said companies;
* Aggregate the data gathered and extrapolate data to represent the whole sector.

Taking into account current market prices for such services, the required budget fr such research is estimated at 45 000 – 70 000 euros (not incl. VAT). However, the cost of acquiring such data is considered as not proportional to potential gain from such analysis.

# Storage, handling and transport of metal products (NFR 2.C.7.d)

Input data for 2000-2017 Emission factor required from EMEP / EEA Technical Manual (version - 2016) section „2.C.7.d Storage, handling and transport of metal products” Table 3.2 Tier 2 emission factors for source category 2.C.7.d Storage, handling and transport of iron ore, uncontrolled storage” for application.

Input data for 2000-2017 Emission factor required from EMEP / EEA Technical Manual (version - 2016) section **„2.C.7.d Storage, handling and transport of metal products”** Tables **„Table 3.3 Tier 2 emission factors for source category 2.C.7.d Storage, handling and transport of iron ore, controlled storage”** for application.

**A brief description of the process:** In this sector, only the storage and processing of iron ore is examined at Tier 2 level. In Lithuania, iron ore is not extracted, it is only transported through Lithuania to other countries for a short period of time. Therefore, iron ore processing is not going on in Lithuania and emissions should not be counted, it can be labeled as NO - not occurring.

The largest companies in Lithuania transporting iron ore to other countries: : UAB „Klaipėdos konteinerių terminalas“, AB „Klaipėdos jūrų krovinių kompanija“ (KLASCO) ir AB „Lietuvos geležinkeliai“.

## Total iron ore stored with air pollution abatement measures, ha

Taking into account the air pollution abatement measures applied by the largest companies below in warehousing or storage in closed, closed containers, or iron ore pellets that do not remain stationary, it is assumed that all areas of the iron ore stored are equipped with air pollution abatement measures.

## Total iron ore stored with air pollution abatement measures, ha

**JSC „Lietuvos geležinkeliai“** AB Lietuvos Geležinkeliai has been counting its history since 1919, one of the most important in terms of transit. In consultation with Vilmantas Baltrukonis, a specialist of the environmental group of AB Lietuvos Geležinkeliai, it became evident that the revenue from the storage of iron ore is not accounted separately from the general storage service, so the area (ha) of iron ore stored in the company cannot be isolated[[90]](#footnote-90). Company representative has shown iron ore shipments volumes since 2012 (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.c.7.d), AB Lietuvos Geležinkeliai has no accumulated statistics of previous years and therefore could not submit. Consultations by email letters are provided in the annexes.

**JSC Klaipėdos jūrų krovinių kompanija (KLASCO)** is the largest stevedoring company in Klaipeda port, a company of Lithuanian capital concern Achema Group. Privatized in 1999 June General Manager of the Company 2018 Vytautas Kaunas stated that part of the dusty cargo is handled by Klasco in the northern part of the city, i.e. y. iron ore pellets that drip less than iron ore[[91]](#footnote-91). Water cannons (Figure 15) are used in both the southern and northern parts of the port to humidify the cargo. According to V. Kaunas, it has been noticed that the roads must also be wet, as the moving machines can cause dust from the road[[92]](#footnote-92).

Figure 15 AB Klaipėdos jūrų krovinių kompanija (KLASCO) Dust Deposition Cannons



Source: Petrikas, V. 2018

According to the director, Klasco has water collection and treatment systems. Depending on environmental requirements, filters are replaced periodically. Employees of the Environmental Protection Department take samples of water transferred through filters. Purified water is discharged into the lagoon.

In 2018, two more water cannons were bought to cover the entire perimeter of the iron ore loading area. By the way, Klasco loads iron ore pellets, not the iron ore that is stored in the dust. Pellet dust only when unloaded from railway wagons. Their heaps do not rub. Klasco uses about 10 ha of harbor area for bulk cargo, but there is no publicly available data on how much of the 10-ha area is used for stacking and storing iron ore and iron ore pellets.

**Ltd Klaipėdos konteinerių terminalas** was founded 25 years ago[[93]](#footnote-93), it is one of the leading stevedoring companies in Klaipeda port. The total area of the container terminal covered warehouses is 14,000 m2 (1.4 ha). Ro-Ro and general cargo terminal area 20,000 m3 (2 ha), covered warehouse area 10,000 m2 (1 ha)[[94]](#footnote-94). Ro-ro and general cargo terminals are loaded with bulk, bulk and packed cargo, bulk cargoes are loaded, loaded into containers for swing, assembled and prepared for further transportation. Iron ore can be attributed to bulk cargo, but it can also be transported in containers, so the exact area of iron ore stored cannot be named. There are no more publicly available data on iron ore storage.

Indicative dimensions of marine containers[[95]](#footnote-95) (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.c.7.d), in which iron ore may be stored and which may be used by UAB Klaipėdos terminalas and used by AB Klaipedos Stevedoring Company are provided.

The internal heights of marine containers range from 1.956 m to 2.692 m, and the external heights from 2.10 m to 2.896 m [[96]](#footnote-96). Not more than 5-4 containers are loaded on top of each other. According to the data of UAB „Centrinio Klaipėdos terminalo“[[97]](#footnote-97) the height of the closed warehouse in the port is 8 meters. However, the blown iron ore could not be stacked up to a height of 3-4 meters.

Input data for 2000-2017 Emission factors required from the EMEP / EEA Technical Manual (version - 2016), section "2.C.7.d Storage, handling and transport of metal products" Table 3.4 Tier 2 emission factors for source category 2.C.7.d Storage, handling and transport of iron ore, uncontrolled handling for application.

**Short description of the process:** In Lithuania, iron ore is not extracted, it is only transported through Lithuania to other countries for a short period of time. Therefore, iron ore processing is not going on in Lithuania and emissions should not be counted, it can be labelled as NO - not occurring.

**Total amount of iron ore treated uncontrolled (without pollution abatement measures):**

In Lithuania, iron ore is not processed, so the quantity is 0.

# Other industrial processes (NFR 2.H.3)

The activity is not occurring in Lithuania.

# Wood processing (NFR 2.I)

Tier 1 methodology is applied. According to Guidebook 2019 there are no Tier 2 or Tier 3 methodologies for this sector.

# Production of POPs (NFR 2.J)

The activity is not occurring in Lithuania.

# Consumption of POPs and heavy metals (e. g. electrical and scientific equipment (NFR 2.K)

In most cases, emissions from this sector are considered to be insignificant as they account for less than 1% of total national emissions [[98]](#footnote-98). However, for some POTs, the use of electrical equipment may be an important source of emissions. For example, according to the Technical Manual, Berdowski et al. (1997) estimates that 94% of all PCB emissions are generated by electrical equipment. In Lithuania, 100% of all PCB emissions are from electrical equipment.

Input data for 2016-2017 Emission factor is required from EMEP / EEA Technical Manual (version - 2016) section**„2.K Consumption of POPs and heavy metals table 3.4 Leaks (releases) and emission factors of PCBs from electrical equipment (kg/tonne)”** for application.

**A brief description of the process:** According to the requirements of PCB / PCT management regulations adopted by the Minister of Environment of the Republic of Lithuania in 2003. September 26 by Order no. 473 [[99]](#footnote-99) "On the approval of rules for the treatment of polychlorinated biphenyls and polychlorinated terphenyls (PCBs / PCTs)" in which holders of PCBs with more than 5 dm3 and equipment with PCBs ranging from 0,05% to 0,005% by weight of liquids had until 31 December 2004 to use PCBs. carry out an inventory of this equipment. The PCB / PCT management rules are aimed at implementing the September 16 Council Directive 96/59 / EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCBs / PCTs)[[100]](#footnote-100). Updated inventory reports are provided annually to Regional Environmental Protection Departments (RAAD).

According to PCB / PCT handling rules, PCB-containing equipment should have been decontaminated and / or eliminated by 2010 at the latest. December 31 Most by 2010 By the end of 2007, the inventory of equipment in Lithuania was removed by this deadline. It should be noted that not all companies holding PCB equipment were able to comply with this deadline. Regional environmental departments monitor these companies for their situation, and the disposal / decontamination actions and plans for PCBs are no longer allowed. However, transformers with liquids between 0.05% and 0.005% by weight of PCBs must be decontaminated or disposed of after the end of their service life.

Based on 2018 In Lithuania, only one company in Lithuania still uses this equipment - Domus Altera UAB. The equipment is used by UAB Dirbtinis pluostas. From 2012 to 2016 the number of fluid-containing devices containing liquid PCBs remained unchanged and remained at 8 pcs, with 12 tons of liquid containing PCB. As there is no information on the amount of PCB in the liquid, the same assumption is made as in the previous emission assessment, that PCB is equal to 0.05% of the liquid mass (Lithuania IIR 2018).

**Tonnage of transformer-containing PCBs in tonnes since 2016:** Every year UAB Dirbtinis plstalltas reports directly to the Environmental Protection Agency. Consultation with UAB Dirbtinis plstalltas revealed that the data for 2016-2018 are already provided to EPA, therefore, in its preparation, as an example of what information is provided in inventory reports, the company sent a report for 2018[[101]](#footnote-101), which has already been forwarded to the responsible authority. The report contains data on equipment containing PCBs in Table 2.10 and PCB identification in MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 2.k).

The above tables show that only 5 installations were used in 2018, which is 3 less than in 2012-2016. The 2017 inventory report was sent directly to EPA, so they are not included here.

# Other production, consumption, storage, transportation or handling of bulk products (NFR 2.L)

The activity is not occurring in Lithuania.

# Biological treatment of waste - Solid waste disposal on land (NFR 5.A)

Tier 3 methodology is applied. Based on Guidebook 2016 there is no Tier 2 methodology for this sector. Lithuania gathers all required data about waste quantities reaching the landfills, average wind speed, while average moisture content can be calculated.

In response to comments provided by TERT, while calculating the PM2.5 emissions it is recommended to include quantities of mineral waste reaching the landfills. 2016-2018 data is published by Department of Statistics. In order to obtain data for the period of 1990-2015 extrapolation could be used. However it should be noted that since Department of Statistics provide data for only 3 years period, such extrapolation would be unreliable. However, extrapolation could be applied in future, when more data is available.

Quantities of mineral waste in landfills are provided in the file attached (see MS EXCEL FILE OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.XLSX, SHEET 5.A).

# Biological treatment of waste - Composting (NFR 5.B.1)

According to 2016 technical manual, emissions from any pollutant in this sector are not considered significant at national level. In Lithuania, even before 2010-2011, composting activities were almost non-existent, emissions were very small and did not have a significant impact on the overall emissions of the state.

Input data for 1990-2017 needed from the EMEP / EEA Technical Manual (version - 2016) section **5.B.1 Biological treatment of waste – Composting, Table 3-1 Tier 2 emission factors for source category 5.B.1 Biological treatment of waste -composting, compost production”** for application.

**A brief description of the process:** The data for this sector for 1990-2017 are the amount (tonnes) of organic waste used for composting and information on air pollution measures and their effectiveness in compost production.

Based on the annual emissions of organic waste used for composting in the Greenhouse Gas (GHG) report [[102]](#footnote-102), [[103]](#footnote-103) the data for 1990-2017 were taken from there. Taking into account that in 2018 The GHG report does not consistently present the amounts of organic waste consumed throughout the year, some of which were obtained by extrapolation. There are no real data for the periods from 1990 to 2003, so the same expert assessment as in the GHG report should be followed that composted quantities are in the same trend as in 2004-2011. The gradual growth of composted waste is calculated over this period by the exponential trend formula:

, (2)

Here: Y – amount of composted waste;

X – years of composting.

The extrapolation of this equation until 1990 was used to estimate the amount of composted waste in the 1990-2004 period. In the absence of more detailed data, such estimation of composted quantities should remain in the calculation of emissions later.

The Lithuanian Association of Regional Waste Management Centers (LRATCA) was also consulted on the amount of organic waste used for composting. However, the LRATCA has data only from 2014 onwards and they are included in their annual publications.

In general, in the period 1990-2017, composting of organic waste in Lithuania became more active only after the establishment of Regional Waste Management Centers (RATCs) in 2011. And in 2015, after completion of the construction of Mechanical Biological Treatment (MBA) equipment, composting intensified. From 1 January 2019 with the introduction of individual food waste collection, food waste management - composting will become even more intensive and more dependent on the population than the MBA or Regional Waste Management Centers. The first in the country started a separate food collection in the Alytus region, and in autumn 2018 the municipality of Druskininkai also joined. Food waste containers have been distributed to the residents of individual houses, and it is planned to include apartment dwellers since 2019. Already in 2017, the LRATC states that organic waste was no longer dumped in one landfill, further actions of better sorting, collection and composting of organic waste in Lithuania will help to maintain these results.

**Annual amount of organic waste used for composting (wet or dry weight), t:** presents GHG data, extrapolation data and composting data in the LRATCA annual publications [[104]](#footnote-104), [[105]](#footnote-105), [[106]](#footnote-106), [[107]](#footnote-107), [[108]](#footnote-108), [[109]](#footnote-109) (see MS Excel file OTHER\_SECTORS\_COLLECTED\_DATA\_1990-2019\_EN.xlsx, sheet 5.b.1).

Input data for 1990-2017 Emission factor required from the EMEP / EEA Technical Manual (Version - 2016) section **5.B.1 Biological treatment of waste – Composting Table 3-3 Abatement efficiencies (ηabatement) for source category 5.B.1 Biological treatment of waste -composting, compost production** for application.

**A brief description of the process:** In the Technical Guide (version - 2016), emissions in this sector can be reduced by estimating the use of air pollution measures. The Biofilter is a 90% reduction in ammonia contamination mentioned in the manual for compost production.

In Lithuania, in consultation with LRATCA [[110]](#footnote-110), Algirdas Reipas, Director of Alytaus Regional Waste Management Center, said that air protection (air pollution abatement) measures are not applied for open composting, but the biofilter of the MBA equipment is everywhere. The consultation e-mails are attached in the annexes.

**Air pollution abatement measures and their efficiency are applied,%:** When assessing emissions from open composting in Lithuania, no air pollution abatement measures are applied and emissions cannot be reduced, but air pollution is reduced by biofilters according to the activity of MBA equipment, according to 2016. Technical guide - 90%.

# Biological treatment of waste - Anaerobic digestion at biogas facilities (NFR 5.B.2)

Tier 1 methodology is applied, since there is no possibility to apply Tier 2. In order to apply Guidebook 2019 methodology a separate research is needed. The proposed methodology of said research:

* Identify companies producing biogas taking into account their size in order to form a sample comprising ~80% percent of the biogas produced (or in case there is small amount of such companies – all of the companies;
* Conduct interviews with company representatives, in order to determine types and quantities of different waste used (manure, agriculture residue and etc.);
* Aggregate the data gathered and extrapolate data to represent the whole sector.

Based on current market prices, such research is estimated to cost 30 000 – 60 000 euros (not incl. VAT). Given that the emissions from this sector is considered insignificant, the cost of gathering such data is deemed as unreasonable.

# Waste burning (NFR 5.C.1)

## Municipal waste incineration (NFR 5.C.1.a)

Tier 1 level is applied, since there is no possibility to apply Tier 2. Required data is not available, since incineration occurred before 1999 and there is not sufficient data from that period. Later on, waste incineration was used for energy production, hence the emissions are included in NFR 1.A.1.a.

## Industrial waste incineration (NFR 5.C.1.b.i)

Tier 2 cannot be applied. Emissions are calculated in NFR 5.C.1.a and 1.A.1.a.

## Hazardous waste incineration (NFR 5.C.1.b.ii)

Tier 1 / Tier 2 is applied. For period of 1990-2013 there is no sufficient data to apply higher tier level. From 2013 Tier 2 level methodology can be applied since all activities are conducted in one main company (UAB „Toksika“). In previous inventories abatement measures are described. No additional data is required.

## Clinical waste incineration (NFR 5.C.1.b.iii)

Tier 2 is applied, clinical waste incineration is conducted by UAB Toksika.

## Sewage sludge incineration (NFR 5.C.1.b.iv)

Sewage sludge incineration was conducted in the period of 1990-1994. Later on this activity was not conducted. It should be noted that UAB Toksika (mentioned in chapters 18.3 and 18.4) burns small quantities of hazardous sewage sludge, however these emissions are calculated in NFR 5.C.1.B.II.

## Cremation (NFR 5.C.1.b.v)

Tier 1 is applied. In Lithuania cremation of sheep and cow corpses is not occurring, hence Tier 2 level cannot be applied.

## Other waste incineration (NFR 5.C.1.b.vi)

Activity is not occurring in Lithuania.

# Open burning of waste (NFR 5.C.2)

Tier 1 is applied. Tier 2 methodology cannot be used since the required data is cannot be gathered. Theoretically, in order to evaluate the amount of openly burned agricultural waste more precisely, anonymous survey of farmers could be conducted. However, given the low response rate of farmer surveys conducted in 2019, such survey is not suggested.

# Domestic wastewater handling (NFR 5.D.1)

Tier 1 is applied. In order to apply Tier 2 level methodology disaggregation of waste water quantities between domestic and industrial wastewater is needed. The additional research needed in order to estimated needed data is described in chapter 21. Based on the proposed research, all the water that is non-industrial can be considered domestic. It should be noted that the cost of the said research is deemed as unreasonable given low amount of emissions from this NFR.

# Industrial wastewater handling (NFR 5.D.2)

Tier 1 is applied. In order to apply Tier 2 level methodology disaggregation of waste water quantities between domestic and industrial wastewater is needed. The additional research needed in order to estimated needed data is described below:

* Identify industries in which‘s processes produce the largest amount of wastewater;
* Identify largest companies in each industry;
* Conduct surveys in order to estimate:
  + Wastewater quantities if company is gathering such data;
  + Total amount of water used and estimation from company representatives what percentage of water is not consumed by industrial processes turns to wastewater;
* Aggregate the data gathered and extrapolate data to represent the whole sector.

Given the large scope of the research (multiple industries to be investigated) and current market prices for such services the estimated budget of such research is at 80 000 – 110 000 euros (not incl. VAT). Accordingly it is evaluated that the cost of gathering such data is unreasonable given the low amount of emissions in this NFR.

# Other wastewater handling (NFR 5.D.3)

Tier 2 is already applied. EPA has all required data and it was used previous reports.

# Other waste (NFR 5.E)

Tier 2 is already applied. EPA has all required data and it was used previous reports.

# Other (included in national total for entire territory (NFR 6.A)

Activity is not occurring in Lithuania. According Guidebook 2016 this chapter includes emissions that were not included in other sectors. However, in case all emissions where provided in other sector this chapter is left empty.

# CONCLUSIONS

The data were provided or directly handed over by the EPA during the consultation: Lithuanian Hydrometeorological Service, Lithuanian Geological Survey, Lithuanian Railways and Lithuanian Regional Waste Management Centers (LRATCA). Useful information on the application of air pollution abatement measures and scope of activities has been gathered from the publicly available IPPC, EIA, EIA selection conclusions, web sites of companies themselves. Companies publish their environmental management certificates on their websites, and in most cases, it is easy to collect this information. However, in only a few cases, the exact date of receipt of the certificate, the year of implementation of the environmental management system, is relevant.

Problems with data collection were sectors 1.B.1.a, 2.A.5.c and 2.C.7.d. This is because almost all of the Lithuanian market in these sectors is occupied by several large companies whose activities are under-publicly available, environmental documentation is not available or the data is missing. Companies with a small market share in these sectors are less likely to provide specific storage areas, annual volumes or similar statistics on their website. In some cases, expert evaluations were carried out on the basis of photographs provided by the companies.

Collection of data is particularly difficult for the collection of old data from 1990-2005. Environmental documents publicly available on the Internet: IPPC, EIA, EIA selection conclusions do not reach earlier than 2010. Therefore, there is already an expert assessment in this place, looking for other publicly available information about the company in order to determine the start of the activity, the period of activity, the scope and significance of the sector (one of the largest in Lithuania, the largest, etc.).

At the time of data collection (especially during company surveys), attention was drawn to the fact that individual companies do not want to provide their data during the consultation, if this is not necessary. Since data are collected for more accurate sectoral emissions calculations, companies are reluctant to provide data, knowing that they would not be penalized for higher emissions or non-use of air pollution abatement measures. Even knowing that there will be no punishment and that confidentiality is guaranteed, companies are reluctant to provide data. In most cases, certain activity data companies have not collected themselves, especially during the previous operating period. Therefore, the previous period from 1990 to 2000 or even from 2010, when no available data should be evaluated should be based on preliminary calculations (extrapolations, etc.), estimated data available or mandatory surveys.

The data collected in this interim report can improve the accuracy of emission calculations when used for emission calculations. The assessment of the use of air pollution abatement measures will not only potentially reduce the emissions of the sectors, but will also more realistically represent Lithuania's position in the sectors.

**Data sources used in the report.** The table below (Figure 16) provides information and data collection sources to use during this phase to collect data on individual sectors of economy.

Figure 16 DATA SOURCES AMOUNT BY SECTOR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NFR code | Branch Title | Total quantity of data collection sources, units | | |
| II interim report (2018 m.) | III interim report (2019 m.)[[111]](#footnote-111) | IV interim report (2020 m.) |
| 1.B.1.a | Fugitive emission from solid fuels: Coal mining and handling | 8 | 9 | 9 |
| 2.A.5.a | Quarrying and mining of minerals  other than coal | 49 | 51 | 54 |
| 2.A.5.b | Construction and demolition | 3 | 3 | 5 |
| 2.A.5.c | Storage, handling and transport of mineral products | 5 | 5 | 5 |
| 2.C.7.d | Storage, handling and transport of metal products (please specify in the IIR) | 8 | 8 | 8 |
| 2.K | Consumption of POPs and heavy metals (e.g. electrical and scientific equipment))) | 4 | 4 | 4 |
| 5.A | Biological treatment of waste - solid waste disposal on land | 0 | 0 | 1 |
| 5.B.1 | Biological treatment of  waste – Composting | 5 | 7 | 8 |
|  | **Total:** | **82** | **87** | **94** |

1. <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/emep-eea-guidebook-revision-log/view> [↑](#footnote-ref-1)
2. <https://www.e-tar.lt/portal/lt/legalActSearch> [↑](#footnote-ref-2)
3. <https://op.europa.eu/lt/web/eu-vocabularies/> [↑](#footnote-ref-3)
4. Overlap of legal acts in different Eurovoc terms is not evaluated. [↑](#footnote-ref-4)
5. Aplinkos apsaugos agentūra. Interaktyvus: < http://gamta.lt/cms/index?rubricId=cdee8497-5553-4965-9693-4bcd029d8f07>; [↑](#footnote-ref-5)
6. LR Aplinkos ministerijos Marijampolės regiono aplinkos apsaugos departamento 2012 m. spalio 9 d. atrankos išvada „dėl planuojamos ūkinės veiklos poveikio aplinkai vertinimo“. UAB „Dameta“. [↑](#footnote-ref-6)
7. UAB „Grasta“. Akmens anglis [interaktyvus]. Prieiga per internetą: <http://www.grasta.lt/akmens-anglis>. [↑](#footnote-ref-7)
8. UAB „Grasta“. Apie mus [interaktyvus]. Prieiga per internetą: <http://www.grasta.lt/Apie-mus-819.html>. [↑](#footnote-ref-8)
9. UAB „Baltijos Anglis“ is also selling coal, however, no information on the type is provided. Baltijos Anglis Mūsų prekės [interaktyvus]. Prieiga per internetą: <https://baltijosanglis.lt/lt/products>. [↑](#footnote-ref-9)
10. UAB „Viljosinda“. Kietas kuras [interaktyvus]. 2019 Prieiga per internetą: <http://www.viljosinda.lt/lt/Produktai-paslaugos/Kietas-kuras/>. [↑](#footnote-ref-10)
11. UAB „Hufa“. Pradžia [interaktyvus]. Prieiga per internetą: <http://www.hufa.lt/#>. [↑](#footnote-ref-11)
12. UAB „Vaimanta“. Akmens anglis [interaktyvus]. Prieiga per internetą: <http://www.vaimanta.lt/akmens-anglis/4594182525>. [↑](#footnote-ref-12)
13. UAB „Vivalsa“. Pradžia [interaktyvus]. 2018. Prieiga per internetą: <http://www.vivalsa.lt/>. [↑](#footnote-ref-13)
14. UAB „Kėdainių krovimo aikštelė“. Sandėliavimas, krova pravažiuojamojo kelio nuoma [interaktyvus]. 2013. Prieiga per internetą: <http://www.krovimoaikstele.lt/sandeliavimas-krova.php>. [↑](#footnote-ref-14)
15. AB „Akmenės cementas“ Taršos Integruotos Prevencijos ir Kontrolės leidimas Nr. 1 (T-Š-1-1/2014) [↑](#footnote-ref-15)
16. Dameta, UAB, UAB "Gera anglis", UAB „Kuro Tiekimas“, UAB „Hufa“, UAB „Grasta“, UAB „Vaimanta“, UAB „Malkona“, UAB „Kėdainių krovimo akštelė“, UAB „Vilkdara“, UAB „Simeks“, UAB „Aletovis“, UAB „Viljosinda“. [↑](#footnote-ref-16)
17. Šiaulių regiono aplinkos apsaugos departamento 2011 m. lapkričio 3 d. „Informacija apie priimtą sprendimą dėl Pakruojo rajono Petrašiūnų III dolomito telkinyje planuojamos veiklos leistinumo poveikio aplinkai požiūriu“. [↑](#footnote-ref-17)
18. Petrašiūnų II dolomito telkinio praplečiamo ploto įsisavinimo planuojamos veiklos poveikio aplinkai vertinimo ataskaita. Vilnius, 2017. [↑](#footnote-ref-18)
19. Vitkus, N. AB „Klovainių skalda“ konkurencingumo strategija. Šiauliai, 2014. [↑](#footnote-ref-19)
20. UAB Skalduva. Apie mus [interaktyvus]. Prieiga per internetą: <http://www.skalduva.com/lt/apie-mus#text>. [↑](#footnote-ref-20)
21. LR Aplinkos ministerijos 2016 m. kovo 22 d. sprendimas „dėl Krivaičių dolomito telkinio naudojimo leistinumo poveikio aplinkai vertinimo požiūriu“. [↑](#footnote-ref-21)
22. AB „Kalcitas“. AB „Kalcitas“ įmonės istorija [interaktyvus]. Prieiga per internetą: <http://www.kalcitas.lt/>. [↑](#footnote-ref-22)
23. AB „Akmenės cementas“. Cementininkų žinios [interaktyvus]. 2010. Prieiga per internetą: <http://cementas.lt/index.php?id=168>. [↑](#footnote-ref-23)
24. MB Keramika sau. Molis [interaktyvus]. Prieiga per internetą: <http://www.keramikasau.lt/molis.html>. [↑](#footnote-ref-24)
25. UAB Geodezijos linija. UAB „ADI keramika“ planuojamos ūkinės veiklos – dalies Kuršėnų (2 sklypas) molio telkinio eksploatacija, Tylučių k., Kuršėnų k. seniūnijoje, Šiaulių r. savivaldybėje atrankos dėl Poveikio Aplinkai Vertinimo dokumentai. Šiauliai, 2018. [↑](#footnote-ref-25)
26. Juozapavičius, G; Kuzavinienė, T. 2014. Sapropelio telkiniai Lietuvos ežeruose: žvalgyba, ištekliai, žaliavos kokybė, įsisavinimo sąlygos [interaktyvus]. Prieiga internete: <https://www.gjmagma.lt/images/pranesimai/Sapropelio\_telkiniai\_LT\_ezeruose\_2014\_12\_10.pdf>. [↑](#footnote-ref-26)
27. UAB Gasta. EU projektas [interaktyvus]. Prieiga internete: <http://www.gasta.lt/eu-projektas.html>. [↑](#footnote-ref-27)
28. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2013 m. atrankos išvada „dėl Molėtų rajono Alekniškių žvyro ir smėlio telkinio II sklypo 1,2 ha dalies naudojimo poveikio aplinkai vertinimo“. UAB „Litgravel“. [↑](#footnote-ref-28)
29. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2012 m. spalio 29 d. atrankos išvada „dėl Zarasų rajono Dervinių smėlio ir žvyro telkinio naudojimo poveikio aplinkai vertinimo“. UAB „Turto plėtra“. [↑](#footnote-ref-29)
30. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2012 m. atrankos išvada „dėl Utenos rajono Vieteikių žvyro ir smėlio telkinio naujo 5,4138 ha ploto naudojimo poveikio aplinkai vertinimo“. UAB „Statva“. [↑](#footnote-ref-30)
31. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2011 m. spalio 12 d. atrankos išvadoje „dėl Utenos rajono Kiauliupio III žvyro ir smėlio telkinio naujo 10,51 ha ploto naudojimo planuojamos UAB „Utenos gelžbetonis“ ūkinės veiklos poveikio aplinkai vertinimo“. UAB „Utenos gelžbetonis“. [↑](#footnote-ref-31)
32. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2011 m. rugsėjo 5 d. atrankos išvada „dėl Utenos rajono Kiauliupio žvyro ir smėlio telkinio II sklypo 10,77 ha naujo ploto naudojimo planuojamos UAB „Šilinė“ ūkinės veiklos poveikio aplinkai vertinimo“. [↑](#footnote-ref-32)
33. LR Aplinko ministerijos Klaipėdos regiono aplinkos apsaugos departamento 2011 m. lapkričio 11 d. informacija apie priimtą sprendimą UAB „Orgstatyba“ Klaipėdos rajono Kantvainių smėlio ir žvyro telkinio naujame plote naudojimo leistinumo poveikio aplinkai požiūriu. [↑](#footnote-ref-33)
34. Rizgonys. Apie karjerą [interaktyvus]. Prieiga per internetą: <http://www.rizgonys.lt/>. [↑](#footnote-ref-34)
35. LR Aplinko ministerijos Klaipėdos regiono aplinkos apsaugos departamento 2013 m. galutinė atrankos išvada „dėl Pozingių II smėlio ir žvyro telkinio eksploatavimo poveikio aplinkai vertinimo“. UAB „Simuva“. [↑](#footnote-ref-35)
36. LR Aplinkos ministerijos Aplinkos apsaugos departamento 2010 m. gegužės 6 d. atrankos išvada „dėl Birbinčių žvyro ir smėlio telkinio naudojimo, Birbinčių kaimą, Klaipėdos rajone, poveikio aplinkai vertinimo“. UAB „Vakarų verslo projektai“. [↑](#footnote-ref-36)
37. LR Aplinkos ministerijos Aplinkos apsaugos departamento 2012 m. sausio 11 d. atrankos išvada „dėl Šnaukštų 2 žvyro ir smėlio telkinio naujo ploto dalies naudojimo poveikio aplinkai vertinimo“. UAB „Šnaukštų karjeras“. [↑](#footnote-ref-37)
38. UAB „Geobaltic“. Vilkaviškio rajono Rasių I telkinio smėlio išteklių dalies specialusis naudojimo planas. Vilnius, 2015. [↑](#footnote-ref-38)
39. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2012 m. atrankos išvadą „dėl povaikio aplinkai vertinimo planuojant naudoti Zarasų rajono Salinių II smėlio telkinį“. UAB „Turto plėtra“. [↑](#footnote-ref-39)
40. LR Aplinkos ministro Kauno regiono aplinkos apsaugos departamento sprendimas „dėl Jurbarko savivaldybės Kalnėnų III žvyro telkinio dalyje planuojamos veiklos galimybių“. Kaunas, 2012. [↑](#footnote-ref-40)
41. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2014 m. atrankos išvada „dėl planuojamos ūkinės veiklos (PŪV) – Ignalinos rajono Didžiasalio žvyro telkinio naujo ploto dalies (apie 0,12 ha) naudojimo poveikio aplinkai vertinimo“. UAB „Švenčionėlių keramika“. [↑](#footnote-ref-41)
42. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2014 m. atrankos išvada „dėl Zarasų rajono Zarasų seniūnijos Nadūnų žvyro telkinio dalies naudojimo poveikio vertinimo“. UAB „Melingos keliai“. [↑](#footnote-ref-42)
43. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento atrankos išvada „dėl Zarasų rajono Dervinių II žvyro telkinio naudojimo poveikio aplinkai vertinimo“. UAB „Turto plėtra“. [↑](#footnote-ref-43)
44. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2013 m. atrankos išvada „dėl Utenos rajono Kvyklių žvyro telkinio 17,74 ha ploto eksploatacijos poveikio aplinkai vertinimo“. UAB „Prima Parte“. [↑](#footnote-ref-44)
45. LR Aplinkos ministerijos Utenos Regiono Aplinkos apsaugos departamento atrankos išvada „dėl UAB „Kurklių karjeras“ žvyro karjero įrengimo ir eksploatavimo 5,9780 ha ploto žemės sklype poveikio aplinkai vertinimo“. UAB „Kurklių karjeras“. [↑](#footnote-ref-45)
46. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2011 m. rugpjūčio 24 d. atrankos išvada „dėl žvyro karjero įrengimo ir eksploatavimo 1,19 ha ploto žemės sklype Anykščių rajono Antanuvkos vs. poveikio aplinkai vertinimo“ [↑](#footnote-ref-46)
47. UAB GJ Magma. Rokiškio rajono Juodymo durpių telkinyje planuojamos veiklos poveikio aplinkai vertinimo ataskaita. Vilnius, 2016. [↑](#footnote-ref-47)
48. AB „Rėkyva“. Įmonė [interaktyvus]. Prieiga internete: <https://www.rekyva.eu/#imone>. [↑](#footnote-ref-48)
49. Aplinkos apsaugos agentūros Taršos prevencijos ir leidimų departamento Klaipėdos skyriaus 2014 m. liepos 16 d. atrankos išvada „dėl Šilutės rajono savivaldybės Aukštumalos durpių telkinio dalies naudojimo, Kintų sen., Šilutės rajone poveikio aplinkai vertinimo“. UAB „Klasmann-Deilmann Šilutė“. [↑](#footnote-ref-49)
50. Butkų durpynas. Produkcija [interaktyvus]. Prieiga per internetą: <http://www.butkudurpynas.lt/index.php/lt/produkcija.html>. [↑](#footnote-ref-50)
51. LR Aplinkos ministerijos Kauno regiono aplinkos apsaugos departamento 2009 m. vasario 19 d. „Informacija apie priimtą sprendimą Ežerėlio durpių telkinio II sklype, Krušinskų k., Kauno r.“. [↑](#footnote-ref-51)
52. Aplinkos apsaugo agentūros Taršos integruotos prevencijos ir leidimų departamento Vilniaus skyriaus 2014 m. atrankos išvada „dėl Bajorų durpių telkinio dalies (148 ha) išteklių naudojimo poveikio aplinkai vertinimo“. UAB „Gavyba“. [↑](#footnote-ref-52)
53. Aplinkos apsaugo agentūros Taršos integruotos prevencijos ir leidimų departamento Vilniaus skyriaus 2015 m. galutinė atrankos išvada „dėl Naujienų durpių telkinio dalie (138,48 ha) naudojimo poveikio aplinkai vertinimo“. UAB „Ferta“. [↑](#footnote-ref-53)
54. Aplinkos apsaugo agentūros Taršos integruotos prevencijos ir leidimų departamento Vilniaus skyriaus 2014 m. atrankos išvada „dėl Rokiškio rajono Zalūbiškio durpių telkinio poveikio aplinkai vertinimo“. UAB „Legra“. [↑](#footnote-ref-54)
55. Aplinkos apsaugos agentūros Taršos prevencijos ir leidimų departamento Vilniaus skyriaus 2015 m. atrankos išvada „dėl Degutinės durpių telkinio kasybos technologijos pakeitimo poveikio aplinkai vertinimo“. UAB „Poraistė“. [↑](#footnote-ref-55)
56. Aplinkos vadybos sistemos. Reikalavimai ir naudojimo gairės (LST EN ISO 14001:2004) [↑](#footnote-ref-56)
57. UAB Hidrosta. Kokybės vadyba [interaktyvus]. 2016. Prieiga per internetą: <http://hidrosta.lt/>. [↑](#footnote-ref-57)
58. UAB Kamesta. Apie įmonę [interaktyvus]. Prieiga per internetą: <http://www.kamesta.lt/apie-imone>. [↑](#footnote-ref-58)
59. UAB Arunta ir Ko. Sertifikatai [interaktyvus]. 2019. Prieiga per internetą: <http://aruntairko.lt/>. [↑](#footnote-ref-59)
60. UAB „Kauno keliai“. Apie mus [interaktyvus]. 2014. Prieiga per internetą: <http://www.kaunokeliai.lt/lt/keliu-tiesimas>. [↑](#footnote-ref-60)
61. UAB Kauno tiltai. Aplinkos apsauga [interaktyvus]. Prieiga per internetą: <https://www.kaunotiltai.lt/apie-bendrove/aplinkos-apsauga/>. [↑](#footnote-ref-61)
62. UAB Edrija. Kokybė [interaktyvus]. Prieiga per internetą: <http://www.edrija.lt/kokyb/>. [↑](#footnote-ref-62)
63. UAB Alkesta. Apie mus [interaktyvus]. 2017. Prieiga per internetą: <https://www.alkesta.lt/apie-mus/>. [↑](#footnote-ref-63)
64. Lietuvos geologijos tarnybos el. paslaugos. Naudingųjų iškasenų gavyba [interaktyvus]. Prieiga per internetą: <https://www.lgt.lt/epaslaugos/elpaslauga.xhtml [↑](#footnote-ref-64)
65. Lietuvos geologijos tarnyba. 2007. 2006 metų veiklos rezultatai. Informacinis centras. 30 p. [↑](#footnote-ref-65)
66. Kadūnas V. 1998. Žemės gelmių turtai: istorija ir perspektyva. Vilnius: Mokslas ir gyvenimas, Nr. 9. p. 10-14 [↑](#footnote-ref-66)
67. Juozapavičius, G. 2013. Lietuvos naudingosios iškasenos ir jų naudojimo galimybės. Iš: Geologijos akiračiai, 1: 11-17. [↑](#footnote-ref-67)
68. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2013 m. atrankos išvada „dėl poveikio aplinkai vertinimo keičiant technologinę įrangą Zarasų rajono Adomavos telkinyje“. UAB „Zarasų ST“. [↑](#footnote-ref-68)
69. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2013 m. atrankos išvada „dėl Anykščių rajono Juodbalių smėlio telkinio naujo ploto (1,8 ha) naudojimo poveikio aplinkai vertinimo“. UAB „Kupiškio plytų gamykla“. [↑](#footnote-ref-69)
70. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento galutinė išvada „dėl Anykščių rajono Vidugirio smėlio telkinio naudojimo poveikio aplinkai vertinimo“. Viganto Sitipinio IĮ. [↑](#footnote-ref-70)
71. LR Aplinkos ministerijos Utenos regiono Aplinkos apsaugos departamento 2014 m. atrankos išvada „dėl Zarasų rajono Imbrado durpių telkinio naudojimo poveikio aplinkai vertinimo“. UAB „Turto plėtra“. [↑](#footnote-ref-71)
72. Lithuanian Geology Council. 2012. Results of activities for 2011, Annual report, 121 p. [↑](#footnote-ref-72)
73. Lithuanian Geology Council. 2013. Results of activities for 2012, Annual report, 134 p. [↑](#footnote-ref-73)
74. Lithuanian Geology Council. 2014. Results of activities for 2013, Annual report, 132 p. [↑](#footnote-ref-74)
75. Lithuanian Geology Council. 2019. Results of activities for 2018, Annual report, 13 p. [↑](#footnote-ref-75)
76. Lithuanian Geology Council. Results of activities for2019, Yearly report. 13 p. [↑](#footnote-ref-76)
77. Lietuvos geologijos tarnyba. 2019. Lietuvos Respublikos naudingųjų iškasenų ir požeminio vandens gavyba 2015-2018 metais [interaktyvus]. Prieiga per internetą: <https://www.lgt.lt/index.php?option=com\_content&view=article&id=166&Itemid=1261&lang=lt>. [↑](#footnote-ref-77)
78. AB „Dolomitas“ (Petrašiūnų II ir Petrašiūnų III dolomito), AB „Klovainių skalda“ (Klovainių dolomito), UAB „Skaistgirio skalda“ (Petrašiūnų III), UAB „Skalduva“ (Krivaičių telkinys), AB „Kalcitas“ (Karpėnų klinčių karjeras), UAB „ADI keramika“ (Kuršėnų molio telkinys), UAB „Gasta“ (Gariūnų smėlio-žvyro), UAB „Litgravel“ (Alekniškių žvyro ir smėlio), UAB „Turto plėtra“ (Salinių II smėlio, Dervinių II žvyro, Imbrado durpių), UAB „Statva“ (Vieteikių žvyro ir smėlio), UAB „Utenos gelžbetonis“ (Kiauliupio III žvyro ir smėlio), UAB „Šilinė“ (Kiauliupio žvyro ir smėlio), UAB „Keldeva“ (Prūdupio smėlio ir žvyro), UAB „Orgstatyba“ (Kantvainių smėlio ir žvyro), UAB „Rizgonys“ (Kvesų ir Rizgonių smėlio-žvyro), UAB „Simuva“ (Pozingių II ir Gelžinių II žvyro-smėlio), UAB „Vakarų verslo projektai“ (Birbinčių žvyro ir smėlio), UAB „Šnaukštų karjeras“ (Šnaukštų 2 žvyro ir smėlio), UAB „EPT transportas“ (Rasių I telkinys), UAB „Jurmelsta“ (Kalnėnų III žvyro), UAB „Švenčionėlių keramika“ (Didžiasalio žvyro), UAB „Melingos keliai“ (Nadūnų žvyro), UAB „Prima Parte“ (Kvyklių žvyro)

    UAB „Kurklių karjeras“ (Kurkliuose žvyro), UAB „Nereta“ (Juodymo durpių), Kazys Kaškevičius (žvyro Antanuvkos vs.), AB „Rėkyva“ (Rėkyvos ir Degesynės durpynai), UAB „Klasmann-Deilmann“, UAB „Klasmann-Deilmann Šilutė“ (Aukštumalos durpių), UAB „Klasmann-Deilmann Gedrimai“ (Gedrimų durpių), Arūno Adrijausko firma (Butkų durpių)

    Aloyzas Blaževičius (Ežerėlio durpių), UAB „Gavyba“ (Bajorų durpių), UAB „Ferta“ (Naujienų durpių), UAB „Legra“ (Zalūbiškio durpių), UAB „Poraistė“ (Paraisčių ir Degutinės durpių), UAB „Zarasų ST“ (Adomavos žvyro), UAB „Kupiškio plytų gamykla“ (Juodbalių smėlio), IĮ Viganto Stipinio (Vidugirio smėlio), UAB „Hidrosta“, UAB „Kamesta“, UAB „Arunta ir Ko“, UAB „Kauno keliai“, UAB „Kauno tiltai“, UAB „Edrija“, UAB „Alkesta“, UAB "Mestasta" [↑](#footnote-ref-78)
79. Gregorauskienė V.; Lietuvos geologijos tarnyba. - Vilnius, 2015. - 203 + CD : 13 pav. - (LGT fondas; Nr.19909). [↑](#footnote-ref-79)
80. VM-A is a sample of upper arable horizon, VM-C is deep soil rock samples [↑](#footnote-ref-80)
81. <https://www.e-tar.lt/portal/lt/legalAct/TAR.BF41D2C35D24/asr> [↑](#footnote-ref-81)
82. STR 2.06.04:2014 <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.413395/vptKDZkYks> [↑](#footnote-ref-82)
83. Street lane between the red lines describes the traffic lanes and other street elements, like sidewalks, utility networks, lighting, parking spots and etc. [↑](#footnote-ref-83)
84. UAB „Paroc“. Paraiška Taršos integruotos prevencijos ir kontrolės leidimui pakeisti. 2016. Vilnius, 62 p. [↑](#footnote-ref-84)
85. UAB „Paroc“. PAROC Hvac Fire Mat AluCoat LT [interaktyvus]. 2019. Prieiga per internetą: <https://www.paroc.lt/gaminiai/-svok-ir-pramone/svok-armuoti-viela-dembliai/paroc-hvac-fire-mat-alucoat-lt>. [↑](#footnote-ref-85)
86. UAB „Rockwool“. Aplinkosaugos politika [interaktyvus]. 2017. Prieiga per internetą: <https://www.rockwool.lt/kodel-rockwool/ekologija/>. [↑](#footnote-ref-86)
87. Aplinkos apsaugos agentūra. Taršos integruotos prevencijos ir kontrolės leidimas Nr. VR-4.7-V-01-Š-22/T-V.2-22/2016. UAB „Jašiūnų keramika“. [↑](#footnote-ref-87)
88. UAB „Paroc“. Duomenų bankas [interaktyvus]. Prieiga per internetą: <https://img.materialbank.net/NiboWEB/paroc/showCartPublicContent.do?uuid=2999262&random=65741&lang=lt> [↑](#footnote-ref-88)
89. UAB „Rockwool“. Rockwool akmens vatos gamybos procesas [interaktyvus]. 2017. Prieiga per internetą: <https://www.rockwool.lt/apie-mus/gamyba/>. [↑](#footnote-ref-89)
90. AB „Lietuvos geležinkeliai“ [↑](#footnote-ref-90)
91. Bikauskaitė, D. Krovinių dulkėtumas – ne tik Klaipėdos uosto problema [interaktyvus]. 2018. Prieiga per internetą: <https://www.ve.lt/naujienos/ekonomika/ukis/kroviniu-dulketumas---ne-tik-klaipedos-uosto-problema1-1664024/>. [↑](#footnote-ref-91)
92. Dykovienė, A; Petrikas, V. KLASCO: dulkių audros bus suvaldytos [interaktyvus]. 2018. Prieiga per internetą: <http://klaipeda.diena.lt/naujienos/klaipeda/miesto-pulsas/klasco-dulkiu-audros-bus-suvaldytos-876823>. [↑](#footnote-ref-92)
93. UAB „Klaipėdos konteinerių terminalas“. Krovos terminalų operatorius [interaktyvus]. 2018. Prieiga per internetą: <https://www.terminalas.lt/>. [↑](#footnote-ref-93)
94. UAB „Klaipėdos konteinerių terminalas“. Galimybės ir paslaugos [interaktyvus]. 2018. Prieiga per internetą: <https://www.terminalas.lt/copy-of-home>. [↑](#footnote-ref-94)
95. Klaipėdos uosto ir miesto informacinis portalas. Jūrinių konteinerių išmatavimai [interaktyvus]. 2011. Prieiga per internetą: <http://www.uostas.info/konteineriai/matmenys.html>. [↑](#footnote-ref-95)
96. UAB „BALTHANA“. Jūriniai konteineriai [interaktyvus]. 2012. Prieiga per internetą: <http://www.balthana.lt/juriniaik.php>. [↑](#footnote-ref-96)
97. UAB „Centrinis Klaipėdos terminalas“. Sandėliavimas [interaktyvus]. 2014. Prieiga per internetą: <http://www.ckt.lt/?page\_id=40>. [↑](#footnote-ref-97)
98. Lithuanian Environmental Protection Agency; State research institute Center for Physical Sciences and Technology. 2018. Lithuanian Informative Inventory Report 1990-2016. Vilnius, 175 p. [↑](#footnote-ref-98)
99. LR Aplinkos ministro 2003 m. rugsėjo 26 d. įsakymu Nr. 473 „Dėl polichlorintų bifenilų ir polichlorintų terfenilų (PCB/PCT) tvarkymo taisyklių patvirtinimo“ Valstybės žinios, 99-4469 [↑](#footnote-ref-99)
100. Tarybos 1996 m. rugsėjo 16 d. direktyva 96/59/EB „Dėl polichlorintų bifenilų ir polichlorintų terfenilų (PCB/PCT) šalinimo“. Europos Bendrijų oficialus leidinys, 1996-9-24. [↑](#footnote-ref-100)
101. UAB „Dirbtinis pluoštas“. 2019. Įrangos, turinčios PCB, inventorizacijos ataskaita. [↑](#footnote-ref-101)
102. Lithuania‘s national inventory report 2018. Greenhouse Gas Emissions 1990-2016. Vilnius, 617 p. Available from internet: <http://klimatas.gamta.lt/files/LT\_NIR\_20180415\_final.pdf>. [↑](#footnote-ref-102)
103. Lithuania‘s national inventory report 2019. Greenhouse Gas Emissions 1990-2017. Vilnius, 617 p. Available from internet: < https://am.lrv.lt/uploads/am/documents/files/KLIMATO%20KAITA/Studijos%2C%20metodin%C4%97%20med%C5%BEiaga/NIR\_2019\_01\_15\_FINAL.pdf>. [↑](#footnote-ref-103)
104. 2013 m. sukompostuotas atliekų kiekis pagal AAA, pateiktas 2014 m. LRATCA ataskaitoje. [↑](#footnote-ref-104)
105. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija. Komunalinių atliekų tvarkymas Lietuvoje 2014 metais [interaktyvus]. Prieiga per internetą: <https://www.slideshare.net/LRATCA/komunaliniu-atlieku-tvarkymas-lietuvoje-2014-metais>. [↑](#footnote-ref-105)
106. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija. Komunalinių atliekų tvarkymas Lietuvoje 2015 m. [interaktyvus]. Prieiga per internetą: <https://www.slideshare.net/LRATCA/komunalini-atliek-tvarkymas-lietuvoje-2015-metais>. [↑](#footnote-ref-106)
107. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija. Komunalinių atliekų tvarkymas Lietuvoje 2016 metais [interaktyvus]. Prieiga per internetą: <https://www.slideshare.net/LRATCA/komunaliniu-atlieku-tvarkymas-lietuvoje-2016-m>. [↑](#footnote-ref-107)
108. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija. Komunalinių atliekų tvarkymas Lietuvoje 2017 m. [interaktyvus]. Prieiga per internetą: <https://www.slideshare.net/LRATCA/ataskaita-2017-m>. [↑](#footnote-ref-108)
109. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija. Komunalinių atliekų tvarkymas Lietuvoje 2018 m. [interaktyvus]. Prieiga per internetą: <https://www.slideshare.net/LRATCA/komunaliniu-atlieku-tvarkymas-2018-m> [↑](#footnote-ref-109)
110. Lietuvos Regioninių Atliekų Tvarkymo Centrų Asociacija [↑](#footnote-ref-110)
111. Each company survey is counted as 1 source. [↑](#footnote-ref-111)