Bituminous emulsions

Environmental Product Declaration

UNE-EN ISO 14025:2010
UNE-EN15804:2012+A2:2020/AC:2021

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The holder of this declaration is responsible for its contents and for preserving the supporting documentation that substantiates the data and statements included therein during the validity period.

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European Standard EN 15804:2012+A2:2020/AC:2021 serves as the basis for the EPD
Independent verification of the Declaration and data, according to Standard EN ISO 14025:2010 ☐ Internal ☒External
Verification body AENOR Product certification body accredited by ENAC under accreditation Nº 1/C-PR468

1. GENERAL INFORMATION.

1.1. The organisation.

The holder of this Environmental Product Declaration (EPD) is **RLESA.**

Repsol is a global company that seeks people's well-being and takes a proactive role in building a better future through the development of smart energy solutions. It is an integrated and broadly diversified company, spanning from traditional businesses such as exploration, refining, and the sale and distribution of fuels, to others like LPG (a global leader) and new energies (e.g., wind power).

Repsol Lubricantes, Aviación, Asfaltos y Especialidades, S.A. (RLESA) is one of the companies in the Repsol group, responsible for developing, producing, and marketing lubricants and specialties, as well as asphalt bitumen and related derivatives.

1.2. Scope of the Declaration.

This Environmental Product Declaration describes the environmental information relating to the life cycle of the conventional bitumen produced by RLESA in 2022 at its production plants located in Puertollano (Ciudad Real, Spain), Cartagena (Murcia, Spain), Gajano (Cantabria, Spain), and Mangualde (Viseu Dão-Lafões, Portugal).

The function of bituminous emulsions is their contribution to road paving—either as an auxiliary material used for surface treatments/sprays, or as a binding component for the manufacture of cold asphalt mixes.

The results presented reflect the environmental performance of the production-weighted average conventional bitumen across the different plants. The scope of this Environmental Product Declaration (hereinafter, "EPD") is cradle-to-gate.

1.3. Lyfe-cycle and compliance.

This EPD has been developed and verified in accordance with UNE-EN ISO 14025:2010 and UNE-EN 15804:2012+A2:2020/AC:2021, "Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products."

Table 1. PRODUCT CATEGORY RULES	
Descriptive title	Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products
Reference code & version	UNE-EN 15804:2012+A2:2020/AC:2021
Publication date	2021
Program operator	AENOR

This Environmental Product Declaration includes the following life cycle stages:

Table 2. System boundaries — Information modules considered

Products stage	A1	Raw material supply	X
	A2	Transport to factory	X
	A3	Manufacturing	X
Construction	A4	Transport to site	MNE
	A5	Installation/construction	MNE
Use stage	B1	Use	MNE
	B2	Maintenance	MNE
	B3	Repair	MNE
	B4	Replacement	MNE
	B5	Refurbishment	MNE
	B6	Operational energy use	MNE
	B7	Operational water use	MNE
End of life	C1	Deconstruction/demolition	MNE
	C2	Transport	MNE
	C3	Waste processing	MNE
	C4	Disposal	MNE
	D	Potential for reuse, recovery and/or recycling	MNE

X =Module included in the LCA; NR = Module not relevant;MNE = Module not evaluated

This EPD may not be comparable with those developed under other Programs or in accordance with different reference documents.

Likewise, EPDs may not be comparable if the data sources differ (e.g., databases), if all relevant information modules are not included, or if they are not based on the same scenarios.

Comparison of construction products shall be made for the same function, using the same functional unit and at the building—or at the level of architectural, engineering, or civil works—, that is, including the product's performance over its entire life cycle—as well as the specifications in Clause 6.7.2 of Standard UNE-EN ISO 14025:2010.

2. THE PRODUCT.

2.1. Identification of the product.

Bituminous emulsions (CPC 33500) are colloidal dispersions of bitumen droplets in an aqueous phase composed of water and one or more anionic or cationic emulsifiers whose role is to enable bitumen dispersion, ensure emulsion stability, and guarantee adhesion to aggregates.

Their fluid consistency allows, on the one hand, their use as auxiliary sprays/tack coats between the different layers of a road pavement and, on the other, their use in mix production, achieving coating and bonding with aggregates. Emulsion performance is mainly based on the breaking process, whereby the bitumen particles separate from the aqueous phase and deposit either on the surface of a mix (when applied as a tack coat) or on the aggregate (when used in mix production); once released, the residual binder provides cohesion to the system. Bituminous emulsions are the fundamental basis that has enabled the development of cold road technologies.

RLESA produces all types of emulsions—cationic and anionic, rapid-, medium-, slow-breaking, and over-stabilized—covering all common fields of use for these materials.

Cationic emulsions are governed by UNE-EN 13808:2023, which describes in-plant production control and the attainment of CE marking. In the case of anionic emulsions, there is no harmonized European standard and therefore no CE marking; however, the Spanish standard UNE 51603:2013 specifies the requirements that the different marketed types of anionic emulsions must meet.

2.2. Intended use of the product.

The main applications of both anionic and cationic bituminous emulsions are:

- Prime coats
- Tack coats (bond coats)
- Curing sprays (curing/fog seals)
- Slurry seals and microsurfacing
- Gravel–emulsion mixes (emulsion-treated aggregates)
- Surface dressings (chip seals)
- Open-graded bituminous mixes
- In-situ recycling
- Warm mixes
- Cold mixes; protective seals (seal coats)

2.3. Product composition.

The following table shows the main components of the product.

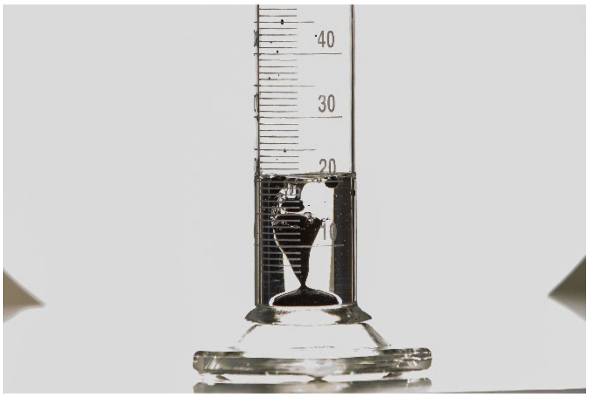
Table 3. Product composition

Substance/Component	Cationic emulsions	Anionic emulsions
Bitumen	50-69%	60-69%
Emulsifiers	0,2-0,7%	2%
Fluxing agent	1-6%	1-6%
Latex	0-3%	-
HCl	0,18-0,2%	-
Caustic soda (NaOH)	-	0,4%
Water	48-30%	48-30%

None of the raw materials used to produce this product are included on the Candidate List of Substances of Very High Concern (SVHC) for authorisation or are otherwise regulated.

2.4. Product performance.

Cationic emulsions correspond to those described in PG-3 (General Technical Specifications for Road and Bridge Works), Article 214 — Bituminous Emulsions, i.e., the types used in Spain that comply with UNE-EN 13808:2023 and its national annex; and, for anionic emulsions, those described in UNE 51603:2013..



3. LCA INFORMATION

3.1. Life cycle assessmet.

The study "LCA Report for conventional bitumen, polymer-modified bitumen, bitumen with crumb rubber from end-of-life tyres, and bituminous emulsions — REPSOL. V2," which underpins this EPD, was prepared by ReMa-INGENIERÍA, S.L. using data provided directly by RLESA for its conventional bitumens produced in 2022 at its production plants located in Puertollano (Ciudad Real, Spain), Cartagena (Murcia, Spain), Gajano (Cantabria, Spain), and Mangualde (Viseu Dão-Lafões, Portugal).

The life cycle assessment (LCA) on which this declaration is based was carried out in accordance with UNE-EN ISO 14040:2006 (and UNE-EN ISO 14040:2006/A1:2021), UNE-EN ISO 14044:2006 (and UNE-EN ISO 14044:2006/A1:2018 and UNE-EN ISO 14044:2006/A2:2021), and UNE-EN 15804:2012+A2:2020 (and UNE-EN 15804:2012+A2:2020/AC:2021).

The LCA was performed with the support of SimaPro software version 9.6.0.1 and the Ecoinvent 3.10 (2023) database.

For the asphalt plants in Spain, the electricity supplier is Repsol Comercializadora de Electricidad y Gas, S.L.U., and the 2022 remaining energy mix published by the CNMC has been used (0.00 $kgCO_2/kWh$). For the asphalt plant in Mangualde (Portugal), the electricity supplier is Repsol Energía Portugal, and the energy mix information provided by Repsol has been used (0.37 $kgCO_2/kWh$).

3.2. Declared unit.

The declared unit was defined as: **"1 tonne of bituminous emulsion".**

3.3. Reference service life (RSL)

Not applicable.

3.4. Allocation and cut-off criteria.

For the crude oil extraction, transport, and refining stages, the allocation rules described in "THE EUROBITUME LIFE-CYCLE ASSESSMENT 4.0 FOR BITUMEN. March 2025" have been applied.

General framework: When a process yields multiple products, environmental impacts are allocated among them in accordance with ISO 14044:2006, 4.3.4.2.

Refinery: In atmospheric and vacuum distillation, with multiple co-products, the base criterion is energy allocation (net calorific value) for all inputs and non-product flows. Energy allocation is also used in the background LCI data for the joint production of crude oil and gas. In the refinery model used for the background LCI datasets (e.g., HFO, heavy fuel oil), energy allocation is applied to feedstock inputs and mass allocation to energy consumption.

Cogeneration (CHP): For combined production of electricity and steam at the refinery, allocation is based on exergy content.

Refinery "overhead" and utilities: General energy use (lighting, crude storage, dewatering/desalting), as well as waste, water use and discharge, are allocated by energy in the base case, and by mass in the sensitivity analysis.

Waste management in the refinery: Follows ISO 14044:2006, 4.3.4.3, and applies to the treatment of refinery waste and the end of life of included infrastructure. A cut-off approach (100:0) is used: incoming recycled materials arrive “clean” (without prior burdens), and no credits are granted for

scrap/recyclable material leaving at end of life. Given the uncertainty of generic waste-treatment data, energy recovery credits from incineration are excluded from the ILCD-published datasets.

As for the **bitumen plants**, mass allocation has been applied.

3.5. Representativeness, quality, and selection of data.

For the study of the upstream stages (extraction, crude oil transport, and refining), data from the document “THE EUROBITUME LIFE-CYCLE ASSESSMENT 4.0 FOR BITUMEN. March 2025” were used.

For the study of the conventional bitumen production process, data from RLESA’s bitumen production plants located in Puertollano (Ciudad Real, Spain), Cartagena (Murcia, Spain), Gajano (Cantabria, Spain), and Mangualde (Viseu Dão-Lafões, Portugal) for the year 2022 were used.

For secondary data, the Ecoinvent 3.10 database was employed and modelled with SimaPro 9.6.0.1. All data correspond to a Spain 2022 geographic context. The results presented are representative of conventional bitumens, expressed as a production-weighted average.

The precision and accuracy of the data entered in the databases used (Ecoinvent v3.10) have been assessed by their authors and found to have an acceptable level of uncertainty for the intended purpose of this report. Furthermore, the data collected or calculated by the authors of this study are considered to have a low degree of uncertainty, as they refer to plant information supplied and explained in detail by the company’s responsible personnel.

To assess the quality of the primary data for the production of the declared product, the semi-quantitative Data Quality Rating (DQR) criteria proposed by the European Union in its Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) Guide have been followed.

The following table shows the Data Quality Rating (DQR) scores used to identify the quality level.

Overall data quality score (DQR)	Overall data quality level
≤ 1,6	«Excellent quality»
1,6 a ≤ 2,0	«Very good quality»
2,0 a ≤ 3,0	«Good quality»
3 a ≤ 4,0	«Reasonable quality»
> 4	«Insufficient quality»

Overall data quality level based on the obtained Data Quality Rating (DQR) score

Overall data quality was calculated by summing the scores obtained for each quality criterion and dividing by the total number of criteria. Each criterion is scored from 1 to 5, where 1 is the highest quality and 5 the lowest.

Results by criterion:

- Technological representativeness (TeR): Good, score 2.
- Geographical representativeness (GR): Good, score 2.
- Temporal representativeness (TiR): Good, score 2.
- Completeness (C): Excellent, score 1.5.
- Precision/uncertainty (P): Excellent, score 1.5.
- Methodological appropriateness and consistency (M): Reasonable, score 3.

According to these results, the Data Quality Rating (DQR) is 2, which indicates that the quality level of the data used is very good.

3.6. Cut-off criteria.

In this cradle-to-gate LCA study, more than 95% of all material and energy inputs and outputs of the system have been included, excluding those data that are unavailable or not quantified. The excluded data are the following:

- Channelled atmospheric pollutants generated in combustion stages that are not measured or not covered by the applicable legislation.
- The production of machinery, industrial equipment and facilities, due to the difficulty of inventorying all the assets involved, and because the LCA community considers that their environmental impact per unit of product is low compared to the other processes that are included. Moreover, the databases used do not include these processes, so their inclusion would require additional effort beyond the scope of this study.

3.7. Other rules for calculation and hypotheses.

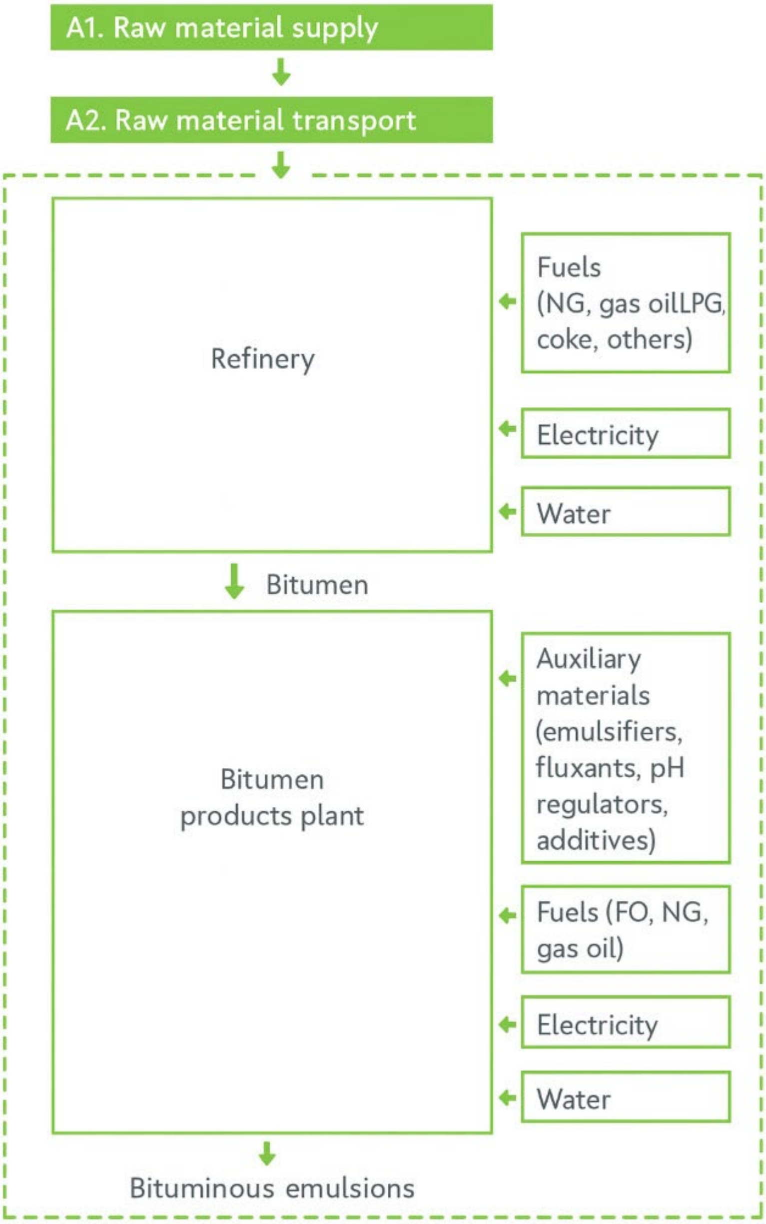
This EPD expresses the average performance of a group of products. The results presented in this document are representative of an "average bituminous emulsion." These averages were calculated as the mean of the data for emulsions manufactured in 2022 at the plants in Puertollano (Ciudad Real, Spain), Cartagena (Murcia, Spain), Gajano (Cantabria, Spain), Rábade (Lugo, Spain), and Mangualde (Viseu Dão-Lafões, Portugal), weighted by the quantities produced at each plant.

To verify the representativeness of the averages, the coefficient of variation was calculated by dividing the standard deviation by the arithmetic mean of the impact category results for the products from each plant, generally yielding values below 20%. There are no universal criteria for judging whether a coefficient value is "low" or "high," although in practice values below 30–40% are often considered low, values between those figures and ~80% are considered moderate, and above 120–140% dispersion is regarded as quite high.

Therefore, in light of these results, dispersion is generally low and representativeness is high.

4. SYSTEM BOUNDARIES, SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION.

As this is a cradle-to-gate study, life cycle modules A1 (raw material supply), A2 (transport to the manufacturing plant), and A3 (manufacturing) have been included.



4.1. Pre-manufacturing (upstream processes).

For the study of the upstream stages (extraction, crude oil transport, and refining), data from “THE EUROBITUME LIFE-CYCLE ASSESSMENT 4.0 FOR BITUMEN. March 2025” were used.

A1 Raw material supply.

Crude oil extraction data include, among others, the following operations:

- **Production and processing at source** of the crude oil up to the point where it is ready for further processing.

- **Extraction technologies:** a mix of conventional (onshore and offshore drilling) and unconventional (oil sands and in-situ production), selected by country of origin.
- **Energy and auxiliaries** from the background system associated with that production (electricity, thermal energy and process steam, on-site/internal transport, and other energy carriers).

A2 Transport.

The transport of extracted crude from the oil field to the refinery has been modelled as a combination of pipelines and marine tanker transport.

REFINERY.

Atmospheric distillation: The crude received at the refinery is heated and fed into the atmospheric distillation column, where light fractions (LPG, naphtha, kerosene, gas oils) are separated, along with an atmospheric residue that proceeds to the next stage.

Vacuum distillation: The atmospheric residue is distilled under vacuum to avoid thermal cracking and to obtain vacuum gas oils and a **vacuum residue (bitumen),** which remains at the bottom of the column.

Storage at the refinery: Bitumen is stored in heated, insulated tanks; on average at ~170 °C.

4.2. Product manufacturing.

BITUMINOUS EMULSION PLANT

The manufacture of bituminous emulsions is carried out in dedicated facilities. The first stage is the preparation of raw materials for each of the phases that make up the emulsion:

- Preparation of the binder phase: The bitumen is heated to 130–140 °C in heated/insulated tanks where it is stored after arriving by road tankers or directly via refinery pipelines. Heating is provided by fossil fuels (gas oil, fuel oil, or natural gas).

- Preparation of the aqueous phase: The surfactant (emulsifier) is added to hot water at 60–65 °C (temperature adjusted to the required viscosity), and the necessary amount of pH-regulating additive (HCl or NaOH) is dosed.

In the emulsion plant, the two prepared phases are circulated through piping and mixed in a colloid mill powered by electricity. The produced emulsion, at 80–90 °C, is transferred via pipeline directly to individual storage tanks for the different emulsion types, where it is kept until it cools.

Delivery is made in road tankers at temperatures not exceeding 40–50 °C at full load, for road transport.

Before loading, emulsions are tested/characterized in the laboratory. In addition to these initial in-plant controls, a planned and documented quality-control system ensures compliance with all product specifications.

The specifications to be met are:

- For cationic emulsions: production control and CE marking in accordance with UNE-EN 13808:2023 and its national annex.
- For anionic emulsions: the requirements set out in UNE 51603:2013.

5. DECLARATION OF ENVIRONMENTAL PARAMETERS DERIVED FROM THE LCA AND LCI.

The estimated impact results are relative and do not indicate the final value for the impact categories, nor do they refer to threshold values, safety margins or risks.

Table 4. Potential environmental impacts — 1t bituminous emulsion.

Parameters	Units	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	3,65E+02	7,99E+00	1,70E+01	3,90E+02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
GWP-fossil	kg CO2 eq	3,64E+02	7,99E+00	1,70E+01	3,89E+02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
GWP-biogenic	kg CO2 eq	1,41E+00	2,15E-03	3,25E-03	1,41E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
GWP-luluc	kg CO2 eq	2,04E-01	4,12E-04	1,22E-03	2,06E-01	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
ODP	kg CFC11 eq	2,02E-06	1,73E-07	2,28E-07	2,43E-06	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
AP	mol H+ eq	1,23E+00	1,21E-02	3,69E-02	1,28E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
EP-freshwater	kg P eq	9,32E-04	1,25E-05	3,49E-05	9,80E-04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
EP-marine	kg N eq	3,23E-01	3,44E-03	1,50E-02	3,41E-01	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
EP-terrestrial	mol N eq	3,38E+00	3,87E-02	1,64E-01	3,58E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
POCP	Kg NMVOC eq	1,52E+00	2,43E-02	5,86E-02	1,60E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
ADP-minerals& metals [2]	kg Sb eq	1,62E-04	1,09E-06	4,52E-06	1,68E-04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
ADP-fossil [2]	MJ	2,95E+04	1,13E+02	1,51E+02	2,98E+04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
WDP [2]	m^3 depriv.	2,12E+01	1,02E-01	1,70E+01	3,83E+01	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE

GWP - total: Global warming potential (total); **GWP - fossil:** Global warming potential from fossil sources; **GWP - biogenic:** Biogenic global warming potential; **GWP - LULUC:** Global warming potential from land use and land-use change; **ODP:** Stratospheric ozone depletion potential; **AP:** Acidification potential (accumulated exceedance); **EP - freshwater:** Eutrophication potential (fraction of nutrients reaching the freshwater compartment); **EP - marine:** Eutrophication potential (fraction of nutrients reaching the marine compartment); **EP - terrestrial:** Eutrophication potential (accumulated exceedance); **POCP:** Photochemical ozone formation potential (tropospheric ozone); **ADP - minerals & metals:** Abiotic depletion potential for non-fossil resources (minerals & metals); **ADP - fossil:** Abiotic depletion potential for fossil resources; **WDP:** Water deprivation potential (user) — deprivation-weighted water consumption. **NR:** Not relevant

Table 5. Additional potential environmental impacts — 1t bituminous emulsion

Parameter	Units	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1,86E-05	7,82E-08	1,62E-07	1,88E-05	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
IRP [1]	kBq U235 eq	5,09E+00	1,51E-02	4,83E-02	5,15E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
ETP-fw [2]	CTUe	1,78E+04	5,42E+00	1,07E+01	1,78E+04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
HTP-c [2]	CTUh	1,01E-06	7,47E-09	1,83E-08	1,03E-06	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
HTP-nc [2]	CTUh	9,16E-06	9,11E-09	1,89E-08	9,19E-06	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
SQP [2]	-	8,81E+02	5,88E+00	1,07E+01	8,97E+02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE

PM: Potential disease incidence due to particulate matter emissions; **IRP:** Ionizing radiation — human health (human exposure efficiency relative to U-235); **ETP-fw:** Ecotoxicity — freshwater (comparative toxic unit for ecosystems); **HTP-c:** Human toxicity — cancer effects (comparative toxic unit for humans); **HTP-nc:** Human toxicity — non-cancer effects (comparative toxic unit for humans); **SQP:** Soil quality potential index. **NR:** Not relevant

Notice 1: This impact category primarily addresses the potential effects of low-dose ionizing radiation on human health from the nuclear fuel cycle. It does not consider effects from potential nuclear accidents or occupational exposure from the disposal of radioactive waste in underground facilities. Ionizing radiation potential from soil due to radon or from certain construction materials is also not measured by this parameter.

Notice 2: The results for this environmental impact indicator should be used with caution, as uncertainties are high and experience with this parameter is limited.

Table 6. Resource use — 1t bituminous emulsion.

Parameters	Units	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	2,97E+02	4,24E-01	1,53E+00	2,99E+02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
PERM	MJ	9,00E+01	0,00E+00	0,00E+00	9,00E+01	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
PERT	MJ	3,87E+02	4,24E-01	1,53E+00	3,89E+02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
PENRE	MJ	6,00E+03	1,20E+02	1,61E+02	6,28E+03	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
PENRM	MJ	2,44E+04	0,00E+00	0,00E+00	2,44E+04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
PENRT	MJ	3,04E+04	1,20E+02	1,61E+02	3,07E+04	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
FW	m^3	8,26E-01	3,73E-03	3,98E-01	1,23E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE

PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM:** Use of renewable primary energy resources used as raw materials; **PERT:** Total use of renewable primary energy resources; **PENRE:** Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM:** Use of non-renewable primary energy resources used as raw materials; **PENRT:** Total use of non-renewable primary energy resources; **SM:** Use of secondary material; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Net use of fresh water resources. **NR:** Not relevant

Table 7. Output flows and waste categories — 1t bituminous emulsion.

Paramters	Units	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg	1,29E-02	7,63E-04	8,02E-02	9,38E-02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
NHWD	kg	4,61E+00	1,71E-02	3,41E-01	4,97E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
RWD	kg	2,71E-02	1,01E-05	3,61E-05	2,71E-02	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
MFR	kg	8,67E-01	0,00E+00	1,62E+00	2,49E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
MER	kg	4,68E-01	0,00E+00	0,00E+00	4,68E-01	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE
EE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE	MNE

HWD: Hazardous waste disposed; **NHWD:** Non-hazardous waste disposed; **RWD:** Radioactive waste disposed; **CRU:** Components for reuse; **MFR:** Materials for recycling; **MER:** Materials for energy recovery; **EE:** Exported energy. **NR:** Not relevant

6. ADDITIONAL ENVIRONMENTAL INFORMATION.

Biogenic carbon content
The product contains no biogenic carbon and is supplied in bulk; therefore, no biogenic carbon content is declared for either the product or the packaging.

Recycling of bituminous materials
According to Austroads' *Asphalt Recycling Guide*, in general, **100%** of the materials recovered from deteriorated pavements can be reused—either on the same project where they are generated, in another pavement (the most common practice), or in other construction works.

There are two main routes for reusing asphalt pavement materials:

- **Hot recycling in mixing plants:** The bituminous layers of aged pavements are removed by milling or demolition and transported to an asphalt plant, where the material is stockpiled, characterised, and, if needed, processed to meet specific size and moisture requirements. The treated material is then incorporated into new hot mixes at varying percentages depending on plant capability, and blended with virgin aggregates, new bitumen and/or rejuvenating agents. The resulting composite bituminous mix is laid and compacted as a conventional mix, achieving comparable performance.
- **Cold recycling (in-place or plant) with bituminous emulsion:** Another route is cold application using a bituminous emulsion as the binder. This technique offers the added advantage of potentially reusing **100%** of the recycled material extracted directly from the pavement, without transporting it to a plant and without heating the material for reapplication—thereby reducing the use of both virgin materials and fuels.

Recycling materials in road construction and rehabilitation is the best approach to lower the consumption of new materials while reducing quarrying. By recycling bituminous layers and making use of the binder they contain, bitumen consumption is decreased. It also reduces landfill volumes—thus lowering the space required for disposal—and cuts the associated management costs.

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Index

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