CRADLE-TO-GATE LIFE-CYCLE ASSESSMENT OF COMPOSITE I-JOISTS PRODUCED IN THE SOUTHEAST REGION OF THE UNITED STATES

CORRIM FINAL REPORT

Module F2

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Information contained in this report is based on new survey data (2012) and supersedes information in the original Phase I report (Wilson and Dancer 2004). This report is a cradle to gate LCA and includes all forestry related upstream processes and packaging of final product. CORRIM REPORT - Life Cycle Assessment of I-joist Production has not been certified but is written in compliance to the Product Category Rules North American Structural and Architectural Wood Products (June 2015) and can serve as a LCA for an Environmental Product Declaration.

1 EXECUTIVE SUMMARY

1.1 Study Goals

The goal of this study was to update life-cycle assessment (LCA) data on I-joist production in the southeast (SE) region of the United States. The authors collected primary mill data from I-joist production facilities per Consortium on Research for Renewable Industrial Materials (CORRIM) research guidelines. Comparative assertions were not a goal of this study.

1.2 Method

The authors collected mill data through a survey mailed to I-joist manufacturing plants. This survey tracked raw material inputs (including energy), product and coproduct outputs, and pertinent emissions to water and air as well as solid waste generation. The study used an industry-standard production unit to a metric production unit, one thousand linear meters (km) (i.e. declared unit). At I-joist production facilities, finger-jointed lumber (FJL) and laminated veneer lumber (LVL) production may occur on site; in those cases, data were collected for those processes too. Secondary data, such as pre-I-joist production gate processes (e.g. forestry operations, oriented strandboard (OSB) production, and electricity production), were taken from peer-reviewed literature, public databases, or other life-cycle inventory (LCI) studies completed concurrently. Using primary and secondary data, material and energy balances were calculated. With these material and energy data, the LCA was constructed to conform with internationally accepted standards. The study based all allocations on the mass of products and coproducts. The life-cycle impact assessment (LCIA) was performed using the Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) 2 method. The following five TRACI impact categories were examined: global warming potential (GWP (kg CO_2-eq)), acidification (kg SO_2-eq), eutrophication (kg N-eq), ozone depletion (kg chlorofluorocarbons-11-eq), and photochemical smog (kg NOx-eq). Primary energy consumption, material resources consumption, and waste generation were also examined.

1.3 Life-Cycle Inventory

Composite I-joist manufacturing comprises five steps: (1) forestry operations, (2) OSB production, (3) FJL production, (4) LVL production, and (5) I-joist production. The most energy-consumptive step was LVL production, followed by OSB, I-joist, and FJL production stages. Emission data produced through modeling found that the total estimated fossil and biomass carbon dioxide (CO_2) emissions were 2,482 and 1,442 kg/km.

The amount and type of energy used during production of building materials such as I-joists are important to the holistic environmental impact of the product. Total cumulative primary energy consumption (CPEC) for the cradle-to-gate production of SE I-joists was 72.8 GJ/km. Use of renewable energy in manufacturing I-joists was substantial. Renewable biomass, by far the largest renewable energy source, represented about 27% of the total CPEC for all stages of production. Energy consumed during phenol-resorcinol formaldehyde (PRF) resin production along with the additives of the resin system were included in the fossil fuel use for I-joists as an upstream process.

1.4 Life-Cycle Impact Assessment

Environmental performance results were provided for the five impact categories (global warming (GW), acidification, eutrophication, ozone depletion and smog), energy consumption from nonrenewables, renewables, and wind, hydro, solar, geothermal, and nuclear fuels, renewable and nonrenewable resources, and solid waste. The five environmental impacts associated with I-joist production were small compared with the impacts associated with LVL production. This included its upstream production impacts.

1.5 Interpretation

Emissions from the forest resources LCI are small relative to manufacturing emissions (OSB, LVL, FJL, and I-joists). At the I-joist production facility, emissions mainly originate from heat production for resin curing. Boiler emissions released were a function of the fuel burned, whereas other emissions were a function of the unit process and associated emission control devices (ECD).

Composite I-joists are primarily made of wood and thus store carbon. Carbon content for wood products is assumed to be 50% percent by mass of oven-dried (OD) wood. Excluding the resin system, the carbon stored in the wood portion of 1.0 km of I-joist on a production-weighted average is equivalent to 7,285 kg CO_2 emissions if left to decay.

For the surveyed mills, a mass balance was performed to verify data quality. Data quality was high. Inputs and outputs were consistent for the two surveyed mills on a cubic meter basis. In addition, total wood mass in and total wood mass out were calculated. Difference for overall wood mass was less than 2% for the region.

The authors compared the energy inputs from the current 2012 study to the earlier CORRIM Phase I study on gate-to-gate I-joist production to show how the cumulative primary energy consumption (CPEC) was affected. About a 22% increase in CPEC is observed compared with the Phase I study for the SE region. For both studies, the energy generated by woody biomass and fossil fuels constituted the majority of the total energy consumed. However, with that being said, no statistical analysis was conducted on the earlier data and different companies provided the primary data for 2000. Therefore, only speculation can made on the apparent differences. In this study, the weighted coefficient of variation representing the variability in the collected process data was calculated and presented.

1.6 Sensitivity Analysis

A sensitivity analysis was completed per the International Organization for Standardization (ISO) 14040 standards to model the effects of natural gas consumption and electricity consumption for I-joist production. The analysis showed that the five environmental impacts associated with producing I-joists were small compared with the environmental impacts associated with LVL production. Therefore, for the I-joist production life-cycle stage, neither natural gas nor electrical consumption on site had a substantial impact on the cradle-to-gate process.

1.7 Key Findings

The results of this study were compared with the earlier CORRIM study on life-cycle evaluation of I-joist manufacturing in the United States. The current study found the CPEC to be higher (about 25%) for the SE compared with the earlier CORRIM study. This may have resulted from increased use of ECD because of increased regulatory controls in the United States since the 2000s, particularly at LVL production facilities. Adoption of ECD other than baghouses results in higher energy consumption, and this may explain the lower energy use in Phase I survey data. Besides, although forest operations contribute only 2.8% of the CPEC in this study, the previous CORRIM study did not include energy use resulting from forest operations.

2 ACKNOWLEDGMENT

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3 BACKGROUND

The Consortium for Research on Renewable Industrial Materials has derived LCI data for major wood products and wood production regions in the United States. The LCI data covers forest regeneration through to the final product at the mill output gate. Research has covered nine major forest products including both structural and nonstructural uses and four major regions. This report focuses on industry-average composite I-joist production in the SE region of the United States (Wilson and Dancer 2004a). Life-cycle inventory data are then used to quantify LCIA. This study updates the cradle-to-gate manufacturing LCIA data for I-joists for the SE. To ensure comparability and consistency, treatment of biogenic carbon was taken from the Norwegian Solid Wood Product Product Category Rules (PCR) (Aasestad 2008) and the PCR for North American structural and architectural wood products (FPInnovations 2015). This report does not include any comparative assertions. Using the LCIA outcomes, the APA – The Engineered Wood Association and its members can explore potential process and parameter improvements internally and new conversion technologies along with the identification of environmental hotspots. LCA practitioners can use the data for their studies, product customers can use the data (perhaps in the eventual form of an environmental product declaration (EPD)) to assist in product selection, and building specifiers can find green building products with documentation. This LCA is in conformance with the PCR for North American structural and architectural wood products (FPInnovations 2015) and ISO 14040/14044 standards (ISO 2006a, 2006b). This report follows data and reporting requirements as outlined in the PCR and contains the LCA components for producing a North American EPD including economic allocation for producing 1 km of composite I-joist in the SE (ISO 2006c; FPInnovations 2015).

4 INTRODUCTION

Documenting the environmental performance of building products is becoming widespread because of many green marketing claims made without scientific merit (i.e. green washing). Developing EPDs for building products is one way to accomplish this objective for scientific documentation and to counter green washing (ISO 2006c; Bergman and Taylor 2011). In addition, developing wood product LCI data helps construct product LCAs that are then used to develop whole-building LCAs for environmental footprint software such as the Athena Impact Estimator for Building (ASMI, 2016). Conducting whole-building LCAs provides for points that go toward green building certification in rating systems such as LEED v4, Green Globes, and the ICC-700 National Green Building Standard (Ritter et al. 2011). This study can be categorized as a cradle-to-gate LCA and includes forestry operations to the manufacturing of OSB, LVL, FJL, and finally composite I-joists ready to be shipped out from the mill gate.

4.1 Life-Cycle Assessment

Life-cycle assessment is an internationally accepted method to analyze complex environmental impacts of a product or process. It is intended to be an objective and holistic examination of a product that identifies and quantifies energy and materials used and emissions and wastes released to the environment and assesses the impact of those energy and material uses and releases on the environment. Life-cycle assessment studies can evaluate full product life cycles, often referred to as cradle-to-grave, or incorporate only a portion of the products life cycle, referred to as cradle-to-gate or gate-to-gate.

As defined by the ISO (ISO 2006a), LCA is a multiphase process consisting of a (1) goal and scope definition, (2) LCI, (3) LCIA, and (4) interpretation (Figure 1). These steps are interconnected, and their outcomes are based on goals of the study.

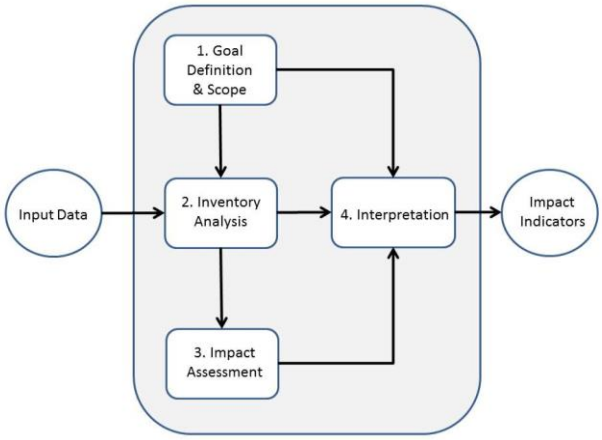

Figure 1. Steps involved in a life-cycle assessment (ISO 2006a).

The key component for conducting an LCA is the LCI step, which is the process of quantifying energy and raw material requirements, air emissions, waterborne effluents, solid waste, and other environmental releases occurring within the system boundaries.

The LCIA process characterizes and assesses the effects of environmental releases identified in the LCI into impact categories such as global warming, acidification, carcinogenics, respiratory effects, eutrophication, ozone depletion, ecotoxicity, and smog. For assessing the environmental impacts of I-joist production, the TRACI 2.0 impact method was used. TRACI is a midpoint-oriented LCIA method developed by the US Environmental Protection Agency specifically for North America using input parameters consistent with U.S. locations (Bare 2011). TRACI is available through the LCA software used for modeling the I-joist process (PRé Consultants 2016).

The life-cycle interpretation is the phase in which the findings of the LCI and/or the LCIA are evaluated in relation to the goal of the study to reach conclusions and recommendations. This final step in an LCA involves an investigation of significant environmental aspects (e.g. energy use and greenhouse gases), their contributions to the indicators under consideration, and determination of which unit processes in the system they come from. For example, if the outcome of an LCIA indicates a particularly high value for GWP, the analyst could refer to the inventory to determine which environmental flows are contributing to the high value and from which unit processes those outputs are coming.

4.2 Description of the Product

Many engineered structural wood products have been developed in the last several decades, e.g., I-joists, OSB, LVL, etc. (Figure 2). I-joists fall into the North American Industry Classification System (NAICS) Code 321213—engineered wood member (except truss) manufacturing, which includes other structural wood-engineered products such as FJL, parallel strand lumber, and glue-laminated timbers (USCB 2012; ASTM 2014). A composite I-joist contains a web made from a structural wood panel, usually OSB but sometimes plywood. The web is glued between two flanges that are sometimes made from solid-sawn lumber or FJL but more commonly from LVL (USEPA 2002; Wilson and Dancer 2004a, 2005a; Stark et al. 2010; ASTM 2014). The typical flange size depends on material. For LVL, the common size is 1.75 by 1.5 in. (44.5 by 38.1 mm), and lumber flanges are usually nominal 2 by 3 in. (50.8 by 76.2 mm). I-joists have an “I” shape form and are measured in linear feet in the United States (Figure 2). There are many different dimensions of composite I-joists, but the most common are dimensions that directly replace 2-

by 10-in. (50.8- by 254-mm) and 2- by 12-in. (50.8- by 304.8-mm) structural lumber (Table 1). I-joists are usually made in continuous lengths and are then cut to 60-ft (18.29-m) lengths for shipping.

This study focused on large-scale production facilities that are representative of the industry. Production values and study results were reported per linear kilometer with an assumed average depth of 30 cm. As shown in Figure 2, depth goes from the top to the bottom of the 'I'. I-joist depth varies notably, but large quantities of I-joists made in the United States have a depth of 30 cm. These engineered structural wood products are designed to be used in the same manner as solid wood products such as sawn lumber but with different properties. In the SE region, I-joists are primarily made with southern pine species including a mix of longleaf pine (*P. palustris*), shortleaf pine (*P. echina*ta), slash pine (*P. elliotti*), and loblolly pine (*P. taeda* L.) along with some hardwood mostly from yellow poplar (*Liriodendron tulipfera*) and a little from red maple (*Acer rubrum*) used to make the LVL flanges.

Production of I-joists is measured on a linear basis (feet, meters) with no measurement for the dimensions of height and width, which is the practice for the I-joist data given in this study. The most common dimensions of I-joists for the SE can be found in Table 1. This LCA uses a weighted average for producing a generic I-joist (Table 1). This I-joist is slightly larger than you would expect to find in that region because of the small amount of waste and inefficiencies of producing the I-joists included in the product.

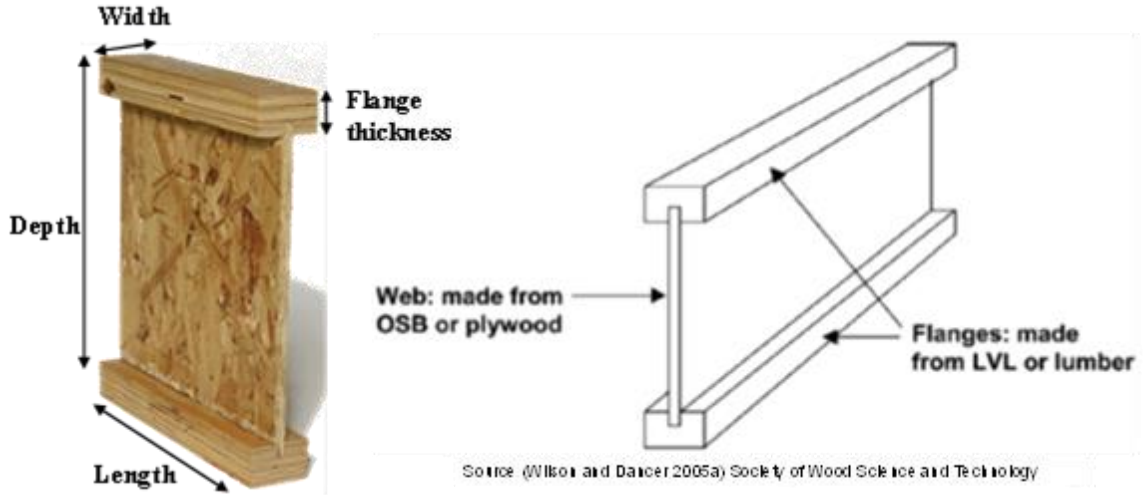

Figure 2. Typical composite I-joists shown here made with laminated veneer lumber (LVL) flanges and an oriented strandboard (OSB) web.

Table 1. Common dimensions for composite I-joists.

Common I-Joist Dimensions					
Depth	**Flange thickness**	**Width**	**Height**	**Flange thickness**	**Width**
millimeters			**inches**		
241.30	33.34	44.45	9.50	1.31	1.75
301.75	38.10	44.45	11.88	1.50	1.75
301.75	38.10	38.10	11.88	1.50	1.50
301.63	79.38	38.10	11.88	3.13	1.50
Generic I-Joist Dimensions					
298.45	33.34	47.75	11.75	1.31	1.88

5 METHOD

5.1 Goal

The goal of the study was to update the cradle-to-gate LCA of I-joist manufacturing for the SE. The authors updated the gate-to-gate I-joist manufacturing LCI data developed by Wilson and Dancer (2005a) and developed FJL manufacturing LCI data from collected primary data and secondary data (Milota 2015; Puettmann and Wilson 2005). The authors then linked the data to available forest resource LCI data (Johnson et al. 2005; Puettmann et al. 2013), OSB production LCI data (Kaestner 2015; Puettmann et al. 2015), and LVL production LCI data (Bergman and Alanya-Rosenbaum 2016).

5.2 Scope

In accordance with ISO 14040 and 14044 standards (ISO 2006a, 2006b; ILCD 2010), the scope of this LCA study was to cover the life-cycle stages of I-joists from forest resource activities through OSB, LVL, and FJL production to the final product — I-joists ready for shipping from the plant. Impacts from OSB and LVL production were included in the analysis using LCI data developed from updating LVL for the SE and OSB (Bergman and Alanya-Rosenbaum 2016; Kaestner 2015; Puettmann et al. 2015). Analyses included CPEC of I-joist production and environmental impacts in several impact categories including GW.

5.2.1 Intended audience

The primary audience for the LCA report includes the American Wood Council, Canadian Wood Council, APA – The Engineered Wood Association, North American wood I-joist manufacturers, and other LCA practitioners.

5.2.2 Comparative assertions

The report does not include product use and end of life phases which are required for comparative assertions relative to substitute products. If future comparative studies are intended and disclosed to the public, the LCA boundary would need to be expanded to include the use and end of life phases consistent with the ISO 14040/44:2006 (ISO 2006a) guidelines and principles and compliance with the wood products PCR (FPInnovations 2015). (If the LCA is used to develop an EPD, internal and/or external critical review would be required).

5.2.3 Allocation procedure

Selecting an allocation approach is an important part of an LCA study. In this study, all primary energy and environmental outputs were assigned to various coproducts by mass allocation. The decision was

based on the understanding that the wood residues were coproducts with a value rather than a waste material. Economic allocation was performed in addition to mass allocation, because product category rules suggest using economic allocation for a multioutput process when the difference in revenues is more than 10% (FPInnovations 2015) as it was for this study. The results of analysis using economic allocation are provided in Appendix C (Tables 26-31).

5.2.4 Functional and declared unit

In accordance with the PCR developed (FPInnovations 2015), the declared unit for I-joists was one kilometer (1.0 km). A declared unit is used in instances in which the function and the reference scenario for the whole life cycle of a wood building product cannot be stated (FPInnovations 2015). For conversion of units from the U.S. I-joist industry measure, 1 km equals 3.281 thousand feet with an oven-dried moisture content of 6%. All input and output data were allocated to the declared unit of product based on the mass and economics of products and coproducts in accordance with ISO 14044 (ISO 2006b) and the North American structural and architectural wood products PCR (FPInnovations 2015). Because the analysis did not take the declared unit to the stage of being an installed building product, no service life was assigned.

5.2.5 System boundaries

The system boundary began with regeneration in the forest and ended with the final I-joist product. The system boundary included forest resource management activities such as site preparation and planting seedlings, fertilization and thinning on a subset of hectares, and final harvest; transportation of roundwood to the primary breakdown facility; OSB, LVL, and FJL production; transportation to the I-joist facility if needed; and I-joist production (Figure 3). The I-joist production complex was modeled as a single unit approach representing all the steps necessary to make I-joists. Three main unit processes exist in manufacturing I-joists: (1) routing and shaping of web and flanges, (2) assembly of I-joists, and (3) sawing and curing with energy generation as an auxiliary process (USEPA 2002; Wilson and Dancer 2005a; Puettmann et al. 2013). A single unit (i.e. black box) approach was used to model the I-joist process because little wood left the system except as the final product and because of the relative simplicity of the I-joist manufacturing processes. This simply means all process inputs and outputs are grouped into one I-joist process.

Fuel resources used for the cradle-to-gate production of energy and electricity were included within the cumulative system boundary. Off-site emissions included those from grid electricity production; transportation of feedstock; OSB, LVL, and FJL production; transportation to the I-joist facility; and production of fuels off site and consumed both on and off site. Ancillary material consumption data such as motor oil, waxes, paint, and hydraulic fluid were included in the analysis.

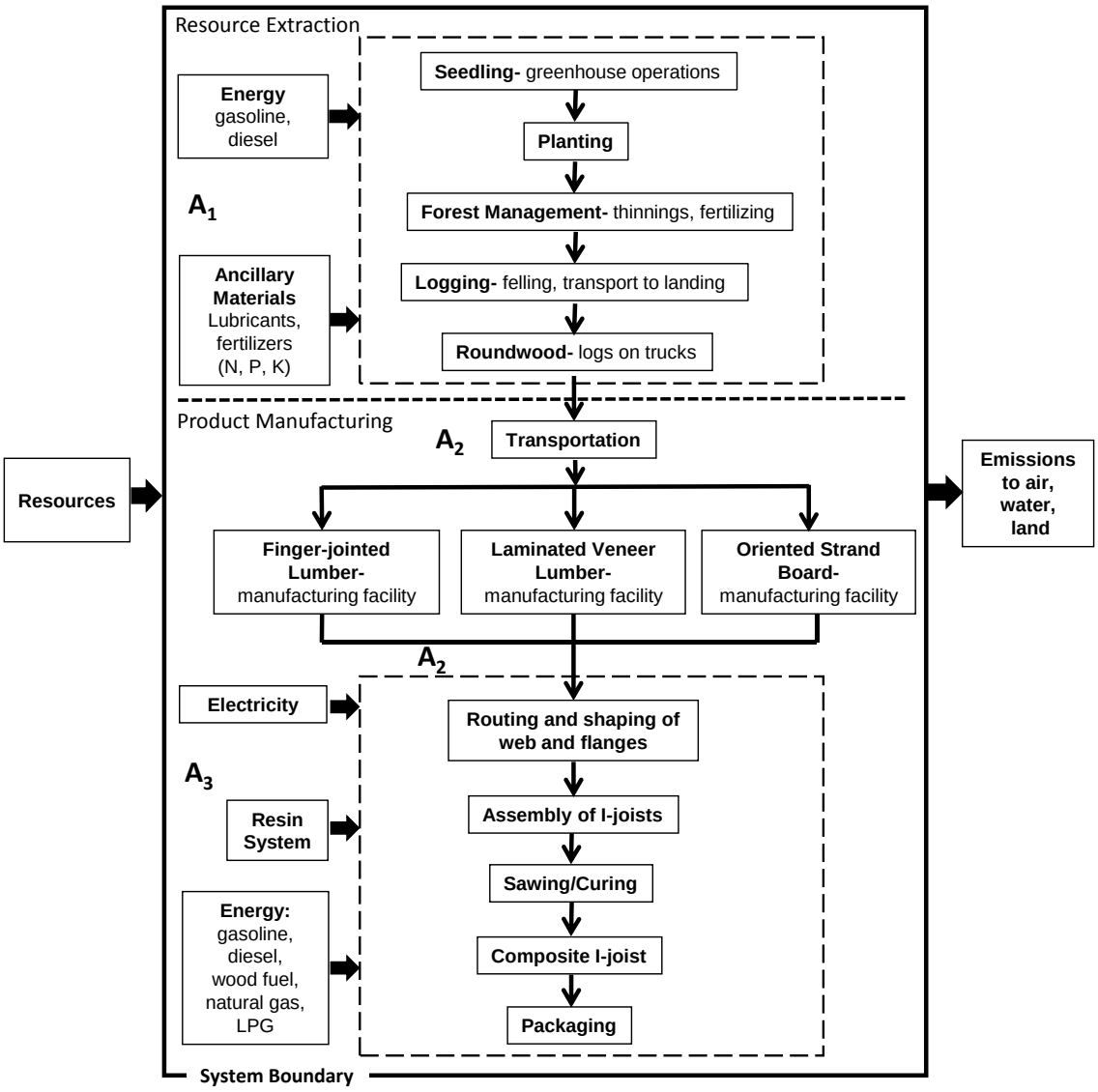

Figure 3. Cradle-to-gate system boundary and process flow for production of I-joists.

5.2.6 Cut-off rules

According to the PCR, if the mass/energy of a flow is less than 1% of the cumulative mass/energy of the model flow, it may be excluded, provided its environmental relevance is minor. This analysis included all energy and mass flows for the primary data collected.

In the primary surveys, manufacturers were asked to report total hazardous air pollutants (HAPs) specific to their wood products manufacturing process, regardless of whether or not they were less than the 1% cutoff. If applicable to the wood product, HAPs are reported later in the LCI data section and thus are not excluded from this LCI. Under Title III of the Clean Air Act Amendments of 1990, the EPA has designated HAPs that wood products facilities are required to report as surrogates for all HAPs. These are methanol, acetaldehyde, formaldehyde, propionaldehyde (propanal), acrolein, and phenol. All HAPS are included in the LCI; no cut-off rules apply. HAPS are reported in Appendix B and were included in the

impact assessment. There were no cut-offs used in the impact assessment. Therefore, a complete list of all air emissions is located in Appendix B of this report.

5.2.7 Data quality requirements

This study collected primary data from representative I-joist manufacturers in the SE that use average technology for their regions. The raw wood material to produce I-joists comes from manufacturing facilities in the SE region in the form of OSB, LVL, and FJL. In the SE, most I-joist production occurs in conjunction with production of LVL and FJL in the same engineered wood facility or nearby. For one of the two surveyed mills, LVL production occurred at the same site as I-joist production, and most FJL production occurred at the same site as well. This study used OSB manufacturing LCI data for the SE developed by Puettmann et al. (2015) but with the OSB transported from Canada.

Total U.S. I-joist production for 2012 was 109 thousand km (358,900 thousand ft) (APA 2014). Two U.S. I-joist plants representing 27% of 2012 U.S. production, 29.5 thousand km (96,799.180 thousand ft) participated in the study by providing primary data for the SE regions. The surveyed plants provided detailed annual production data on their facilities, including on-site energy consumption; electrical usage; LVL, OSB, and FJL volumes; and I-joist production for 2012. Wilson and Dancer (2005a) performed a 2000 U.S. I-joist LCI study that covered 33% (21.3 thousand km) of production in the SE. The production of surveyed facilities for 2012 was an increase of 26% from 2000. In addition, unlike the earlier 2000 study, 2012 I-joist production data were not available by region. Therefore, production data by region could not be quantified for 2012.

5.2.8 Assumptions and limitations

All flow analyses of wood and bark in the process were determined on an OD weight basis with a weighted-average green specific gravity of 0.55.

Although small in quantity relative to the wood mass, impacts from production of the resin system were included in the analysis. Because of the small consumption values for sodium hydroxide, catalyst, and melamine components of the resin system, no transportation data were provided or incorporated into the analysis. However, impacts from cradle-to-gate production of the entire resin system were included in the analysis.

Melamine-urea-formaldehyde (MUF) resin was used as proxy for melamine-formaldehyde (MF) resin, which was used in the FJL production life-cycle stage.

5.2.9 Data collection

Primary data for the LCI were collected through surveys in accordance with CORRIM and ISO 14040 standards along with a site visit at a joint operating LVL/I-joist manufacturing facility. This study relied almost exclusively on production and emissions data provided by I-joist producers in the United States, with some secondary data on electrical grid inputs and resource forest activities from the U.S. LCI database (Goemans 2010; NREL 2012). The survey data represented I-joist production in terms of input materials, electricity, fuel use, and emissions for the 2012 production year. Two production facilities were surveyed and selected to be representative of SE region production practices. Questionnaires were used to survey the I-joist manufacturing processes to collect primary data (Appendix F). The primary data obtained from the surveys were weight-averaged using the formula shown in the next section, Calculation rules (Milota 2004).

Secondary data sources are shown in Table 2. All nonwood related LCI data came from the U.S. LCI Database (NREL 2012), whereas wood LCI data came from previous or concurrent CORRIM research.

Table 2. Secondary LCI data sources used.

Process	LCI data source	Publication date
Electricity	USLCI data for "Electricity, at Grid, SERC[a], 2008/RNA[b] U"	2008
Diesel truck	USLCI data for "Transport, combination truck, diesel powered/US"	2008
Forestry and harvesting	CORRIM data for PNW softwood forestry operation; CORRIM data for SE softwood forestry operations	2005, 2010, updated 2013
LVL	CORRIM data for LVL production	2005, updated 2016
OSB	CORRIM data for OSB production	2005, updated 2016
Natural gas	USLCI data for "Natural gas, combusted in industrial boiler/US, Athena"	2008
Resin	CORRIM data resin production obtained from the USLCI	2009
Slack wax	CORRIM data for Slack wax obtained from the USLCI	2004
Emulsion polymer	USLCI data for "Methylene diphenyl diisocyanate resin, at plant, US SE/US"	2008
Polyurethane polymer	US-EI data for "Polyurethane, flexible foam, at plant/RER with US electricity U"	2009
Hardener	USLCI data for "Phenol-resorcinol-formaldehyde hardener, at plant/US"	2008
Gasoline	USLCI data for "Gasoline, combusted in equipment/US"	2008
Hydraulic fluid, lubricants, oil, and grease	USLCI data for "Gasoline, at refinery/l/US" without combustion emissions	2008
Plastic strapping/wrapping material	USLCI data for "Low density polyethylene resin, at plant/RNA"	2008

[a]SERC stands for Southeastern Electric Reliability Council
[b]North America

5.2.10 Calculation rules

In the surveys, I-joist production was reported in linear feet. These data were converted to 1 km and a weighted average based on production (Eq. 1). This approach resulted in an I-joist complex that represents a composite of the mills surveyed in the SE region but does not represent any mill in particular. The U.S. LCI database was used to assess off-site impacts associated with the materials and energy used. SimaPro, version 8+ (Pré Consultants 2016) was used as the accounting program to track all of the materials.

$$\bar{P}_{weighted} = \frac{\sum_{i=1}^{n} P_i x_i}{\sum_{i=1}^{n} x_i} \quad (1)$$

Where $\bar{P}_{weighted}$ is the weighted average of the values and was reported by *n* mills, P_i is the reported mill value, and x_i is the fraction of the mill's value to total production of the surveyed mills for that specific value. Because the surveyed mill data varied between facilities, a statistical analysis was conducted. In this study, the weighted coefficient of variation was calculated (NIST ITL 1996) (Eq. 3). The weighted coefficient of variation (CoV_w) is the weighted standard deviation (sd_w) (Eq. 2) divided by the weighted mean ($\bar{P}_{weighted}$) (Eq. 1):

$$CoV_W = \frac{sd_w}{\bar{P}_{weighted}} \quad (2)$$

$$sd_w = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \bar{x}_w)^2}{\frac{(N'-1)\sum_{i=1}^{N} w_i}{N'}}} \quad (3)$$

Where w_i is the weight of the i^{th} observation, *N* is the number of nonzero weights, and $\bar{x}_w$ is the weighted mean of the observations.

Missing data were defined as data not reported in surveys by the I-joist facilities. Whenever missing data occurred for survey items, they were checked with plant personnel to determine whether it was an unknown value or zero. Missing data were carefully noted to prevent them from being averaged as zeros. Any outliers were resolved by contacting mill personnel. A summary of conversion factors used in calculations can be found in Appendix A, Tables 22-24.

5.2.11 Life-cycle impact assessment method

The LCIA was performed using the TRACI 2 method (Bare 2011). The five impact categories examined were GW (kg CO_2-eq), acidification (kg SO_2-eq), eutrophication (kg N-eq), ozone depletion (kg chlorofluorocarbons-11-eq), and photochemical smog (kg NOx-eq).

The life cycle impact assessment (LCIA) phase establishes links between the life cycle inventory results and potential environmental impacts. The LCIA calculates impact indicators, such as global warming potential and smog. These impact indicators provide general, but quantifiable, indications of potential environmental impacts. The target impact indicator, the impact category, and means of characterizing the impacts are summarized in Table 3. These five impact categories reported were consistent with the requirement of the wood products PCR (FPInnovations 2015).

Table 3. Selected impact indicators, characterization models, and impact categories.

Impact Indicator	Characterization Model	Impact Category
Greenhouse gas (GHG) emissions	Calculate total emissions in the reference unit of CO_2 equivalents for CO_2, methane, and nitrous oxide.	Global warming
Releases to air decreasing or thinning of ozone layer	Calculate the total ozone forming chemicals in the stratosphere including CFCs HCFCs, chlorine, and bromine. Ozone depletion values are measured in the reference units of CFC equivalents.	Ozone depletion
Releases to air potentially resulting in acid rain (acidification)	Calculate total hydrogen ion (SO_2) equivalent for released sulfur oxides, nitrogen oxides, hydrochloric acid, and ammonia. Acidification value of SO_2 mole- eq. is used as a reference unit.	Acidification
Releases to air potentially resulting in smog	Calculate total substances that can be photo-chemically oxidized. Smog-forming potential of O_3 is used as a reference unit.	Photochemical smog
Releases to air potentially resulting in eutrophication of water bodies	Calculate total substances that contain available nitrogen or phosphorus. Eutrophication potential of N-eq. is used as a reference unit.	Eutrophication

Each impact indicator is a measure of an aspect of a potential impact. This LCIA does not make value judgments about the impact indicators, meaning that no single indicator is given more or less value than any of the others. Additionally, each impact indicator value is stated in units that are not comparable with others. For the same reasons, indicators should not be combined or added.

6 DETAILED DESCRIPTION OF DATA AND PROCESSES

6.1 Forestry Operations

Logs used in the production of I-joists include in their life cycle the upstream activities associated with establishment, growth, and harvest of trees. This group of activities is collectively referred to as forest resource management. Forest operations modeled as inputs to production processes were based on forest resource LCI data inputs from the SE softwood forests (Johnson et al. 2005; Puettmann et al. 2013). Forestry operations vary regionally (Johnson et al. 2005) but typically include some combination of growing seedlings, regeneration, site preparation, planting (where applicable), thinning, fertilization (where applicable), and final harvest. Harvesting includes felling, skidding, processing, and loading for both commercial thinning and final harvest operations.

For SE forests, reforestation occurs primarily by planting that requires inputs from human-related activities (i.e., the technosphere) for seedlings, site preparation, planting, and precommercial thinning (Table 4). Weighted-average allocation to different processes takes into account inherent differences in site productivity and energy usage by different kinds of logging equipment. Inputs to the forest resources management LCI include seed, electricity used during greenhouse operations, fertilizer used during seedling production and stand growth, and the fuel and lubricants needed to power and maintain equipment for thinning, and (final) harvest operations. The primary output product is a log destined for softwood veneer or plywood, OSB, or lumber. The coproduct, nonmerchantable (logging) slash, is generally left at a landing. Slash disposal was not modeled as it was assumed to decay in-situ.

Table 4. Inputs to the regeneration phase and midrotation fertilization per hectare (ha) of SE forest (Puettmann et al. 2013).

Inputs	Unit	Low intensity	Medium intensity	High intensity	Weighted average
		Reforesting 1 ha			
Diesel and gasoline	L	38.55	132.27	272.21	104.59
Seedlings, at greenhouse	p[a]	1,794	1,794	1,794	1,794
Nitrogen in fertilizer					
In seedlings	kg	0.14	0.14	0.14	0.14
On site	kg	-	264.52	712.86	189.06
Phosphorous in fertilizer					
In seedlings	kg	0.01	0.01	0.01	0.01
On site	kg	-	72.86	128.90	48.70
Potassium in fertilizer					
In seedlings	kg	0.08	0.08	0.08	0.08
On site	kg	-	-	-	-

[a] p = individual seedling.

In the SE region, most harvested lands are reforested for the next crop cycle with the sequence of treatments from planting to harvest averaging 27 years for the SE (Johnson et al. 2005; Puettmann et al. 2013). Forestry operations and their associated impacts are not stationary and will change based on both

past and prospective technologies, evolving forest management procedures, and market demands. Given that the nature of productivity gains is not confirmed or well developed, this assessment was based on data representing the current state of the art in forest operations. It does not discount future operations or estimate potential productivity gains from future technologies. Outputs representing quantities of product, measures of consumed resources, and the emissions associated with those consumed resources were developed as a weighted average across the hectares managed for timber production. These quantities of product are used as inputs to the LVL manufacturing LCI, and the consumed resources and emissions are tracked for inclusion in the cradle-to-gate LCI.

6.2 Product Manufacturing

6.2.1 Resource transport

Wood raw materials were delivered to the I-joist plants by truck and rail; the wood material consists primarily of OSB, FJL, and LVL purchased off site. For the surveyed mills, one mill produced LVL and the other one produced FJL on site.

6.2.2 Laminated veneer lumber process

Inputs into composite I-joist manufacturing include LVL. For every kilometer of I-joist produced, 2,597 kg (4.6 m^3) of LVL were incorporated into the final product for the SE. Dry veneers, parallel laminated lumber, and resins are the primary raw materials consumed for the production of SE LVL. Wilson and Dancer (2004b, 2005b) and Bergman and Alanya-Rosenbaum (2016) give detailed information on the production of LVL.

6.2.3 Oriented strandboard process

Inputs into composite I-joist manufacturing include OSB. For every kilometer of I-joist produced, 2,212 kg of OSB were incorporated into the final product. Chips and resins are the primary raw materials consumed for the production of SE OSB. Kline (2005) and Kaestner (2015) give detailed information about SE OSB manufacturing.

6.2.4 Finger-jointed lumber production

Inputs into composite I-joist manufacturing include FJL. For every kilometer of I-joist produced, 28.3 kg of FJL were incorporated into the final product. Finger joints are machined on both ends of softwood lumber with special cutter heads. A structural resin, such as MUF is applied, and the joints in successive boards are coupled. The resin is cured with the joint under end pressure and heat. Most manufacturers use a continuous radio-frequency curing system for this step. For this study, the surveyed mills provided primary data on FJL production and MUF resin consumption, whereas electrical consumption data for cutting or forming the joint for FJL was embedded in the electricity consumed for I-joist production and therefore not noted separately. Also, FJL production included the impacts of softwood lumber production as well as resin production.

6.2.5 Methylene diphenyl di-isocyanate resin

Methylene diphenyl diisocyanate (MDI) resin[1] is used in the production of I-joists. The LCI for production of MDI resin was based on a cradle-to-gate study of plastic resins and polyurethane precursors completed by Franklin Associates (2011). Franklin Associates collected primary data for MDI production including data on the following MDI precursors: olefins, benzene, chlorine–caustic soda, and nitric acid–

[1] MDI is listed under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of US EPA and subject to reporting requirements according to EPCRA Section 313 Toxic Chemicals

nitrobenzene–aniline. For MDI production, data were gathered from four North American producers that represent approximately 95% of North American production capacity (Franklin Associates 2011).

6.2.6 Phenol resorcinol formaldehyde resin

Phenol-resorcinol-formaldehyde resin is the primary resin used for both web-to-web and web-to-flange joints. The PRF data were collected by survey from eight plants in the United States that represented 63% of total production for the year 2005 (Wilson 2009). Total annual production of PRF was 15,513,000 kg (34,166,667 lb) of neat[2] resin at 60% nonvolatile solids content. PRF resins differ somewhat from other resins in that hardeners are required to help in curing glue-laminated timbers and I-joists.

6.2.7 Melamine urea formaldehyde resin

Melamine-urea-formaldehyde resin is used for FJL. The MUF production data were collected by survey from six plants in the United States that represented 77% of total production for the year 2005 (Wilson 2009). Total annual production was 86,588,000 kg (190,893,000 lb) of neat resin at 60% nonvolatile solids content. Essentially, MUF production is identical to production of urea formaldehyde resin (these resins are used for particleboard and medium-density fiberboards) with the exception that melamine, about 8% by weight on a neat resin basis, is substituted for a portion of the urea input. The inputs to produce 1.0 kg of neat MUF resin at 60% nonvolatile solids content consist of three primary chemicals on a dry basis of melamine at 0.081 kg, urea at 0.397 kg, and methanol at 0.304 kg; much lesser amounts of formic acid, ammonium sulfate, and sodium hydroxide; and 0.791 kg of water. A significant portion of the processing water is recycled back into the resin. Based on CORRIM Phase I glulam surveys, 0.96 kg of MUF resin was used to produce 1.0 m^3 of FJL (Puettmann and Wilson 2005; Puettmann et al. 2013). In this study, the MUF consumption value in the FJL manufacturing process was quantified as 1.235 kg/m^3 based on primary mill data. The resin was assumed to have a solids content of 65% (Silva et al. 2015).

6.2.8 Energy generation

Energy production for manufacturing of I-joists comes from electricity, natural gas, diesel, and liquid petroleum gas (LPG). Electricity was used for mechanical pressing during resin application, for running the saws and assembly machinery as well as for pneumatic and mechanical conveying equipment, fans, and other equipment in the plant. Natural gas was used for the purpose of generating heat for resin curing. Diesel was used for rolling stock, which transported materials outside the plant, and LPG used in rolling stock including forklift trucks, which operated inside the plant. Kaestner (2015) provides information on energy consumption for producing OSB, and Bergman and Alanya-Rosenbaum (2016) provide information on energy consumption for producing LVL.

6.2.9 I-joist manufacturing

Routing and shaping of web and flanges is the first step in producing composite I-joists. This process requires machining of the OSB web pieces so they fit together at the ends as well as tapering them on the top and bottom edges so that they can be fitted into the flanges. Flanges are made primarily from LVL along with some FJL. The flanges are routed their entire length to accept the inserted tapered OSB web material. The coproduct created during this process is dry sawdust.

Resin application and pressing of the I-joist web and flange members is the next step. Resin is applied in web-to-web and web-to-flange joints. Resins may be MDI or PRF. Assembly is done mechanically, pressing web sections end-to-end and into the top and bottom flange, which are also pressed end-to-end. The result is a continuous ribbon of I-beam that can be of infinite length. No coproducts are created during this process. The final steps before packaging are sawing the I-joists to length and allowing the

[2] Neat resin means the resin as purchased from the supplier, does not include any inert fillers.

joints to cure. In some cases, the I-joist may be heated in a radio-frequency oven to accelerate resin cure time. Wilson and Dancer (2004a, 2005a) provide more information about composite I-joist manufacturing.

6.2.10 Packaging

Finished I-joists are packaged for transport. Inputs include final product (I-joist) and outputs include packaged I-joist. For this study, it was assumed that only wrapping material was used for each I-joist. Packing materials represent about 1% of the cumulative mass of the model flow. The material list was provided by Puettmann et al. (2013) (Table 5).

Table 5. Materials used in packaging and shipping per kilometer I-joist.

Material	Value	Unit
Wrapping material – HDPE[a] and LDPE[b] laminated paper	47.45	kg
PET[c] strapping	-	kg
Cardboard strap protectors	-	kg
Wooden spacers	-	kg
Total	-	kg

[a]High-density polyethylene (HDPE)
[b]Low-density polyethylene (LDPE)
[c]Polyethylene terephthalate (PET)

6.3 Air Emissions

The main emission sources were from hot presses. Baghouses were the primary collectors of particulate matter, and both surveyed plants used the ECD. To decrease volatile organic compound (VOC) emissions from dryers, plants reported the use of regenerative catalytic oxidizers (RCOs), which are sometimes referred to as regenerative thermal oxidizers (RTOs) and wet scrubbers. RCOs are designed to destroy VOCs and other emissions including particulate matter (PM) and soot (USEPA 2003a).

7 INPUTS AND OUTPUTS

7.1 Material Transportation

Based on mill surveys, the weighted-average one-way haul distance for feedstock along with the components of the resin system are shown in Table 6. All upstream transportation of inputs to LVL, FJL, and OSB production were included in the respective LCI input values.

Table 6. Weighted-average delivery distance (one way) by mode for materials to I-joist plants.

Material delivered to mill	**Delivery distance**
	km
OSB to I-joist plant, by truck	175
OSB to I-joist plant, by rail	0
LVL to I-joist plant	112
FJL to I-joist plant	230
MDI and PRF resin to I-joist plant	89

7.2 Energy Sources

For I-joist production, thermal energy generated from natural gas was commonly produced in the form of steam and then used in the hot-pressing unit process for resin curing. Electricity (grid) was the main energy source used on site, which was derived from off-site sources. Table 7 shows the electrical grid composition for I-joist production in the SE region of the United States. Nuclear (25.2%) and coal (56.4%) power comprises most of the SE grid (SERC). Outputs included electricity and emissions primarily of fossil CO_2.

Table 7. Percentage of each energy source for electricity for producing I-joists in the SE[a] (NREL 2012).

Energy source	Percentage of total grid electricity
Natural gas	13.4
Coal	56.4
Oil	0.7
Nuclear	25.2
Hydro	2.0
Wind	0.0
Biomass	1.5
Geothermal	0.0
Miscellaneous	0.8
Total	100.0

[a] SERC is the electric grid comprised of Alabama, Georgia, Mississippi, North Carolina, South Carolina, and parts of Arkansas, Florida, Illinois, Iowa, Kentucky, Louisiana, Missouri, Tennessee, Texas, and Virginia.

7.3 Gate-to-Gate I-Joist Production

Table 8 shows the detailed description of the material and energy inputs and outputs crossing the system boundary of I-joist production, gate-to-gate. Electricity consumed on site for the SE was calculated to be 257.8 kWh/km. Natural gas was the primary fossil fuel used on site. Air emissions were derived from the surveyed mills along with pertinent emissions data categorized by the U.S. Environmental Protection Agency (USEPA 2002, 2003a, 2003b, 2003c, 2015). When available, surveyed air emission data as primary data were selected rather than secondary data.

Table 8. Unit process inputs and outputs to produce 1 km of composite I-joists, SE, gate-to-gate.

Products	**Unit/km**	**Value**	**Allocation[a]**
I-joists	km	1.000E+00	91.15%
Sawdust, sold	kg	4.109E+02	8.48%
Panel trim, sold	kg	6.863E-01	0.01%
Rejects	kg	1.713E+01	0.30%
Resources	**Unit/km**	**Value**	
Water, well, in ground	L	3.189E-01	
Materials/fuels[b]	**Unit/km**	**Value**	
Wood feedstock, LVL, oven-dried	kg	2.597E+03	
Wood feedstock, OSB, oven-dried	kg	2.212E+03	
Wood feedstock, FJL, oven-dried	kg	2.826E+01	
Phenol-resorcinol-formaldehyde resin	kg	3.352E+01	
MDI (proxy for emulsion polymer isocyanate)	kg	1.469E+00	
Polyurethane polymer	kg	3.121E-01	
Hardener	kWh	5.496E-01	
Electricity, at grid	L	2.578E+02	
Diesel, combusted in industrial equipment	L	4.772E+00	
Gasoline, combusted in equipment	m^3	2.173E-01	
Propane, combusted in industrial equipment	tkm	4.735E+00	
Natural gas, combusted in industrial boiler	tkm	4.096E+01	
Transport, combination truck, diesel power, LVL	tkm	3.082E+02	
Transport, combination truck, diesel power, OSB	tkm	4.108E+02	
Transport, combination truck, diesel power, FJL	tkm	7.148E+00	
Transport, combination truck, diesel powered, PRF resin	kg	4.759E+00	
Hydraulic fluid	kg	2.551E-02	
Greases	kg	6.377E-03	
Motor oil	kg	2.551E-02	
Potable water	kg	3.153E-01	
Plastic strapping	kg	6.377E-02	
Wrapping material - packaging	kg	4.745E+01	
Emissions to air	**Unit/km**	**Value**	
Acetone[c]	kg	2.083E-04	
Acrolein	kg	not reported	
Carbon monoxide	kg	5.517E-02	
Formaldehyde	kg	4.593E-03	
Methanol	kg	3.982E-02	
Nitrous oxide	kg	6.705E-02	
PM_{10}	kg	1.027E-01	
Phenol	kg	1.027E-01	
Propionaldehyde	kg	9.428E-02	
Sulfur dioxide	kg	not reported	
VOC	kg	7.114E-04	
Waste to treatment	**Unit/km**	**Value**	
Waste to inert landfill	kg	0.000E+00	
Waste to recycling	kg	6.379E+00	

[a] Mass allocation approach.
[b] Wood feedstocks include OSB, LVL, and FJL.
[c] Secondary data (USEPA 2002).

7.4 Material Flows

To evaluate data quality, a mass balance was performed (Table 9). For the SE, LVL, OSB and FJL usage in OD kg basis was 2,597, 2,212, and 28 per 1 km of I-joist produced. The major coproduct produced was sawdust (412 OD kg on average), whereas I-joists produced constituted about 91% by mass of the total output. Purchased LVL made up the largest portion of feedstock consumed at the facility at 2,597 OD kg per km of SE I-joist. The second largest portion was OSB. Phenol-resorcinol-formaldehyde resin made up most of the additives, which were overall about 0.7% by mass of the total input.

Table 9. Mass balance of I-joist manufacturing per kilometer I-joist, SE, gate-to-gate.

	(OD kg)	Mass (%)	CoVw[a] (%)
Feedstocks	**Inputs**		
LVL	2,597	53.7	2.4
OSB	2,212	45.7	7.0
FJL	28	0.6	
Total, feedstock	**4,809**	**99.4**	**2.2**
Additives			
Phenol-resorcinol-formaldehyde resin	33.5	0.7	141
Aqueous emulsion polymer	1.5	0.0	141
Total, additives	**36**	**0.7**	**46.2**
Total, in	**4,840**	**100**	
Products	**Outputs**		
I-joists	4,415	91.2	4.6
Coproducts			
Sawdust, sold	411	8.5	18
Sawdust, wood fuel	1	0.0	141
Panel trim, sold	17	0.4	141
Total, coproducts	**428**	**8.8**	**39**
Total, outputs	**4,844**	**100**	

[a] Coefficient of variation, production-weighted.

7.5 On-Site Energy Inputs

Weighted-average energy inputs consumed at the I-joist manufacturing site were developed from survey data (Table 10). Electricity and natural gas were the primary energy inputs at 258 kWh and 41 m^3 for the SE per linear km of I-joist.

Table 10. On-site energy inputs for I-joist manufacturing, SE, gate-to-gate.

	Quantity	Unit	CoVw[a] (%)
Energy inputs			
Electricity	258	kWh	33
Natural gas	41	m^3	49
Diesel	4.77	L	16
Propane	4.74	L	5.3
Gasoline	0.217	L	141

[a] Coefficient of variation.

8 LIFE-CYCLE INVENTORY DATA

Cradle-to-gate LCI flows for composite I-joist manufacturing was presented by five life stages: (1) forestry operations, (2) OSB production, (3) FJL production, (4) LVL production, and (5) I-joist production. As noted previously, LVL production included dry veneer production and veneer transportation to LVL plants. Thus, because dry veneer production was captured within LVL production and LVL was the heaviest component of an I-joist, most raw material energy consumption occurred during LVL production followed by OSB and I-joist stages with a small portion arising from FJL production and forestry operations (Table 11). In particular, wood fuel consumption was dominated by the LVL stage resulting from veneer input to LVL production. As with this study, wood is burned primarily at the veneer production facility to generate thermal energy for log conditioning and drying veneers (Wilson and Dancer 2005b; Bergman and Taylor 2011; Kaestner 2015).

Table 11. Raw material energy consumption per kilometer I-joist produced, cradle-to-gate, mass allocation.

Fuel	Unit	Forestry operations	OSB production	FJL production	LVL production	I-joist production
Wood fuel	OD kg	0.00E+00	1.18E+02	9.94E+00	7.97E+02	9.18E+00
Gas, natural, in ground	m^3	1.04E+01	1.46E+02	2.87E-01	3.35E+02	1.01E+02
Coal, in ground	kg	2.20E+00	1.54E+02	1.15E+00	3.18E+02	9.22E+01
Uranium oxide, in ore	kg	5.08E-05	4.37E-03	3.22E-05	8.97E-03	2.22E-03
Oil, crude, in ground	kg	3.43E+01	4.39E+01	2.98E-01	8.19E+01	5.05E+01

Primary energy is energy embodied in the original resources such as crude oil and coal before conversion. Table 12 shows the CPEC for cradle-to-gate production of SE I-joist. The LVL stage consumed the most primary energy at 45.1 GJ/m^3 (61.9%). For LVL production, wood and natural gas were used to generate thermal energy for log conditioning and for drying and pressing veneers. At the I-joist life-cycle production stage, natural gas was used to generate thermal energy for resin curing, whereas electricity was consumed for sawing, trimming, and the radio-frequency ovens. Cradle-to-gate primary energy was derived from wood fuel at 19.5 GJ/m^3 and natural gas at 22.7 GJ/m^3 with CPEC for all five life-cycle stages at 72.8 GJ/m^3, representing more than 58% of the CPEC. Coal consumption was third with 20.4% contribution from generating electricity. Other renewable energy sources of hydro and wind along with wood fuel comprised 27% of CPEC. Total energy use at the I-joist production stage was dominated by fossil fuels of which the greatest contributor was natural gas (28.5%), unlike the upstream products for which biomass dominated. Other major primary energy sources were coal and crude oil.

Wood products typically consume more energy during the manufacturing stage than any other stage (Puettmann and Wilson 2005; Winistorfer et al. 2005; Puettmann et al. 2010). To compare with an earlier CORRIM study on making 1 km of I-joist in the SE, cumulative allocated energy consumptions is 58.2 GJ/m^3 with a biomass energy percentage of 45% (Wilson and Dancer 2005a, Puettmann et al 2013). Like the present study, mass allocation was used.

Table 12. Cumulative primary energy consumption per kilometer I-joist produced, cradle-to-gate, mass allocation.

Fuel	Percentage	Total	Forestry Operations	OSB Production	FJL Production	LVL Production	I-joist Production
		MJ/ km					
Wood fuel	26.9	1.95E+04	0.00E+00	2.47E+03	2.08E+02	1.67E+04	1.92E+02
Gas, natural, in ground	31.2	2.27E+04	3.97E+02	5.58E+03	1.10E+01	1.28E+04	3.88E+03
Coal, in ground	20.4	1.49E+04	5.77E+01	4.03E+03	3.01E+01	8.33E+03	2.41E+03
Oil, crude, in ground	13.2	9.60E+03	1.56E+03	2.00E+03	1.36E+01	3.73E+03	2.30E+03
Uranium oxide, in ore	8.2	5.96E+03	1.94E+01	1.66E+03	1.23E+01	3.42E+03	8.44E+02
Hydro	0.2	1.29E+02	2.35E-01	3.21E+01	2.31E-01	7.74E+01	1.92E+01
Wind	0.0	3.96E+00	0.00E+00	5.27E-01	3.38E-04	8.74E-01	2.56E+00
Solar	0.0	4.45E-02	0.00E+00	2.41E-03	3.13E-06	6.08E-03	3.60E-02
Geothermal	0.0	1.95E-01	0.00E+00	1.95E-01	2.71E-07	5.18E-06	0.00E+00
Total	100	7.28E+04	2.04E+03	1.58E+04	2.75E+02	4.51E+04	9.64E+03
Total, by percentage		100	2.8	21.7	0.4	61.9	13.2

Air emission data were collected from surveyed mill data that were augmented by a secondary resource for acetone emissions from I-joist plants (USEPA 2002). As mentioned previously, baghouses are the primary collectors of PM, and both surveyed plants used the ECD. I-joist manufacturers reported on-site air emissions (Table 8) of acetone, carbon monoxide, formaldehyde, methanol, nitrous oxides, PM, phenol, sulfur dioxide, and VOCs. The emissions greater than 10^{-4} and HAPs generated from I-joist production along with the ones reported by the mills themselves are reported in Appendix B. Fossil and biogenic CO_2 released in the production of 1 km of I-joist were 2,482 and 1,442 kg, respectively.

All waterborne emissions occurred off site for gate-to-gate I-joist production (Table 25). I-joist plants are zero-discharge facilities. For unspecified suspended solids, most of the emissions came from natural gas extraction, then crude oil production, followed by production of PRF resin. Most chloride emissions were from the same sources.

Solid emissions were dominated by LVL and I-joist production stages. Solid emissions include ash generated at the wood boiler during veneer production for LVL production and primarily fuels and resins used (Table 13). A total of 107 kg/km solid waste was generated (Table 16). Overall, 84% of the solid waste generated was landfilled.

Table 13. Waste to treatment (kg) per kilometer I-joist, cradle-to-gate, mass allocation.

Waste to treatment	Total	Forestry operations	OSB production	FJL production	LVL production	I-joist production
	kg/km					
Waste in inert landfill	9.05E+01	0.00E+00	1.17E+01	1.89E-04	7.77E+01	1.03E+00
Waste to recycling	1.70E+01	0.00E+00	0.00E+00	0.00E+00	1.12E+01	5.81E+00
Total waste	1.07E+02	0.00E+00	1.17E+01	1.89E-04	8.89E+01	6.85E+00

9 LIFE-CYCLE IMPACT ASSESSMENT

Table 14 shows environmental performance results for impact categories (GW, acidification, eutrophication, ozone depletion, and smog), primary energy consumption from nonrenewable and renewable sources (wind, hydro, solar, geothermal, and nuclear fuels), consumption of renewable and nonrenewable resources, and solid waste generated. Values in Table 14 are the cumulative impact of all upstream processes required for I-joist production including those from forestry; OSB, FJL, and LVL production; and I-joist production as well as the transportation energy required to move these materials to the I-joist facility. For example, differences between I-joist production data in Table 8 and those in Table 14 are a result of the resources and fuels used in the upstream processes, e.g. fresh water use. In addition, the contribution of major substances to the overall impact for eutrophication, acidification, smog, and GW impact categories are provided in Appendix D (Tables 30-31). The data on solid waste generated during OSB and LVL production were obtained from Kaestner (2015) and Bergman and Alanya-Rosenbaum (2016), respectively.

Table 14. Environmental performance of 1 km of I-joist, cradle-to-gate, mass allocation.

Impact category	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Global warming	kg CO_2 eq	2.72E+03	1.29E+02	6.36E+02	3.82E+00	1.49E+03	4.57E+02
Acidification	kg SO_2 eq	2.66E+01	1.72E+00	6.26E+00	4.03E-02	1.40E+01	4.50E+00
Eutrophication	kg N eq	1.22E+00	3.14E-01	1.64E-01	1.20E-03	3.65E-01	3.78E-01
Ozone depletion	kg CFC-11 eq	1.78E-04	1.10E-08	2.21E-06	3.66E-09	7.71E-07	1.75E-04
Smog	kg O_3 eq	2.91E+02	4.87E+01	6.40E+01	8.00E-01	1.36E+02	4.14E+01
Total primary energy consumption	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total	MJ	7.28E+04	2.04E+03	1.58E+04	2.75E+02	4.51E+04	9.64E+03
Nonrenewable fossil	MJ	4.72E+04	2.02E+03	1.16E+04	5.46E+01	2.49E+04	8.58E+03
Nonrenewable nuclear	MJ	5.96E+03	1.94E+01	1.66E+03	1.23E+01	3.42E+03	8.44E+02
Renewable[a]	MJ	1.33E+02	2.35E-01	3.28E+01	2.31E-01	7.82E+01	2.18E+01
Renewable, biomass	MJ	1.95E+04	0.00E+00	2.47E+03	2.08E+02	1.67E+04	1.92E+02
Material resources consumption (nonfuel resources)	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Nonrenewable materials	kg	1.49E+01	0.00E+00	6.18E+00	1.06E-03	8.08E+00	6.16E-01
Renewable materials	kg	4.07E+03	7.17E+02	2.07E+01	3.62E+01	3.27E+03	1.99E+01
Fresh water	L	1.22E+04	4.22E-01	1.40E+03	3.23E+01	6.12E+03	4.61E+03
Waste generated	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Solid waste	kg	1.07E+02	0.00E+00	1.17E+01	1.89E-04	8.89E+01	6.85E+00

[a] solar, wind, hydroelectric, and geothermal.

10 COMPARISON OF UPDATED LIFE-CYCLE INVENTORY WITH A PREVIOUS STUDY

The on-site, industry-average energy inputs reported in 2012 were substantially higher than for Phase I except for the electricity and propane consumption (Wilson and Dancer 2005a; Puettmann et al. 2013). In particular, diesel and natural gas consumption is driving the total impact from energy with changes of 33% and 587%, respectively (Table 15). Therefore, a sensitivity analysis investigating the energy inputs into I-joist production was completed in Section 13 to see their overall impact. The CPEC of gate-to-gate

I-joist production was quantified as 58.2 GJ/km in the earlier CORRIM Phase I study (Wilson and Dancer 2005a), which is about 22% lower compared with the current study. Similarly, at the I-joist facilities in the earlier study, natural gas was used to generate heat for resin curing although at a much lower consumption. For both studies, the energy generated by woody biomass and fossil fuels constituted the majority of the total energy consumed. However, with that being said, no uncertainty estimate was provided with the earlier data and different companies provided the primary 2000. Therefore, only speculation can made on the apparent differences. In this study, the weighted coefficient of variation representing variability in the collected process data was calculated and presented in the report. In addition, in this study, a sensitivity analysis was performed investigating the impact of the variation of energy inputs into I-joist production to the overall output.

Table 15. Production weighted-average SE on-site energy inputs for manufacturing 1 km of I-joist.

	SE Phase I	SE 2012		
Energy inputs	**Quantity**	**Quantity**	**Unit**	**Change (%)**
Electricity	246	257.8	kWh	5
Natural gas	5.95	40.9	m^3	587
Diesel	3.6	4.77	L	33
Propane	4.72	4.74	L	0

11 TREATMENT OF BIOGENIC CARBON

Treatment of biogenic carbon is consistent with the Intergovernmental Panel for Climate Change (IPCC 2006) inventory reporting framework. There is no assumption that biomass combustion is carbon neutral, but net carbon emissions from biomass combustion are accounted for under the Land-Use Change and Forestry (LUCF) sector and are therefore ignored in energy emissions reporting for the product LCA. This prevents double counting. Standards such as ASTM D 7612 (2010), which are used in North America to define legal, responsible, and/or certified sources of wood materials, are in place to provide assurances regarding forest regeneration and sustainable harvest rates and serve as proxies to ensure stable carbon balances in the forest sector. They are outside the accounting framework for this LCA.

This approach to the treatment of biogenic carbon was taken from the Norwegian Solid Wood Product PCR (Aasestad 2008), and the North American PCR (FPInnovations 2015) adopted an identical approach to ensure comparability and consistency. The North American PCR approach is followed here for GW impact reporting. Therefore, the default TRACI impact assessment method was used. This default method does not count the CO_2 emissions released during the combustion of woody biomass during production. Other emissions associated from wood combustion, e.g. methane or nitrogen oxides, do contribute to and are included in the GW impact category. Bare (2011) provides a complete list of emissions factors for the GW impact method used. Using this method, 2,716 kg CO_2eq were released in the cradle-to-gate production of 1 km of I-joist for the SE (Table 14). That same 1 km of I-joist stores 7,285[3] kg CO_2eq (Table 16).

[3] 4,415 OD kg of wood in I-joist x 0.9 × (0.5 kg carbon/1.0 OD kg wood) × (44 kg CO_2/kmole/12 kg carbon/kmole) = 7,285 kg CO_2eq.

Table 16. Carbon balance per kilometer I-joist.

Source	kg CO_2 equivalent
Released forestry operations	129
Released manufacturing	2,588
CO_2eq. stored in product	7,285

12 LIFE-CYCLE INTERPRETATION

As defined by ISO (2006a, b), the term life-cycle interpretation is the phase of the LCA that the findings of either the LCI or the LCIA, or both, are combined consistent with the defined goal and scope to reach conclusions and recommendations. This phase in the LCA reports the significant issues based on the results presented in the LCI and LCIA of this report. Additional components report an evaluation that considers completeness, sensitivity, and consistency checks of the LCI and LCIA results and conclusions, limitations, and recommendations.

12.1 Identification of Significant Issues

The objective of this element is to structure the results from the LCI or the LCIA phases to help determine the significant issues found in the results and presented in previous sections of this report. A contribution analysis was applied for the interpretation phase of this LCA study. Contribution analysis examines the contribution of life-cycle stages, unit process contributions in a multi-unit manufacturing process, or specific substances that contribute to particular impact categories.

12.2 Life-Cycle Phase Contribution Analysis

Allocation was performed using both mass and economic methodologies to investigate the influence of the allocation method on the results. The contribution of five life-cycle stages to the LCA results for mass and economic allocation are provided in Table 17 and Table 18, respectively. Overall, the cradle-to-gate environmental impacts from I-joist production for the five impact categories resulted in less than a 10% difference between economic and mass allocation. Applying economic allocation resulted in a 10% increase in the impact resulting from the I-joist production stage in all impact categories, which was caused by the environmental burdens shifted toward the production of I-joists, whereas economic value of the coproducts was minor.

Table 17. Life-cycle stages contribution analysis of 1 km of I-joist, cradle-to-gate, mass allocation.

Impact category	Unit	Forestry operations	OSB production	FJL production	LVL production	I-joist production
Global warming	kg CO_2 eq	4.7%	23.4%	0.1%	54.9%	16.8%
Acidification	kg SO_2 eq	6.5%	23.6%	0.2%	52.9%	17.0%
Eutrophication	kg N eq	25.7%	13.4%	0.1%	29.9%	31.0%
Ozone depletion	kg CFC-11 eq	0.0%	1.2%	0.0%	0.4%	98.3%
Smog	kg O_3 eq	16.8%	22.0%	0.3%	46.7%	14.3%
Total primary energy consumption	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total	MJ	2.8%	21.7%	0.4%	61.9%	13.2%
Nonrenewable fossil	MJ	4.3%	24.6%	0.1%	52.8%	18.2%
Nonrenewable nuclear	MJ	0.3%	27.9%	0.2%	57.4%	14.2%
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	0.2%	24.6%	0.2%	58.7%	16.3%
Renewable, biomass	MJ	0.0%	12.7%	1.1%	85.3%	1.0%
Material resources consumption (nonfuel resources)	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Nonrenewable materials	kg	0.0%	41.5%	0.0%	54.3%	4.1%
Renewable materials	kg	17.6%	0.5%	0.9%	80.5%	0.5%
Fresh water	L	0.0%	11.5%	0.3%	50.3%	37.9%
Waste generated	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Solid waste	kg	0.0%	10.9%	0.0%	82.7%	6.4%

Table 18. Life-cycle stages contribution analysis of 1 km of I-joist, cradle-to-gate, economic allocation.

Impact category	Unit	Forestry operations	OSB production	FJL production	LVL production	I-joist production
Global warming	kg CO_2 eq	4.5%	24.2%	0.2%	53.5%	17.6%
Acidification	kg SO_2 eq	6.2%	24.4%	0.2%	51.5%	17.8%
Eutrophication	kg N eq	24.5%	13.8%	0.1%	29.1%	32.4%
Ozone depletion	kg CFC-11 eq	0.0%	1.2%	0.0%	0.4%	98.3%
Smog	kg O_3 eq	16.2%	23.0%	0.4%	45.3%	15.1%
Total primary energy consumption	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total	MJ	2.7%	22.8%	0.5%	59.8%	14.2%
Nonrenewable fossil	MJ	4.1%	25.3%	0.2%	51.5%	19.0%
Nonrenewable nuclear	MJ	0.3%	28.8%	0.3%	55.8%	14.8%
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	0.2%	25.1%	0.2%	57.6%	16.9%
Renewable, biomass	MJ	0.0%	14.2%	1.5%	83.2%	1.1%
Material resources consumption (nonfuel resources)	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Nonrenewable materials	kg	0.0%	44.7%	0.0%	50.7%	4.5%
Renewable materials	kg	18.0%	0.6%	1.5%	79.4%	0.5%
Fresh water	L	0.0%	12.2%	0.3%	46.8%	40.6%
Waste generated	**Unit**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Solid waste	kg	0.0%	10.9%	0.0%	82.2%	6.9%

12.3 Substance Contribution Analysis

The contribution of substances released to GWP is presented in Table 19. The major substances that contributed to GWP for the five life-cycle stages of I-joist manufacturing include fossil carbon dioxide (CO_2), methane (CH_3), and nitrous oxide (N_2O). The results are presented for both mass and economic allocation, for both of which CO_2 emissions had the highest contribution.

Table 19. Substance contribution analysis to GWP (kg CO_2 eq) by life-cycle stage (total percentage basis and values are displayed per kilometer I-joist, cradle-to-gate)[a]

		Mass allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartments		**100.00**	5%	23%	0.1%	55%	17%
Carbon dioxide	Air	91.4%	1.15E+02	5.84E+02	3.61E+00	1.37E+03	4.14E+02
Methane	Air	7.9%	6.15E+00	5.13E+01	1.99E-01	1.20E+02	3.82E+01
Nitrous oxide	Air	0.6%	7.57E+00	1.33E+00	1.30E-02	4.49E+00	4.08E+00
Other substances	Air	<1	5.19E-05	5.44E-02	3.10E-03	3.61E-01	5.36E-01
		Economic allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartments		**100.00**	5%	24%	0.2%	54%	18%
Carbon dioxide	Air	91.4%	1.15E+02	6.31E+02	5.17E+00	1.40E+03	4.54E+02
Methane	Air	8.0%	6.15E+00	5.55E+01	2.78E-01	1.23E+02	4.19E+01
Nitrous oxide	Air	0.6%	7.57E+00	1.39E+00	1.86E-02	4.77E+00	4.47E+00
Other substances	Air	<1	5.19E-05	5.86E-02	4.09E-03	3.38E-01	5.88E-01

[a] Additional substance contributions for other impact categories can be found in Appendix D of this report.

12.4 Completeness, Sensitivity, and Consistency Checks

Evaluating the completeness, sensitivity, and consistency of an LCA offers confidence in and the reliability of the LCA results. The ***completeness check*** process verifies whether information from the life-cycle phases of an LCA is sufficient for reaching the goals and scope and conclusions of the study and making sound interpretations of the results. Three life-cycle stages (forestry operations, wood material production, and I-joist production) were checked for data completeness including all input elements, such as raw and ancillary materials input, energy inputs, transportation scenarios, water consumption, and outputs such as products and coproducts, emissions to air, water, and land, and final waste disposals. All input and output data were found to be complete, and no data gaps were identified.

The consistency check process verifies that the assumptions, methods, and data are consistently applied throughout the study and are in accordance with the goal and scope of the LCA. A comprehensive review process was completed for this LCA to make certain consistency was applied to the assumptions made, methods used, models, data quality including data sources, data accuracy, age, time-related coverage, technology, and geographical coverage.

Sensitivity analysis can be applied to the LCA to determine changes in results caused by variations in assumptions, methods, and data. Sensitivity analysis is a systematic approach for estimating the effects of the choices made concerning methods and data on the outcome of a study. Sensitivity analysis is a key component of data quality analysis and can be applied to quantify the impact of changes in assumptions or input data on study results. A sensitivity analysis was completed per ISO 14040 standards (ISO 2006a, b) to model the effects of natural consumption and electricity consumption for I-joist production. Sensitivity analysis can be useful to understand how various process parameters contribute to environmental output factors.

12.5 Cumulative Primary Energy Consumption

During gate-to-gate I-joist manufacturing, natural gas is used for curing resin. Changing the on-site consumption of natural gas may have a significant effect on CPEC and GHG emissions for cradle-to-gate I-joist production. Lower (-20%) and higher (+20%) natural gas consumptions were selected to compare with the baseline fuel mix developed from the mill survey data (Table 20). Although natural gas usage changed by 20%, the outcomes changed less than 1% for both GHG emissions and CPEC.

Table 20. Key parameters for changing on-site natural gas consumption during 1 km of I-joist production, cradle-to-gate, mass allocation.

Parameter	Unit	Low (-20%)	Surveyed (0%)	High (+20%)
		Values		
GHG emissions	kg CO_2eq	2,698	2,716	2,734
CPEC	GJ	72.5	72.8	73.1

12.6 Electricity Consumption

During gate-to-gate I-joist manufacturing, electricity is used in the mechanical pressing during resin application, running the saws and assembly machinery as well as pneumatic and mechanical conveying equipment, fans, radio-frequency ovens, and other equipment in the plant. However, changing the electricity consumption by 20% changed the outcome by less than 1.2% for both GHG emissions and CPEC for cradle-to-gate I-joist production (Table 21).

Table 21. Key parameters on changing electricity consumption during 1 km of I-joist production, cradle-to-gate, mass allocation.

Parameter	Unit	Low (-20%)	Surveyed (0%)	High (+20%)
		Values		
GHG emissions	kg CO_2eq	2,683	2,716	2,750
CPEC	GJ	72.2	72.8	73.4

Neither natural gas nor electrical consumption on-site had a substantial impact on the overall process because on-site I-joist production CPEC contributed roughly 13% of the energy impacts of cradle-to-gate I-joist production.

13 CONCLUSION, LIMITATIONS, AND RECOMMENDATIONS

The cradle-to-gate LCA for I-joists includes the LCI of (1) forest resources, (2) OSB production, (3) FJL production, (4) LVL production, and (5) I-joist production. It relies on primary survey data and secondary data for process inputs such as natural gas, diesel, and electricity. The survey results for I-joists were representative of the SE region of the United States. The survey data were representative of the I-joist sizes and production volumes consistent with trade association production data.

The amount and type of energy used has a substantial impact on the holistic environmental impacts of the production of building materials. For I-joists from the SE region, from cradle-to-gate, 26.9% of the cumulative energy was from biomass (wood fuel) and 65% was from nonrenewable fossil fuels, leaving a small portion of energy needs coming from nuclear (8.2%) and the remaining (0.2%) from hydro, wind,

solar, and geothermal. Emissions from the forest resources LCI was small relative to other manufacturing emissions (LVL, OSB, FJL, and I-joists).

Cradle-to-gate LCI results showed 2,482 kg fossil CO_2 were released in the production of 1 km of I-joist. Carbon content for wood products is assumed to be 50% by mass of OD wood. Excluding the resin system (about 10% by mass), the carbon stored in the wood portion of 1 km of I-joist on a production-weighted average is equivalent to 7,285 kg CO_2 emissions if left to decay.

Data quality was high. A wood mass balance was performed to verify data quality. Inputs and outputs were consistent for the four surveyed mills on a cubic meter basis. Difference for overall wood mass was less than 2%. A difference less than 10% would be good. Therefore, tracking of wood mass is excellent for this study.

Specific wood production LCA data such as those for I-joists can be used for several purposes. One purpose is to use the present cradle-to-gate LCAs to compare with LCAs of I-joists manufactured from different materials, i.e. steel I-joists. Secondly, production companies can explore potential process improvements in conjunction with new conversion technologies to identify potential environmental hotspots. Thirdly, other groups can use the data, such as LCA practitioners for their studies, customers needing to select products (perhaps eventually with an EPD), and building specifiers looking for green building products with documentation. Fourthly, developed wood product LCI data can contribute to product LCAs that are then incorporated into whole-building LCAs in environmental footprint software. Lastly, the gate-to-gate I-joist production data can be included or used to update current LCI data found in LCI databases.

Recommendations for future work on LCIA of I-joist manufacturing in the United States include expanding the system boundaries by including the use phase of the I-joist product. The cradle-to-grave analysis will allow a more comprehensive assessment of hotspots in the whole-product life cycle.

14 CRITICAL REVIEW

14.1 Internal Review

An internal critical review of the survey procedures, data, analysis, and report was completed by Dr. Maureen Puettmann, WoodLife Environmental Consultants (Corvallis, Oregon) to assess conformance with CORRIM guidelines, the PCR, and ISO 14040 standards.

The review provided assurances that the study methodology, data collection, and analyses were scientifically sound, and in conformance with internationally accepted standards and CORRIM research protocol (ISO 2006b; ILCD 2010; CORRIM 2014).

14.2 External Review

If an EPD is to be developed based on this LCA, an external review process is required. The external review process is intended to ensure consistency between the completed LCA and the principals and requirements of the international standards on LCA (ISO 2006a) and the PCR for North American structural and architectural wood products (FPInnovations 2015) by an independent third party. Following CORRIM's internal review, documents were submitted to UL Environment for independent external review.

15 REFERENCES

Aasestad K (2008) The Norwegian emission inventory 2008. Documentation of methodologies for estimating emissions of greenhouse gases and long-range transboundary air pollutants. Statistisk sentralbyrå. Reports 2008/48: 252 pp.

APA (2014) Engineered wood statistics: Third quarter 2014. APA—The Engineered Wood Association, Tacoma, WA. 9 pp.

ASMI (2016) Athena impact estimator for buildings. http://www.athenasmi.org/our-software-data/impact-estimator. Athena Sustainable Material Institute, Ottawa, Ontario, Canada. (1 March 2016).

ASTM (2010) ASTM D 7612-10. Standard practice for categorizing wood and wood-based products according to their fiber source. American Society for Testing and Materials, West Conshohocken, PA. pp. 783-793.

ASTM (2014) ASTM D 5456-14b. Standard specification for evaluation of structural composite lumber products. American Society for Testing and Materials, West Conshohocken, PA. 33 pp.

Bare JC (2011) TRACI 2.0: The tool for the reduction and assessment of chemical and other environmental impacts 2.0. Clean Technol Envir 13:687-696.

Bergman RD, Alanya-Rosenbaum S (2016) Cradle-to-gate life-cycle assessment of laminated veneer lumber produced in Southeast region of the United States. Consortium for Research on Renewable Industrial Materials (CORRIM), Inc., University of Washington, Seattle, WA.

Bergman RD, Taylor AM (2011) Environmental product declarations of wood products—An application of life cycle information about forest products. Forest Prod J 61(3):192-201.

CORRIM (2014) Research guidelines for life-cycle inventories (draft). Consortium for Research on Renewable Industrial Materials (CORRIM), Inc., University of Washington, Seattle, WA. 40 pp.

FPInnovations (2015) Product category rule (PCR): For preparing an environmental product declaration (EPD) for North American structural and architectural wood products. UN CPC 31. NAICS 321. https://fpinnovations.ca/ResearchProgram/environment-sustainability/epd-program/Documents/pcr-v2.pdf (15 July 2016).

Franklin Associates (2011) Life cycle inventory of nine plastic resins and four polyurethane precursors. Prepared for the Plastics Division of the American Chemistry Council. https://plastics.americanchemistry.com/LifeCycle-Inventory-of-9-Plastics-Resins-and-4-Polyurethane-Precursors-Rpt-Only (2 March 2016).

Goemans C (2010) US LCI Database – North American electricity generation by fuel type update and template methodology. Athena Institute, National Renewable Energy Laboratory, Golden, CO. http://www.nrel.gov/lci/database/.

Hodgman CD (1955) Handbook of chemistry and physics. 37th edition 1955-1956. Chemical Rubber Publishing Co., Cleveland, Ohio. 3156 pp.

ILCD (2010) International Reference Life Cycle Data System (ILCD) Handbook - General guide for life cycle assessment—Detailed guidance. EUR 24708 EN. European Commission–Joint Research Centre–Institute for Environment and Sustainability. Luxembourg. Publications Office of the European Union. 417 pp.

IPCC 2006. Task Force on National Greenhouse Gas Inventories. http://www.ipcc-nggip.iges.or.jp/faq/faq.html (September 22, 2016). ISO (2006a) Environmental management—life-cycle assessment—requirements and guidelines. ISO 14044. International Organization for Standardization, Geneva, Switzerland. 46 pp.

ISO (2006a) Environmental management—Life-cycle assessment—Requirements and guidelines. ISO 14044. International Organization for Standardization, Geneva, Switzerland. 46 pp.

ISO (2006b) Environmental management—Life-cycle assessment—Principles and framework. ISO 14040. International Organization for Standardization, Geneva, Switzerland. 20 pp.

ISO (2006c) Environmental labels and declarations—Type III environmental declarations—Principles and procedures. ISO 14025. International Organization for Standardization, Geneva, Switzerland. 25 pp.
Johnson LR, Lippke BR, Marshall JD, Comnick J (2005) Life-cycle impacts of forest resource activities in the Pacific Northwest and southeast United States. Wood Fiber Sci 37(CORRIM Special Issue):30-46.
Kaestner D (2015) Life cycle assessment of the oriented strand board and plywood industries in the United States of America. Master's Thesis, University of Tennessee. 122 pp. http://trace.tennessee.edu/utk_gradthes/3376 (1 March 2016).
Kline ED (2005) Gate-to-gate life-cycle inventory of oriented strandboard production. Wood Fiber Sci 37 (Special Issue):74-84.
Milota MR (2004) Softwood lumber—Pacific Northwest Region. CORRIM Phase I Final Report Module B. University of Washington, Seattle, WA. www.corrim.org/reports/. 75 pp.
Milota MR (2015) Softwood lumber production life-cycle inventory data. Oregon State University, Corvallis, OR. Personal communication with M Puettmann on 12 October 2015.
NIST ITL (1996) Weighted standard deviation. National Institute of Standards and Technology Information Technology Laboratory. www.itl.nist.gov/div898/software/dataplot/refman2/ch2/weightsd.pdf. (2 July 2015).
NREL (2012) Life-cycle inventory database project. National Renewable Energy Laboratory. www.lcacommons.gov/nrel/search. (1 March 2016).
PRé Consultants (2016) SimaPro 8 Life-cycle assessment software package, Version 8. Plotter 12, 3821 BB Amersfoort, the Netherlands. www.pre.nl/. (1 March 2016).
Puettmann ME, Bergman RD, Hubbard S, Johnson L, Lippke B, Wagner F (2010) Cradle-to-gate life-cycle inventories of US wood products production—CORRIM Phase I and Phase II Products. Wood Fiber Sci 42 (CORRIM Special Issue):15-28.
Puettmann M, Kaestner D, Taylor A (2015) Dry veneer and oriented strandboard production life-cycle inventory data. University of Tennessee, Knoxville, TN. Personal communication with M. Puettmann on 13 October 2015.
Puettmann ME, Oneil EE, Wilson J, Johnson L (2013) Cradle to gate life cycle assessment of engineered I-joists production from the Pacific Northwest. Consortium for Research on Renewable Industrial Materials. University of Washington, Seattle, WA. 24 pp.
Puettmann ME, Wilson JB (2005) Life-cycle analysis of wood products: Cradle-to-gate LCI of residential wood building materials. Wood Fiber Sci 37 (Special Issue):18-29.
Ritter MA, Skog KE, Bergman RD (2011) Science supporting the economic and environmental benefits of using wood and wood products in green building construction. Gen Tech Rep FPL-GTR-206. USDA For Serv Forest Products Laboratory, Madison, WI. 9 pp.
Salazar J, Meil J (2009) Franklin database. http://www.fal.com/lifecycle-services.html. (11 August 2015).
Silva DAL, Lahr FAR, Varanda LD, Christoforo AL, Ometto, AR (2015) Environmental performance assessment of the melamine-urea-formaldehyde (MUF) resin manufacture: A case study in Brazil. J Clean Prod 96: 299-307.
Stark NM, Cai Z, Carll C (2010) Wood-based composite materials: Panel products, glued-laminated timber, structural composite lumber, and wood–nonwood composite materials. In: Wood handbook—wood as an engineering material. Gen Tech Rep FPL–GTR–113. USDA For Serv Forest Products Laboratory, Madison, WI. pp. 11-1–11-28.
Starr C (1971) Energy and power. Sci Am 225(3):37-69.
Todreas NE, Kazimi MS (1990) Thermal hydraulics fundamentals: Nuclear system Volume I Page 2, Table 1-1. Taylor & Francis, New York.
USCB (2012) 2012 North American Industry Classification System Definitions. 321215 Structural wood product manufacturing. United States Census Bureau, Washington, DC. www.census.gov/eos/www/naics/. (1 March 2016).

USEPA (2002) AP 42 Section 10.9 Engineered wood products manufacturing. United States Environmental Protection Agency. pp. 10.9-1–24. http://www.epa.gov/ttnchie1/ap42/ch10/final/c10s09.pdf. (1 March 2016).
USEPA (2003a) Air pollution control technology fact sheet. EPA-452/F-03-021. Regenerative incinerator. United States Environmental Protection Agency, Washington, DC. 5 pp. http://www.epa.gov/ttn/catc/dir1/fregen.pdf. (1 March 2016).
USEPA (2003b) Air pollution control technology fact sheet. EPA-452/F-03-025. Fabric filter (baghouse). United States Environmental Protection Agency, Washington, DC. 6 pp. http://www.epa.gov/ttn/catc/dir1/ff-pulse.pdf. (1 March 2016).
USEPA (2003c) Air pollution control technology fact sheet. EPA-452/F-03-015. Packed-bed/packed-tower wet scrubber. United States Environmental Protection Agency, Washington, DC. 6 pp. http://www.epa.gov/ttn/catc/dir1/fpack.pdf. (1 March 2016).
USEPA (2015) Industrial commercial institutional boilers and process heaters. United States Environmental Protection Agency, Washington, DC. http://www.epa.gov/airtoxics/boiler/boilerpg.html. (1 March 2016).
Wilson JB (2009) Resins: A life cycle inventory of manufacturing resins used in the wood composites industry. In CORRIM Phase II Final Report Module H. January 2009. 103 pp. http://www.corrim.org/pubs/reports/2010/phase2/Module_H.pdf. (22 March 2016).
Wilson JB, Dancer ER (2004a) Composite I-joists–Pacific Northwest and Southeast. In CORRIM Phase I Final Report Module F. 122 pp. http://www.corrim.org/pubs/reports/2005/Phase1/Module_F_Final.pdf. (2 March 2016).
Wilson JB, Dancer ER (2004b) Laminated veneer lumber manufacturing. In CORRIM Phase I Final Report Module H. 87 pp. http://www.corrim.org/pubs/reports/2005/Phase1/Module_H_Final.pdf. (22 March 2016).
Wilson JB, Dancer ER (2005a) Gate-to-gate life-cycle inventory of I-joist production. Wood Fiber Sci 37 (Special Issue):85-98.
Wilson JB, Dancer ER (2005b) Gate-to-gate life-cycle inventory of laminated veneer lumber production. Wood Fiber Sci 37 (Special Issue):114-127.
Winistorfer P, Chen Z, Lippke B, Stevens N (2005) Energy consumption and greenhouse gas emissions related to use, maintenance, and disposal of a residential structure. Wood Fiber Sci 37(Special Issue):128-139.

16 APPENDIX A: CONVERSION FACTORS

Table 22. Common conversions from English to SI units.[a]

To convert from	to	multiply by
Cubic feet (ft^3)	Cubic meter (m^3)	0.02831685
Pounds (avdp) (lb)	Kilograms (kg)	0.4535924
Cubic inches (in^3)	Cubic centimeters (cm^3)	16.393
Btus	Joules (J)	1054
Cubic yards (yd^3)	Cubic meters (m^3)	0.7645549
Feet (ft)	Meters (m)	0.305
Gallons (US gal)	Liters (L)	3.785
Kilowatt hours (kWh)	Mega joules (MJ)	3.6
Miles (mi)	Kilometers (km)	1.609
Ounces (avdp)	Kilograms (kg)	0.028
Square feet (ft^2)	Square meters (m^2)	0.093
Tons (short)	Kilograms (kg)	907.185
Tons (short)	Metric ton (t)	0.9071847
Pounds (lb)	Metric ton (t)	0.0004
Watts (W)	Joules/sec (J/s)	1
Yards (yd)	Meters (m)	0.914
Acres	Hectares (ha)	0.405

[a] Source: Starr (1971).

Table 23. Electricity grids and dataset name by source.

Region	North American grid	Source
Southeast	Electricity, at grid, SERC, 2008/RNA U	U.S. LCI database

Table 24. Energy contents and densities of various fuels.

Fuel	HHV[a,b] MJ/kg	Density	Density units	HHV[a] Btu/lb
Coal	26.19			11,260
Distillate fuel oil[c]	45.54	0.85	kg/L	19,580
Liquid propane gas	54.05	0.49	kg/L	23,240
Natural gas	54.45	0.70	kg/m^3	23,410
Residual fuel oil	43.45	0.96	kg/L	18,680
Wood	20.93			9,000
Uranium	381,000.00			1.64E+08
Gasoline	48.36	0.72	kg/L	20,810
Diesel	44.00	0.88	kg/L	18,930

[a] Hodgman (1955); Salazar and Meil (2009); Todreas and Kazimi (1990).
[b] HHV: High heating value.
[c] Same as for crude oil.

17 APPENDIX B: SOUTHEAST I-JOIST LIFE-CYCLE INVENTORY FLOWS, MASS ALLOCATION

Table 25. Mass allocation inventory.

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Aluminium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.19E-05
Aluminium, 24% in bauxite, 11% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.57E-08	0.00E+00	9.59E-03
Anhydrite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-06
Anhydrite, in ground	Raw	kg	0.00E+00	0.00E+00	5.32E-12	0.00E+00	3.28E-05
Barite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-04
Barite, 15% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.13E-09	0.00E+00	2.75E-02
Basalt	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E-09
Basalt, in ground	Raw	kg	0.00E+00	0.00E+00	3.32E-11	0.00E+00	7.80E-07
Borax	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E-10
Borax, in ground	Raw	kg	0.00E+00	0.00E+00	2.91E-12	0.00E+00	7.22E-08
Bromine, 0.0023% in water	Raw	kg	0.00E+00	0.00E+00	6.34E-13	0.00E+00	3.97E-01
Cadmium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.24E-13
Cadmium, 0.30% in sulfide, Cd 0.18%, Pb, Zn, Ag, In, in ground	Raw	kg	0.00E+00	0.00E+00	1.01E-13	0.00E+00	6.26E-10
Calcite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-01
Calcite, in ground	Raw	kg	0.00E+00	0.00E+00	1.78E-05	0.00E+00	8.58E-01
Carbon dioxide, in air	Raw	kg	1.24E+04	1.00E+02	3.17E-02	1.33E+02	1.84E+00
Carbon, in organic matter, in soil	Raw	kg	0.00E+00	0.00E+00	2.81E-10	0.00E+00	1.02E-04
Carbon, organic, in soil or biomass stock	Raw	kg	0.00E+00	0.00E+00	0.00E+00	4.21E+03	8.09E+03
Cerium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.94E-24
Chromium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E-06
Chromium, 25.5% in chromite, 11.6% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.04E-09	0.00E+00	1.06E-04
Chrysotile	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.77E-09
Chrysotile, in ground	Raw	kg	0.00E+00	0.00E+00	1.04E-11	0.00E+00	3.04E-04
Cinnabar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.49E-07
Cinnabar, in ground	Raw	kg	0.00E+00	0.00E+00	9.78E-13	0.00E+00	2.79E-05
Clay, bentonite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E-05
Clay, bentonite, in ground	Raw	kg	0.00E+00	0.00E+00	4.57E-08	0.00E+00	1.34E-03
Clay, unspecified	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-03
Clay, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	2.32E-06	0.00E+00	1.97E-02
Coal, 26.4 MJ per kg	Raw	kg	2.20E+00	1.49E+02	1.15E+00	3.18E+02	8.16E+01
Coal, bituminous, 24.8 MJ per kg	Raw	kg	0.00E+00	1.10E-05	5.86E-06	1.12E-04	0.00E+00
Coal, bitumous, in ground	Raw	kg	0.00E+00	4.58E+00	0.00E+00	0.00E+00	0.00E+00
Coal, brown	Raw	kg	0.00E+00	9.90E-07	5.27E-07	1.01E-05	1.76E-02
Coal, brown, in ground	Raw	kg	0.00E+00	0.00E+00	2.60E-04	0.00E+00	5.71E+00
Coal, hard	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-01
Coal, hard, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	1.50E-04	0.00E+00	4.71E+00
Coal, lignite, in ground	Raw	kg	0.00E+00	3.80E-01	0.00E+00	0.00E+00	0.00E+00
Cobalt	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-11
Cobalt, in ground	Raw	kg	0.00E+00	0.00E+00	3.63E-12	0.00E+00	2.32E-05
Colemanite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E-09
Colemanite, in ground	Raw	kg	0.00E+00	0.00E+00	8.20E-11	0.00E+00	6.47E-03
Copper ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.61E-04
Copper, 0.99% in sulfide, Cu 0.36% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-08
Copper, 0.99% in sulfide, Cu 0.36% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.56E-11	0.00E+00	1.16E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Copper, 1.18% in sulfide, Cu 0.39% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.44E-09
Copper, 1.18% in sulfide, Cu 0.39% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	7.91E-11	0.00E+00	3.65E-05
Copper, 1.42% in sulfide, Cu 0.81% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-09
Copper, 1.42% in sulfide, Cu 0.81% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.10E-11	0.00E+00	9.69E-06
Copper, 2.19% in sulfide, Cu 1.83% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E-09
Copper, 2.19% in sulfide, Cu 1.83% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.05E-10	0.00E+00	4.80E-05
Diatomite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-13
Diatomite, in ground	Raw	kg	0.00E+00	0.00E+00	3.61E-15	0.00E+00	8.06E-11
Dolomite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.08E-05
Dolomite, in ground	Raw	kg	0.00E+00	0.00E+00	1.50E-10	0.00E+00	2.88E-05
Energy, from biomass	Raw	MJ	0.00E+00	7.01E-01	9.73E-07	1.86E-05	0.00E+00
Energy, from gas, natural	Raw	MJ	0.00E+00	4.03E+01	0.00E+00	8.46E+00	0.00E+00
Energy, from hydro power	Raw	MJ	2.35E-01	3.21E+01	2.31E-01	7.74E+01	1.92E+01
Energy, from oil	Raw	MJ	0.00E+00	1.59E+01	0.00E+00	3.35E+00	0.00E+00
Energy, geothermal	Raw	MJ	0.00E+00	1.95E-01	2.71E-07	5.18E-06	0.00E+00
Energy, gross calorific value, in biomass	Raw	MJ	0.00E+00	0.00E+00	1.98E-04	0.00E+00	5.37E+00
Energy, gross calorific value, in biomass, primary forest	Raw	MJ	0.00E+00	0.00E+00	1.95E-08	0.00E+00	7.06E-03
Energy, kinetic (in wind), converted	Raw	MJ	0.00E+00	5.27E-01	3.38E-04	8.74E-01	2.56E+00
Energy, potential (in hydropower reservoir), converted	Raw	MJ	0.00E+00	0.00E+00	1.04E-03	0.00E+00	1.74E+01
Energy, recovered	Raw	MJ	0.00E+00	4.24E+01	7.47E-07	1.43E-05	0.00E+00
Energy, solar, converted	Raw	MJ	0.00E+00	2.41E-03	3.13E-06	6.08E-03	3.60E-02
Feldspar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-04
Feldspar, in ground	Raw	kg	0.00E+00	0.00E+00	1.81E-16	0.00E+00	1.91E-12
Fluorine	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.83E-09
Fluorine, 4.5% in apatite, 1% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.28E-09	0.00E+00	1.70E-02
Fluorine, 4.5% in apatite, 3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E-09
Fluorine, 4.5% in apatite, 3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.00E-09	0.00E+00	1.29E-02
Fluorspar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.15E-06
Fluorspar, 92%, in ground	Raw	kg	0.00E+00	0.00E+00	7.72E-08	0.00E+00	2.76E-01
Gadolinium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.22E-29
Gallium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-17
Gallium, 0.014% in bauxite, in ground	Raw	kg	0.00E+00	0.00E+00	5.30E-19	0.00E+00	3.48E-15
Gas, mine, off-gas, process, coal mining/m3	Raw	m3	0.00E+00	0.00E+00	1.45E-06	0.00E+00	4.33E-02
Gas, natural, 36.6 MJ per m3	Raw	m3	0.00E+00	4.20E-05	2.24E-05	4.27E-04	0.00E+00
Gas, natural, 36.7 MJ per m3, in ground	Raw	kg	0.00E+00	9.97E+00	0.00E+00	0.00E+00	0.00E+00
Gas, natural, 46.8 MJ per kg	Raw	kg	0.00E+00	1.66E-01	5.02E-05	2.18E-01	1.63E-02
Gas, natural, 49.8 MJ per kg, in ground (EMR)	Raw	kg	0.00E+00	7.18E+00	0.00E+00	0.00E+00	0.00E+00
Gas, natural, in ground	Raw	m3	0.00E+00	0.00E+00	6.94E-03	0.00E+00	9.77E+00
Gas, natural/m3	Raw	m3	1.04E+01	1.21E+02	2.80E-01	3.34E+02	9.13E+01
Gold	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.94E-14
Gold, Au 1.1E-4%, Ag 4.2E-3%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.62E-14
Gold, Au 1.1E-4%, Ag 4.2E-3%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.50E-16	0.00E+00	2.22E-12
Gold, Au 1.3E-4%, Ag 4.6E-5%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-14
Gold, Au 1.3E-4%, Ag 4.6E-5%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	8.25E-16	0.00E+00	4.07E-12
Gold, Au 1.4E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.88E-16	0.00E+00	4.87E-12

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Gold, Au 2.1E-4%, Ag 2.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-13
Gold, Au 2.1E-4%, Ag 2.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.51E-15	0.00E+00	7.44E-12
Gold, Au 4.3E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-14
Gold, Au 4.3E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.74E-16	0.00E+00	1.84E-12
Gold, Au 4.9E-5%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E-14
Gold, Au 4.9E-5%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	8.96E-16	0.00E+00	4.41E-12
Gold, Au 6.7E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-13
Gold, Au 6.7E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.39E-15	0.00E+00	6.83E-12
Gold, Au 7.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-13
Gold, Au 7.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.56E-15	0.00E+00	7.71E-12
Gold, Au 9.7E-4%, Ag 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.53E-15
Gold, Au 9.7E-4%, Ag 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.37E-17	0.00E+00	4.62E-13
Granite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.09E-14
Granite, in ground	Raw	kg	0.00E+00	0.00E+00	1.27E-16	0.00E+00	8.58E-13
Gravel	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-04
Gravel, in ground	Raw	kg	0.00E+00	0.00E+00	9.07E-05	0.00E+00	1.01E-01
Gypsum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-05
Gypsum, in ground	Raw	kg	0.00E+00	0.00E+00	3.08E-10	0.00E+00	1.86E-06
Helium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.99E-16
Indium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-14
Indium, 0.005% in sulfide, In 0.003%, Pb, Zn, Ag, Cd, in ground	Raw	kg	0.00E+00	0.00E+00	1.71E-15	0.00E+00	1.03E-11
Iodine, 0.03% in water	Raw	kg	0.00E+00	0.00E+00	1.50E-13	0.00E+00	2.06E-01
Iron	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-03
Iron ore	Raw	kg	0.00E+00	1.91E-07	9.62E-06	2.24E-07	1.00E-04
Iron, 46% in ore, 25% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.31E-08	0.00E+00	1.57E-03
Kaolinite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-07
Kaolinite, 24% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.92E-09	0.00E+00	1.76E-05
Kieserite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.78E-10
Kieserite, 25% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	7.80E-12	0.00E+00	6.05E-08
Lanthanum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-23
Lead	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.68E-07
Lead, 5.0% in sulfide, Pb 3.0%, Zn, Ag, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	2.12E-12	0.00E+00	1.20E-06
Limestone	Raw	kg	0.00E+00	6.18E+00	1.06E-03	8.08E+00	6.16E-01
Lithium, 0.15% in brine, in ground	Raw	kg	0.00E+00	0.00E+00	2.70E-15	0.00E+00	1.89E-11
Magnesite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-06
Magnesite, 60% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.31E-09	0.00E+00	2.32E-05
Magnesium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-13
Magnesium, 0.13% in water	Raw	kg	0.00E+00	0.00E+00	2.50E-15	0.00E+00	1.41E-11
Manganese	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.22E-07
Manganese, 35.7% in sedimentary deposit, 14.2% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.14E-11	0.00E+00	2.95E-02
Metamorphous rock, graphite containing	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E-09
Metamorphous rock, graphite containing, in ground	Raw	kg	0.00E+00	0.00E+00	3.53E-11	0.00E+00	1.38E-05
Molybdenum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-09
Molybdenum, 0.010% in sulfide, Mo 8.2E-3% and Cu 1.83% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-10
Molybdenum, 0.010% in sulfide, Mo 8.2E-3% and Cu 1.83% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.95E-12	0.00E+00	8.92E-07
Molybdenum, 0.014% in sulfide, Mo 8.2E-3% and Cu 0.81% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-11

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Molybdenum, 0.014% in sulfide, Mo 8.2E-3% and Cu 0.81% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.76E-13	0.00E+00	1.27E-07
Molybdenum, 0.022% in sulfide, Mo 8.2E-3% and Cu 0.36% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-09
Molybdenum, 0.022% in sulfide, Mo 8.2E-3% and Cu 0.36% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.57E-11	0.00E+00	7.84E-06
Molybdenum, 0.025% in sulfide, Mo 8.2E-3% and Cu 0.39% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.95E-11
Molybdenum, 0.025% in sulfide, Mo 8.2E-3% and Cu 0.39% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.01E-12	0.00E+00	4.66E-07
Molybdenum, 0.11% in sulfide, Mo 4.1E-2% and Cu 0.36% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.16E-11	0.00E+00	1.58E-05
Neodymium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-9.98E-25
Nickel, 1.13% in sulfide, Ni 0.76% and Cu 0.76% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-08
Nickel, 1.13% in sulfide, Ni 0.76% and Cu 0.76% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.12E-06	0.00E+00	4.43E-04
Nickel, 1.98% in silicates, 1.04% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-05
Nickel, 1.98% in silicates, 1.04% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.88E-09	0.00E+00	1.62E-04
Nitrogen	Raw	kg	0.00E+00	7.70E-01	0.00E+00	0.00E+00	2.63E-03
Occupation, arable, conservation tillage	Raw	m2a	0.00E+00	1.35E-03	8.07E-07	1.58E-03	0.00E+00
Occupation, arable, conventional tillage	Raw	m2a	0.00E+00	1.48E-03	8.84E-07	1.73E-03	0.00E+00
Occupation, arable, non-irrigated	Raw	m2a	0.00E+00	0.00E+00	6.12E-09	0.00E+00	6.91E-05
Occupation, arable, reduced tillage	Raw	m2a	0.00E+00	9.08E-04	5.41E-07	1.06E-03	0.00E+00
Occupation, construction site	Raw	m2a	0.00E+00	0.00E+00	2.00E-08	0.00E+00	1.78E-03
Occupation, dump site	Raw	m2a	0.00E+00	0.00E+00	1.11E-06	0.00E+00	2.85E-02
Occupation, dump site, benthos	Raw	m2a	0.00E+00	0.00E+00	2.20E-11	0.00E+00	1.59E-07
Occupation, forest, intensive	Raw	m2a	0.00E+00	0.00E+00	2.08E-07	0.00E+00	5.97E-03
Occupation, forest, intensive, normal	Raw	m2a	0.00E+00	0.00E+00	2.95E-06	0.00E+00	6.05E-02
Occupation, forest, intensive, short-cycle	Raw	m2a	0.00E+00	0.00E+00	4.88E-09	0.00E+00	1.77E-03
Occupation, industrial area	Raw	m2a	0.00E+00	0.00E+00	3.09E-07	0.00E+00	7.81E-03
Occupation, industrial area, benthos	Raw	m2a	0.00E+00	0.00E+00	2.01E-13	0.00E+00	1.46E-09
Occupation, industrial area, built up	Raw	m2a	0.00E+00	0.00E+00	2.23E-10	0.00E+00	1.41E-06
Occupation, industrial area, vegetation	Raw	m2a	0.00E+00	0.00E+00	1.03E-10	0.00E+00	1.12E-06
Occupation, mineral extraction site	Raw	m2a	0.00E+00	0.00E+00	6.14E-07	0.00E+00	2.12E-02
Occupation, permanent crop, fruit, intensive	Raw	m2a	0.00E+00	0.00E+00	6.83E-09	0.00E+00	1.67E-05
Occupation, shrub land, sclerophyllous	Raw	m2a	0.00E+00	0.00E+00	1.02E-08	0.00E+00	5.83E-04
Occupation, traffic area, rail embankment	Raw	m2a	0.00E+00	0.00E+00	9.17E-11	0.00E+00	4.77E-07
Occupation, traffic area, rail network	Raw	m2a	0.00E+00	0.00E+00	1.01E-10	0.00E+00	5.35E-07
Occupation, traffic area, rail/road embankment	Raw	m2a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.43E-09
Occupation, traffic area, road embankment	Raw	m2a	0.00E+00	0.00E+00	3.25E-08	0.00E+00	6.96E-04
Occupation, traffic area, road network	Raw	m2a	0.00E+00	0.00E+00	2.80E-10	0.00E+00	1.89E-06
Occupation, urban, discontinuously built	Raw	m2a	0.00E+00	0.00E+00	1.13E-14	0.00E+00	7.19E-11
Occupation, water bodies, artificial	Raw	m2a	0.00E+00	0.00E+00	1.55E-06	0.00E+00	2.85E-02
Occupation, water courses, artificial	Raw	m2a	0.00E+00	0.00E+00	6.07E-07	0.00E+00	1.22E-02
Oil, crude	Raw	kg	3.43E+01	2.29E+01	2.96E-01	7.84E+01	4.41E+01
Oil, crude, 41 MJ per kg	Raw	kg	0.00E+00	1.23E+01	0.00E+00	2.58E+00	0.00E+00
Oil, crude, 42 MJ per kg	Raw	kg	0.00E+00	7.49E-01	1.22E-04	9.81E-01	6.56E-02
Oil, crude, 42.7 MJ per kg	Raw	kg	0.00E+00	2.20E-05	1.17E-05	2.23E-04	0.00E+00
Oil, crude, 43.7 MJ per kg, in ground	Raw	kg	0.00E+00	1.39E+00	0.00E+00	0.00E+00	0.00E+00
Oil, crude, 43.7 MJ per kg, in ground (EMR)	Raw	kg	0.00E+00	6.63E+00	0.00E+00	0.00E+00	0.00E+00
Oil, crude, in ground	Raw	kg	0.00E+00	0.00E+00	1.65E-03	0.00E+00	6.29E+00
Olivine	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-06
Olivine, in ground	Raw	kg	0.00E+00	0.00E+00	1.88E-12	0.00E+00	1.14E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Oxygen	Raw	kg	0.00E+00	1.08E+01	8.39E-05	8.59E+00	3.03E+00
Palladium, Pd 2.0E-4%, Pt 4.8E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.62E-12
Palladium, Pd 7.3E-4%, Pt 2.5E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.70E-12
Pd, Pd 2.0E-4%, Pt 4.8E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.96E-12	0.00E+00	3.41E-09
Pd, Pd 7.3E-4%, Pt 2.5E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.70E-12	0.00E+00	8.18E-09
Peat	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E-05
Peat, in ground	Raw	kg	0.00E+00	0.00E+00	5.29E-08	0.00E+00	8.97E-04
Pesticides	Raw	kg	0.00E+00	8.93E-07	4.39E-09	1.05E-06	2.40E-05
Phosphate ore	Raw	kg	0.00E+00	8.49E-05	4.17E-07	9.93E-05	2.34E-03
Phosphorus	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-04
Phosphorus, 18% in apatite, 12% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.02E-09	0.00E+00	5.24E-02
Phosphorus, 18% in apatite, 4% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-08
Phosphorus, 18% in apatite, 4% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.13E-09	0.00E+00	6.79E-02
Platinum, Pt 2.5E-4%, Pd 7.3E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.36E-14
Platinum, Pt 4.8E-4%, Pd 2.0E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-13
Potassium chloride	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-03
Praseodymium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.06E-25
Pt, Pt 2.5E-4%, Pd 7.3E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.50E-14	0.00E+00	7.84E-11
Pt, Pt 4.8E-4%, Pd 2.0E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.61E-13	0.00E+00	2.81E-10
resin	Raw	kg	0.00E+00	5.78E+01	0.00E+00	0.00E+00	0.00E+00
Rh, Rh 2.0E-5%, Pt 2.5E-4%, Pd 7.3E-4%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.47E-14	0.00E+00	7.78E-11
Rh, Rh 2.4E-5%, Pt 4.8E-4%, Pd 2.0E-4%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.40E-13	0.00E+00	2.44E-10
Rhenium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-13
Rhenium, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.04E-14	0.00E+00	1.46E-10
Rhodium, Rh 2.0E-5%, Pt 2.5E-4%, Pd 7.3E-4%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.26E-14
Rhodium, Rh 2.4E-5%, Pt 4.8E-4%, Pd 2.0E-4%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E-13
Roundwood at forest road	Raw	m3	1.17E+01	5.30E+00	0.00E+00	0.00E+00	0.00E+00
Salt, unspecified	Raw	kg	0.00E+00	7.39E+00	0.00E+00	0.00E+00	0.00E+00
Samarium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.67E-27
Sand	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.12E-04
Sand, quartz, in ground	Raw	kg	0.00E+00	9.89E-06	4.86E-08	1.16E-05	2.66E-04
Sand, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	1.20E-09	0.00E+00	4.29E-03
Scrap, external	Raw	kg	0.00E+00	3.47E-01	9.74E-04	4.06E-01	4.77E+00
Seed corn	Raw	kg	0.00E+00	4.79E-06	2.35E-08	5.60E-06	1.29E-04
Shale	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.42E-06
Shale, in ground	Raw	kg	0.00E+00	0.00E+00	1.51E-11	0.00E+00	9.29E-05
Silver, 0.007% in sulfide, Ag 0.004%, Pb, Zn, Cd, In	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.04E-13
Silver, 0.007% in sulfide, Ag 0.004%, Pb, Zn, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	9.98E-15	0.00E+00	4.93E-11
Silver, 3.2ppm in sulfide, Ag 1.2ppm, Cu and Te, in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.74E-13
Silver, 3.2ppm in sulfide, Ag 1.2ppm, Cu and Te, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	7.12E-15	0.00E+00	3.52E-11
Silver, Ag 2.1E-4%, Au 2.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E-14

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Silver, Ag 2.1E-4%, Au 2.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.57E-16	0.00E+00	3.25E-12
Silver, Ag 4.2E-3%, Au 1.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-13
Silver, Ag 4.2E-3%, Au 1.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.50E-15	0.00E+00	7.41E-12
Silver, Ag 4.6E-5%, Au 1.3E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-13
Silver, Ag 4.6E-5%, Au 1.3E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.47E-15	0.00E+00	7.27E-12
Silver, Ag 9.7E-4%, Au 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.82E-14
Silver, Ag 9.7E-4%, Au 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.71E-16	0.00E+00	4.80E-12
Sodium carbonate	Raw	kg	0.00E+00	1.15E-03	6.89E-07	1.35E-03	0.00E+00
Sodium chloride	Raw	kg	0.00E+00	2.12E+00	9.96E-05	5.37E+00	6.51E-01
Sodium chloride, in ground	Raw	kg	0.00E+00	0.00E+00	1.97E-05	0.00E+00	1.10E+01
Sodium nitrate	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-13
Sodium nitrate, in ground	Raw	kg	0.00E+00	0.00E+00	6.74E-17	0.00E+00	3.47E-13
Sodium sulfate	Raw	kg	0.00E+00	6.27E-03	1.54E-05	7.34E-03	7.27E-02
Sodium sulphate, various forms, in ground	Raw	kg	0.00E+00	0.00E+00	1.90E-08	0.00E+00	3.81E-05
Stibnite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-14
Stibnite, in ground	Raw	kg	0.00E+00	0.00E+00	3.75E-16	0.00E+00	8.37E-12
Sulfur	Raw	kg	0.00E+00	3.38E-04	9.05E-07	3.95E-04	7.72E-03
Sulfur, in ground	Raw	kg	0.00E+00	0.00E+00	3.58E-10	0.00E+00	9.63E-02
Sylvinite, in ground	Raw	kg	0.00E+00	4.18E-05	2.06E-07	4.89E-05	1.12E-03
Sylvite, 25 % in sylvinite, in ground	Raw	kg	0.00E+00	0.00E+00	2.69E-10	0.00E+00	8.35E-02
Talc	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.80E-08
Talc, in ground	Raw	kg	0.00E+00	0.00E+00	3.74E-10	0.00E+00	4.08E-06
Tantalum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.34E-13
Tantalum, 81.9% in tantalite, 1.6E-4% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	7.87E-15	0.00E+00	3.89E-11
Tellurium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.60E-14
Tellurium, 0.5ppm in sulfide, Te 0.2ppm, Cu and Ag, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.07E-15	0.00E+00	5.27E-12
Tin	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.19E-11
Tin, 79% in cassiterite, 0.1% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.08E-13	0.00E+00	3.16E-09
TiO2, 54% in ilmenite, 2.6% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.13E-06
TiO2, 54% in ilmenite, 2.6% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.93E-08	0.00E+00	3.81E-04
TiO2, 95% in rutile, 0.40% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.96E-10
TiO2, 95% in rutile, 0.40% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.25E-16	0.00E+00	1.36E-12
Transformation, from arable	Raw	m2	0.00E+00	0.00E+00	1.36E-11	0.00E+00	3.64E-06
Transformation, from arable, non-irrigated	Raw	m2	0.00E+00	0.00E+00	1.13E-08	0.00E+00	1.27E-04
Transformation, from arable, non-irrigated, fallow	Raw	m2	0.00E+00	0.00E+00	4.33E-12	0.00E+00	1.16E-06
Transformation, from dump site, inert material landfill	Raw	m2	0.00E+00	0.00E+00	2.23E-12	0.00E+00	5.04E-05
Transformation, from dump site, residual material landfill	Raw	m2	0.00E+00	0.00E+00	1.94E-09	0.00E+00	6.52E-05
Transformation, from dump site, sanitary landfill	Raw	m2	0.00E+00	0.00E+00	1.03E-10	0.00E+00	6.51E-07
Transformation, from dump site, slag compartment	Raw	m2	0.00E+00	0.00E+00	2.54E-12	0.00E+00	2.60E-07
Transformation, from forest	Raw	m2	0.00E+00	0.00E+00	1.68E-10	0.00E+00	7.87E-05
Transformation, from forest, extensive	Raw	m2	0.00E+00	0.00E+00	2.44E-08	0.00E+00	5.13E-04
Transformation, from forest, intensive, clear-cutting	Raw	m2	0.00E+00	0.00E+00	1.74E-10	0.00E+00	6.32E-05
Transformation, from industrial area	Raw	m2	0.00E+00	0.00E+00	1.42E-09	0.00E+00	1.84E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Transformation, from industrial area, benthos	Raw	m2	0.00E+00	0.00E+00	1.86E-15	0.00E+00	1.37E-11
Transformation, from industrial area, built up	Raw	m2	0.00E+00	0.00E+00	3.26E-12	0.00E+00	2.75E-08
Transformation, from industrial area, vegetation	Raw	m2	0.00E+00	0.00E+00	5.56E-12	0.00E+00	4.69E-08
Transformation, from mineral extraction site	Raw	m2	0.00E+00	0.00E+00	1.16E-08	0.00E+00	5.73E-04
Transformation, from pasture and meadow	Raw	m2	0.00E+00	0.00E+00	6.54E-09	0.00E+00	4.42E-04
Transformation, from pasture and meadow, intensive	Raw	m2	0.00E+00	0.00E+00	9.19E-12	0.00E+00	1.04E-07
Transformation, from sea and ocean	Raw	m2	0.00E+00	0.00E+00	2.21E-11	0.00E+00	1.60E-07
Transformation, from shrub land, sclerophyllous	Raw	m2	0.00E+00	0.00E+00	5.83E-09	0.00E+00	1.93E-04
Transformation, from tropical rain forest	Raw	m2	0.00E+00	0.00E+00	1.74E-10	0.00E+00	6.32E-05
Transformation, from unknown	Raw	m2	0.00E+00	0.00E+00	3.75E-08	0.00E+00	7.85E-04
Transformation, to arable	Raw	m2	0.00E+00	0.00E+00	1.07E-08	0.00E+00	2.43E-04
Transformation, to arable, non-irrigated	Raw	m2	0.00E+00	0.00E+00	1.13E-08	0.00E+00	1.27E-04
Transformation, to arable, non-irrigated, fallow	Raw	m2	0.00E+00	0.00E+00	1.32E-11	0.00E+00	1.33E-06
Transformation, to dump site	Raw	m2	0.00E+00	0.00E+00	8.58E-09	0.00E+00	2.16E-04
Transformation, to dump site, benthos	Raw	m2	0.00E+00	0.00E+00	2.20E-11	0.00E+00	1.59E-07
Transformation, to dump site, inert material landfill	Raw	m2	0.00E+00	0.00E+00	2.23E-12	0.00E+00	5.04E-05
Transformation, to dump site, residual material landfill	Raw	m2	0.00E+00	0.00E+00	1.94E-09	0.00E+00	6.52E-05
Transformation, to dump site, sanitary landfill	Raw	m2	0.00E+00	0.00E+00	1.03E-10	0.00E+00	6.51E-07
Transformation, to dump site, slag compartment	Raw	m2	0.00E+00	0.00E+00	2.54E-12	0.00E+00	2.60E-07
Transformation, to forest	Raw	m2	0.00E+00	0.00E+00	2.92E-09	0.00E+00	1.60E-04
Transformation, to forest, intensive	Raw	m2	0.00E+00	0.00E+00	1.39E-09	0.00E+00	3.98E-05
Transformation, to forest, intensive, clear-cutting	Raw	m2	0.00E+00	0.00E+00	1.74E-10	0.00E+00	6.32E-05
Transformation, to forest, intensive, normal	Raw	m2	0.00E+00	0.00E+00	2.27E-08	0.00E+00	4.67E-04
Transformation, to forest, intensive, short-cycle	Raw	m2	0.00E+00	0.00E+00	1.74E-10	0.00E+00	6.32E-05
Transformation, to heterogeneous, agricultural	Raw	m2	0.00E+00	0.00E+00	2.00E-12	0.00E+00	1.39E-08
Transformation, to industrial area	Raw	m2	0.00E+00	0.00E+00	3.29E-09	0.00E+00	7.86E-05
Transformation, to industrial area, benthos	Raw	m2	0.00E+00	0.00E+00	3.22E-14	0.00E+00	2.08E-10
Transformation, to industrial area, built up	Raw	m2	0.00E+00	0.00E+00	1.89E-10	0.00E+00	3.49E-06
Transformation, to industrial area, vegetation	Raw	m2	0.00E+00	0.00E+00	4.68E-12	0.00E+00	3.95E-08
Transformation, to mineral extraction site	Raw	m2	0.00E+00	0.00E+00	1.58E-08	0.00E+00	6.37E-04
Transformation, to pasture and meadow	Raw	m2	0.00E+00	0.00E+00	3.41E-11	0.00E+00	2.85E-04
Transformation, to permanent crop, fruit, intensive	Raw	m2	0.00E+00	0.00E+00	9.61E-11	0.00E+00	2.35E-07
Transformation, to sea and ocean	Raw	m2	0.00E+00	0.00E+00	1.86E-15	0.00E+00	1.37E-11
Transformation, to shrub land, sclerophyllous	Raw	m2	0.00E+00	0.00E+00	2.04E-09	0.00E+00	1.17E-04
Transformation, to traffic area, rail embankment	Raw	m2	0.00E+00	0.00E+00	2.13E-13	0.00E+00	1.11E-09
Transformation, to traffic area, rail network	Raw	m2	0.00E+00	0.00E+00	2.35E-13	0.00E+00	1.24E-09
Transformation, to traffic area, rail/road embankment	Raw	m2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-11
Transformation, to traffic area, road embankment	Raw	m2	0.00E+00	0.00E+00	2.47E-10	0.00E+00	5.27E-06
Transformation, to traffic area, road network	Raw	m2	0.00E+00	0.00E+00	3.13E-12	0.00E+00	2.14E-08
Transformation, to unknown	Raw	m2	0.00E+00	0.00E+00	1.46E-09	0.00E+00	1.93E-05
Transformation, to urban, discontinuously built	Raw	m2	0.00E+00	0.00E+00	2.24E-16	0.00E+00	1.43E-12
Transformation, to water bodies, artificial	Raw	m2	0.00E+00	0.00E+00	1.06E-08	0.00E+00	1.86E-04
Transformation, to water courses, artificial	Raw	m2	0.00E+00	0.00E+00	7.51E-09	0.00E+00	1.52E-04

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Ulexite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E-12
Ulexite, in ground	Raw	kg	0.00E+00	0.00E+00	2.75E-14	0.00E+00	1.74E-10
Uranium	Raw	kg	0.00E+00	3.25E-08	1.94E-11	3.81E-08	2.17E-04
Uranium oxide, 332 GJ per kg, in ore	Raw	kg	5.08E-05	4.37E-03	3.22E-05	8.97E-03	2.22E-03
Uranium, 2291 GJ per kg	Raw	kg	0.00E+00	2.52E-06	4.14E-10	3.30E-06	2.20E-07
Uranium, in ground	Raw	kg	0.00E+00	0.00E+00	1.04E-08	0.00E+00	2.51E-04
Vermiculite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.82E-13
Vermiculite, in ground	Raw	kg	0.00E+00	0.00E+00	1.83E-14	0.00E+00	7.71E-11
Volume occupied, final repository for low-active radioactive waste	Raw	m3	0.00E+00	0.00E+00	2.15E-11	0.00E+00	4.85E-07
Volume occupied, final repository for radioactive waste	Raw	m3	0.00E+00	0.00E+00	5.43E-12	0.00E+00	1.22E-07
Volume occupied, reservoir	Raw	m3y	0.00E+00	0.00E+00	2.37E-05	0.00E+00	3.16E-01
Volume occupied, underground deposit	Raw	m3	0.00E+00	0.00E+00	1.75E-10	0.00E+00	8.91E-06
Water, consumptive use, unspecified origin/m3	Raw	kg	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00
Water, cooling, unspecified natural origin/kg	Raw	kg	0.00E+00	6.21E-01	9.99E-06	1.57E+00	0.00E+00
Water, cooling, unspecified natural origin/m3	Raw	m3	0.00E+00	5.88E-01	1.15E-02	2.00E+00	3.45E+00
Water, lake	Raw	m3	0.00E+00	0.00E+00	2.36E-08	0.00E+00	1.11E-03
Water, process, surface	Raw	kg	0.00E+00	2.15E+02	1.14E+01	8.09E+02	0.00E+00
Water, process, unspecified natural origin/kg	Raw	kg	0.00E+00	1.15E+01	3.53E-02	2.92E+01	0.00E+00
Water, process, unspecified natural origin/m3	Raw	m3	0.00E+00	1.76E-05	9.40E-06	1.79E-04	0.00E+00
Water, process, well	Raw	kg	0.00E+00	3.20E+02	7.52E+00	3.54E+02	0.00E+00
Water, process, well, in ground	Raw	kg	0.00E+00	0.00E+00	5.26E-03	0.00E+00	5.95E+00
Water, river	Raw	m3	0.00E+00	1.52E-05	5.90E-06	1.78E-05	1.21E-01
Water, salt, ocean	Raw	m3	0.00E+00	0.00E+00	6.29E-06	0.00E+00	2.15E-02
Water, salt, sole	Raw	m3	0.00E+00	0.00E+00	1.32E-06	0.00E+00	1.33E+02
Water, turbine use, unspecified natural origin	Raw	m3	0.00E+00	0.00E+00	6.43E-03	0.00E+00	1.29E+02
Water, unspecified natural origin, RoW	Raw	m3	0.00E+00	9.85E-05	2.00E-05	1.14E-03	0.00E+00
Water, unspecified natural origin, US	Raw	m3	0.00E+00	7.57E-04	1.43E-03	1.90E+00	0.00E+00
Water, unspecified natural origin/kg	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+01
Water, unspecified natural origin/m3	Raw	m3	4.22E-04	2.66E-01	4.01E-05	6.74E-01	9.82E-01
Water, well, in ground	Raw	m3	0.00E+00	8.78E-05	1.56E-06	1.03E-04	2.89E-02
Water, well, in ground, US	Raw	m3	0.00E+00	1.42E-04	2.68E-04	3.55E-01	0.00E+00
Wood and wood waste, 20.9 MJ per kg, ovendry basis	Raw	kg	0.00E+00	1.13E+02	8.92E-02	7.90E+02	0.00E+00
Wood and wood waste, 20.9 MJ/kg,ovendry (burned at kiln)	Raw	kg	0.00E+00	1.95E+00	3.70E+00	2.29E+00	0.00E+00
Wood and wood waste, 20.9 MJ/kg,ovendry (burned at sawmill boiler)	Raw	kg	0.00E+00	3.25E+00	6.15E+00	3.81E+00	0.00E+00
Wood and wood waste, 9.5 MJ per kg	Raw	kg	0.00E+00	3.41E-01	1.68E-03	4.00E-01	9.18E+00
Wood for fiber, feedstock	Raw	kg	0.00E+00	7.32E-01	3.60E-03	8.57E-01	1.97E+01
Wood into sawmill logyard	Raw	m3	0.00E+00	3.83E-02	7.24E-02	4.48E-02	0.00E+00
Wood, feedstock	Raw	kg	0.00E+00	7.78E-01	4.64E-04	9.11E-01	0.00E+00
Wood, hard, NE-NC, standing	Raw	m3	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wood, hard, standing	Raw	m3	0.00E+00	0.00E+00	5.33E-09	0.00E+00	1.07E-04
Wood, primary forest, standing	Raw	m3	0.00E+00	0.00E+00	1.81E-12	0.00E+00	6.55E-07
Wood, soft, standing	Raw	m3	0.00E+00	2.46E-03	4.65E-03	6.91E+00	2.84E-04
Wood, unspecified, standing/m3	Raw	m3	0.00E+00	0.00E+00	4.36E-14	0.00E+00	3.19E-07
Zinc	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-07
Zinc, 9.0% in sulfide, Zn 5.3%, Pb, Ag, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	5.38E-10	0.00E+00	1.33E-04
Zirconium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.67E-13
Zirconium, 50% in zircon, 0.39% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.08E-14	0.00E+00	5.31E-11
1-Butanol	Air	kg	0.00E+00	0.00E+00	5.40E-18	0.00E+00	8.75E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
1-Pentanol	Air	kg	0.00E+00	0.00E+00	5.11E-17	0.00E+00	3.57E-13
1-Pentene	Air	kg	0.00E+00	0.00E+00	3.86E-17	0.00E+00	2.70E-13
1-Propanol	Air	kg	0.00E+00	0.00E+00	3.82E-16	0.00E+00	2.91E-12
1,4-Butanediol	Air	kg	0.00E+00	0.00E+00	3.73E-17	0.00E+00	4.03E-04
2-Aminopropanol	Air	kg	0.00E+00	0.00E+00	7.67E-19	0.00E+00	5.11E-05
2-Butene, 2-methyl-	Air	kg	0.00E+00	0.00E+00	8.56E-21	0.00E+00	5.98E-17
2-Chloroacetophenone	Air	kg	2.32E-10	2.38E-09	3.45E-12	2.18E-09	7.72E-09
2-Methyl-1-propanol	Air	kg	0.00E+00	0.00E+00	9.26E-17	0.00E+00	7.81E-05
2-Methyl-4-chlorophenoxyacetic acid	Air	kg	0.00E+00	8.92E-11	5.32E-14	1.04E-10	0.00E+00
2-Nitrobenzoic acid	Air	kg	0.00E+00	0.00E+00	7.67E-19	0.00E+00	2.09E-04
2-Propanol	Air	kg	0.00E+00	0.00E+00	4.89E-14	0.00E+00	1.68E-04
2,4-D	Air	kg	0.00E+00	4.78E-09	2.85E-12	5.60E-09	0.00E+00
5-methyl Chrysene	Air	kg	2.12E-11	1.46E-09	1.09E-11	3.03E-09	7.74E-10
Acenaphthene	Air	kg	4.92E-10	3.39E-08	2.54E-10	7.02E-08	1.80E-08
Acenaphthylene	Air	kg	2.41E-10	1.66E-08	1.24E-10	3.44E-08	8.79E-09
Acetaldehyde	Air	kg	4.58E-04	2.27E-02	3.94E-04	6.77E-02	7.51E-04
Acetic acid	Air	kg	0.00E+00	0.00E+00	6.94E-08	0.00E+00	4.27E-03
Acetochlor	Air	kg	0.00E+00	6.63E-08	3.95E-11	7.76E-08	0.00E+00
Acetone	Air	kg	0.00E+00	6.78E-03	8.83E-09	0.00E+00	2.73E-04
Acetonitrile	Air	kg	0.00E+00	0.00E+00	1.90E-13	0.00E+00	6.87E-08
Acetophenone	Air	kg	4.98E-10	5.10E-09	7.40E-12	4.66E-09	1.65E-08
Acrolein	Air	kg	5.55E-05	6.69E-03	6.26E-05	6.82E-03	1.74E-05
Acrylic acid	Air	kg	0.00E+00	0.00E+00	1.27E-16	0.00E+00	6.34E-13
Actinides, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	1.74E-07	0.00E+00	3.20E-02
Aerosols, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	4.58E-06	0.00E+00	1.01E-01
Alachlor	Air	kg	0.00E+00	6.52E-09	3.89E-12	7.64E-09	0.00E+00
Aldehydes, unspecified	Air	kg	1.40E-03	1.00E-03	1.25E-05	3.32E-03	1.87E-03
Aluminium	Air	kg	0.00E+00	0.00E+00	6.90E-08	0.00E+00	7.61E-04
Ammonia	Air	kg	3.98E-03	6.83E-03	2.22E-04	1.27E-02	6.58E-03
Ammonium carbonate	Air	kg	0.00E+00	0.00E+00	1.01E-13	0.00E+00	1.16E-07
Ammonium chloride	Air	kg	2.70E-06	2.32E-04	1.71E-06	4.76E-04	1.18E-04
Aniline	Air	kg	0.00E+00	0.00E+00	2.96E-16	0.00E+00	3.19E-04
Anthracene	Air	kg	2.03E-10	1.40E-08	1.04E-10	2.89E-08	7.39E-09
Anthranilic acid	Air	kg	0.00E+00	0.00E+00	5.61E-19	0.00E+00	9.66E-05
Antimony	Air	kg	1.74E-08	1.24E-06	8.97E-09	2.50E-06	7.80E-07
Antimony-124	Air	Bq	0.00E+00	0.00E+00	2.05E-11	0.00E+00	8.63E-07
Antimony-125	Air	Bq	0.00E+00	0.00E+00	2.14E-10	0.00E+00	9.00E-06
Argon-41	Air	Bq	0.00E+00	0.00E+00	2.44E-03	0.00E+00	5.30E+01
Aromatics	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.01E-06
Arsenic	Air	kg	5.38E-07	2.85E-05	2.08E-07	5.84E-05	1.77E-05
Arsine	Air	kg	0.00E+00	0.00E+00	1.47E-21	0.00E+00	7.39E-18
Ash	Air	kg	0.00E+00	1.12E-04	0.00E+00	2.34E-05	0.00E+00
Atrazine	Air	kg	0.00E+00	1.29E-07	7.71E-11	1.51E-07	0.00E+00
Barium	Air	kg	0.00E+00	6.55E-03	5.45E-09	8.75E-07	2.62E-05
Barium-140	Air	Bq	0.00E+00	0.00E+00	1.39E-08	0.00E+00	5.86E-04
Bentazone	Air	kg	0.00E+00	5.27E-10	3.14E-13	6.17E-10	0.00E+00
Benzal chloride	Air	kg	0.00E+00	0.00E+00	2.74E-22	0.00E+00	1.48E-14
Benzaldehyde	Air	kg	0.00E+00	0.00E+00	7.62E-14	0.00E+00	6.61E-10
Benzene	Air	kg	5.62E-04	1.89E-02	4.10E-06	4.45E-02	2.53E-02
Benzene, 1-methyl-2-nitro-	Air	kg	0.00E+00	0.00E+00	6.62E-19	0.00E+00	1.81E-04
Benzene, 1,2-dichloro-	Air	kg	0.00E+00	0.00E+00	9.87E-17	0.00E+00	2.35E-04
Benzene, chloro-	Air	kg	7.31E-10	7.47E-09	1.09E-11	6.84E-09	2.43E-08
Benzene, ethyl-	Air	kg	3.12E-09	6.47E-07	9.46E-09	1.48E-05	5.68E-06
Benzene, hexachloro-	Air	kg	0.00E+00	0.00E+00	4.34E-16	0.00E+00	3.97E-11

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Benzene, pentachloro-	Air	kg	0.00E+00	0.00E+00	7.49E-16	0.00E+00	9.02E-11
Benzo(a)anthracene	Air	kg	7.72E-11	5.32E-09	3.98E-11	1.10E-08	2.81E-09
Benzo(a)pyrene	Air	kg	3.67E-11	2.53E-09	3.48E-11	5.23E-09	2.91E-07
Benzo(b,j,k)fluoranthene	Air	kg	1.06E-10	7.32E-09	5.47E-11	1.51E-08	3.87E-09
Benzo(g,h,i)perylene	Air	kg	2.61E-11	1.80E-09	1.34E-11	3.71E-09	9.50E-10
Benzyl chloride	Air	kg	2.32E-08	2.38E-07	3.45E-10	2.18E-07	7.72E-07
Beryllium	Air	kg	2.69E-08	1.57E-06	1.10E-08	3.26E-06	8.46E-07
Biphenyl	Air	kg	1.64E-09	1.13E-07	8.45E-10	2.34E-07	5.98E-08
Boron	Air	kg	0.00E+00	0.00E+00	6.72E-09	0.00E+00	1.58E-04
Boron trifluoride	Air	kg	0.00E+00	0.00E+00	2.02E-23	0.00E+00	1.00E-19
Bromine	Air	kg	0.00E+00	0.00E+00	7.39E-10	0.00E+00	1.64E-05
Bromoform	Air	kg	1.30E-09	1.33E-08	1.92E-11	1.21E-08	4.30E-08
Bromoxynil	Air	kg	0.00E+00	1.16E-09	6.89E-13	1.35E-09	0.00E+00
BTEX (Benzene, Toluene, Ethylbenzene, and Xylene), unspecified ratio	Air	kg	2.55E-03	2.98E-02	6.90E-05	8.24E-02	2.23E-02
Butadiene	Air	kg	2.33E-05	1.96E-07	4.71E-08	5.66E-06	3.07E-06
Butane	Air	kg	0.00E+00	0.00E+00	3.22E-07	0.00E+00	3.74E-04
Butene	Air	kg	0.00E+00	0.00E+00	2.22E-09	0.00E+00	1.20E-03
Butyrolactone	Air	kg	0.00E+00	0.00E+00	7.57E-19	0.00E+00	3.80E-15
Cadmium	Air	kg	1.37E-07	5.74E-06	3.25E-08	1.21E-05	3.86E-06
Calcium	Air	kg	0.00E+00	0.00E+00	1.13E-08	0.00E+00	1.17E-04
Carbofuran	Air	kg	0.00E+00	9.87E-10	5.89E-13	1.16E-09	0.00E+00
Carbon-14	Air	Bq	0.00E+00	0.00E+00	1.86E-02	0.00E+00	4.20E+02
Carbon dioxide	Air	kg	4.29E+00	8.27E+00	4.77E-03	2.62E+00	1.70E+00
Carbon dioxide, biogenic	Air	kg	8.72E-02	1.15E+02	1.31E+01	1.30E+03	1.15E+01
Carbon dioxide, fossil	Air	kg	1.11E+02	5.75E+02	3.60E+00	1.36E+03	4.12E+02
Carbon dioxide, land transformation	Air	kg	0.00E+00	0.00E+00	5.63E-08	0.00E+00	2.11E-03
Carbon disulfide	Air	kg	4.32E-09	2.75E-07	4.56E-07	3.10E-07	4.74E-06
Carbon monoxide	Air	kg	3.04E-04	1.59E-01	2.71E-05	2.17E-01	1.54E-01
Carbon monoxide, biogenic	Air	kg	0.00E+00	1.13E+00	2.36E-02	3.22E+00	1.27E-04
Carbon monoxide, fossil	Air	kg	1.43E+00	5.62E-01	8.26E-03	1.84E+00	1.02E+00
Cerium-141	Air	Bq	0.00E+00	0.00E+00	3.38E-09	0.00E+00	1.42E-04
Cesium-134	Air	Bq	0.00E+00	0.00E+00	1.62E-10	0.00E+00	6.80E-06
Cesium-137	Air	Bq	0.00E+00	0.00E+00	2.87E-09	0.00E+00	1.21E-04
Chloramine	Air	kg	0.00E+00	0.00E+00	1.80E-16	0.00E+00	1.31E-04
Chloride	Air	kg	6.68E-11	2.15E-09	1.28E-11	4.08E-09	1.06E-09
Chlorinated fluorocarbons and hydrochlorinated fluorocarbons, unspecified	Air	kg	0.00E+00	4.53E-07	4.58E-10	1.02E-06	2.50E-06
Chlorine	Air	kg	0.00E+00	2.11E-05	8.66E-09	1.54E-05	3.77E-02
Chloroacetic acid	Air	kg	0.00E+00	0.00E+00	4.30E-16	0.00E+00	6.60E-04
Chloroform	Air	kg	1.96E-09	2.01E-08	2.93E-11	1.83E-08	2.24E-03
Chlorosilane, trimethyl-	Air	kg	0.00E+00	0.00E+00	1.87E-17	0.00E+00	3.97E-13
Chlorosulfonic acid	Air	kg	0.00E+00	0.00E+00	5.45E-18	0.00E+00	9.95E-05
Chlorpyrifos	Air	kg	0.00E+00	7.60E-09	4.53E-12	8.90E-09	0.00E+00
Chromium	Air	kg	3.92E-07	2.02E-05	1.37E-07	4.23E-05	1.97E-05
Chromium-51	Air	Bq	0.00E+00	0.00E+00	2.17E-10	0.00E+00	9.10E-06
Chromium VI	Air	kg	7.62E-08	5.26E-06	3.93E-08	1.09E-05	3.01E-06
Chrysene	Air	kg	9.65E-11	6.66E-09	4.97E-11	1.38E-08	3.52E-09
Cobalt	Air	kg	7.06E-07	8.54E-06	6.54E-08	1.72E-05	6.92E-06
Cobalt-58	Air	Bq	0.00E+00	0.00E+00	3.02E-10	0.00E+00	1.27E-05
Cobalt-60	Air	Bq	0.00E+00	0.00E+00	2.67E-09	0.00E+00	1.12E-04
Copper	Air	kg	7.11E-09	1.20E-06	5.54E-09	6.03E-07	2.92E-05
Cumene	Air	kg	1.76E-10	2.54E-02	4.08E-07	6.43E-02	2.41E-02
Cyanazine	Air	kg	0.00E+00	1.14E-09	6.79E-13	1.33E-09	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Cyanide	Air	kg	8.30E-08	8.50E-07	1.24E-09	7.77E-07	1.29E-04
Cyanoacetic acid	Air	kg	0.00E+00	0.00E+00	4.46E-18	0.00E+00	8.15E-05
Dicamba	Air	kg	0.00E+00	6.71E-09	4.00E-12	7.86E-09	0.00E+00
Diethylamine	Air	kg	0.00E+00	0.00E+00	1.32E-16	0.00E+00	2.57E-04
Dimethenamid	Air	kg	0.00E+00	1.58E-08	9.46E-12	1.86E-08	0.00E+00
Dimethyl ether	Air	kg	0.00E+00	2.03E-04	1.18E-07	4.65E-04	2.00E-06
Dimethyl malonate	Air	kg	0.00E+00	0.00E+00	5.59E-18	0.00E+00	1.02E-04
Dinitrogen monoxide	Air	kg	2.54E-02	4.46E-03	4.36E-05	1.51E-02	1.37E-02
Dioxin, 2,3,7,8 Tetrachlorodibenzo-p-	Air	kg	2.29E-12	5.15E-09	3.46E-12	6.09E-09	3.28E-11
Dioxins (unspec.)	Air	kg	0.00E+00	1.28E-14	2.42E-14	1.50E-14	0.00E+00
Dipropylamine	Air	kg	0.00E+00	0.00E+00	8.39E-17	0.00E+00	1.15E-04
Dipropylthiocarbamic acid S-ethyl ester	Air	kg	0.00E+00	1.09E-08	6.47E-12	1.27E-08	0.00E+00
Ethane	Air	kg	0.00E+00	0.00E+00	1.17E-06	0.00E+00	1.19E-03
Ethane, 1,1-difluoro-, HFC-152a	Air	kg	0.00E+00	0.00E+00	6.88E-17	0.00E+00	4.60E-13
Ethane, 1,1,1-trichloro-, HCFC-140	Air	kg	3.89E-09	8.94E-09	3.77E-11	1.36E-08	2.65E-08
Ethane, 1,1,1,2-tetrafluoro-, HFC-134a	Air	kg	0.00E+00	7.10E-07	6.22E-10	0.00E+00	6.90E-07
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	Air	kg	0.00E+00	0.00E+00	6.00E-18	0.00E+00	3.01E-14
Ethane, 1,2-dibromo-	Air	kg	3.99E-11	3.31E-08	6.40E-13	3.74E-10	1.32E-09
Ethane, 1,2-dichloro-	Air	kg	1.33E-09	1.36E-08	1.04E-10	1.24E-08	4.47E-04
Ethane, 1,2-dichloro-1,1,2-trifluoro-, HCFC-123	Air	kg	0.00E+00	7.10E-07	0.00E+00	0.00E+00	0.00E+00
Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	Air	kg	0.00E+00	0.00E+00	7.63E-12	0.00E+00	1.77E-07
Ethane, chloro-	Air	kg	1.39E-09	1.43E-08	2.07E-11	1.31E-08	4.63E-08
Ethane, hexafluoro-, HFC-116	Air	kg	0.00E+00	0.00E+00	5.77E-13	0.00E+00	2.23E-07
Ethanol	Air	kg	0.00E+00	0.00E+00	1.76E-08	0.00E+00	5.21E-04
Ethene	Air	kg	0.00E+00	0.00E+00	4.81E-09	0.00E+00	1.08E-03
Ethene, chloro-	Air	kg	0.00E+00	0.00E+00	4.09E-11	0.00E+00	2.46E-07
Ethene, tetrachloro-	Air	kg	4.93E-08	2.91E-06	2.16E-08	6.01E-06	1.54E-06
Ethene, trichloro-	Air	kg	0.00E+00	2.15E-13	3.13E-14	2.52E-13	5.78E-12
Ethyl acetate	Air	kg	0.00E+00	0.00E+00	2.27E-13	0.00E+00	2.11E-06
Ethyl cellulose	Air	kg	0.00E+00	0.00E+00	4.59E-16	0.00E+00	2.30E-12
Ethylamine	Air	kg	0.00E+00	0.00E+00	5.93E-17	0.00E+00	2.37E-04
Ethylene diamine	Air	kg	0.00E+00	0.00E+00	1.24E-15	0.00E+00	8.42E-12
Ethylene oxide	Air	kg	0.00E+00	5.81E-09	3.10E-09	5.91E-08	4.61E-06
Ethyne	Air	kg	0.00E+00	0.00E+00	5.44E-11	0.00E+00	4.40E-04
Fluoranthene	Air	kg	6.85E-10	4.72E-08	3.53E-10	9.77E-08	2.50E-08
Fluorene	Air	kg	8.78E-10	6.06E-08	4.52E-10	1.25E-07	3.20E-08
Fluoride	Air	kg	5.00E-05	2.04E-05	6.04E-08	2.46E-05	5.18E-05
Fluorine	Air	kg	0.00E+00	0.00E+00	5.36E-10	0.00E+00	1.21E-05
Fluosilicic acid	Air	kg	0.00E+00	0.00E+00	6.74E-13	0.00E+00	2.61E-07
Formaldehyde	Air	kg	7.11E-04	5.31E-02	5.41E-04	8.20E-02	5.11E-03
Formamide	Air	kg	0.00E+00	0.00E+00	9.34E-17	0.00E+00	6.53E-13
Formic acid	Air	kg	0.00E+00	0.00E+00	1.27E-12	0.00E+00	4.60E-07
Furan	Air	kg	4.25E-12	3.22E-10	2.78E-12	6.73E-10	1.31E-07
Glyphosate	Air	kg	0.00E+00	1.42E-08	8.50E-12	1.67E-08	0.00E+00
HAPs	Air	kg	0.00E+00	3.93E-04	3.91E-05	4.55E-03	0.00E+00
Heat, waste	Air	MJ	0.00E+00	2.68E+01	4.16E-01	7.00E+01	7.47E+02
Helium	Air	kg	0.00E+00	0.00E+00	4.17E-09	0.00E+00	6.51E-06
Heptane	Air	kg	0.00E+00	0.00E+00	2.20E-08	0.00E+00	3.34E-05
Hexane	Air	kg	2.22E-09	5.55E-07	1.06E-06	6.44E-07	1.17E-04
Hydrazine, methyl-	Air	kg	5.65E-09	5.77E-08	8.39E-11	5.28E-08	1.87E-07
Hydrocarbons, aliphatic, alkanes, cyclic	Air	kg	0.00E+00	0.00E+00	2.01E-12	0.00E+00	1.37E-05
Hydrocarbons, aliphatic, alkanes, unspecified	Air	kg	0.00E+00	0.00E+00	1.07E-07	0.00E+00	5.41E-03

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Hydrocarbons, aliphatic, unsaturated	Air	kg	0.00E+00	0.00E+00	3.36E-09	0.00E+00	1.41E-04
Hydrocarbons, aromatic	Air	kg	0.00E+00	0.00E+00	4.40E-08	0.00E+00	1.60E-04
Hydrocarbons, chlorinated	Air	kg	0.00E+00	0.00E+00	8.24E-11	0.00E+00	2.16E-04
Hydrocarbons, unspecified	Air	kg	1.56E-05	1.34E-03	9.87E-06	2.75E-03	2.76E-03
Hydrogen	Air	kg	0.00E+00	2.72E-05	4.94E-09	3.40E-05	1.18E-02
Hydrogen-3, Tritium	Air	Bq	0.00E+00	0.00E+00	1.08E-01	0.00E+00	2.39E+03
Hydrogen chloride	Air	kg	1.22E-03	8.02E-02	6.07E-04	1.67E-01	4.41E-02
Hydrogen fluoride	Air	kg	1.43E-04	9.97E-03	7.46E-05	2.06E-02	5.50E-03
Hydrogen peroxide	Air	kg	0.00E+00	0.00E+00	3.40E-16	0.00E+00	1.70E-12
Hydrogen sulfide	Air	kg	2.16E-12	6.95E-11	1.69E-07	1.32E-10	2.32E-04
Indeno(1,2,3-cd)pyrene	Air	kg	5.89E-11	4.06E-09	3.03E-11	8.39E-09	2.15E-09
Iodine	Air	kg	0.00E+00	0.00E+00	3.93E-10	0.00E+00	8.86E-06
Iodine-129	Air	Bq	0.00E+00	0.00E+00	1.89E-05	0.00E+00	4.18E-01
Iodine-131	Air	Bq	0.00E+00	0.00E+00	9.65E-04	0.00E+00	2.09E+01
Iodine-133	Air	Bq	0.00E+00	0.00E+00	3.84E-08	0.00E+00	4.90E-03
Iodine-135	Air	Bq	0.00E+00	0.00E+00	4.70E-08	0.00E+00	9.12E-03
Iron	Air	kg	0.00E+00	7.46E-07	2.42E-08	8.74E-07	3.39E-04
Isocyanic acid	Air	kg	0.00E+00	0.00E+00	1.78E-05	0.00E+00	9.67E-12
Isophorone	Air	kg	1.93E-08	1.97E-07	2.86E-10	1.80E-07	6.40E-07
Isoprene	Air	kg	2.19E-03	7.05E-02	4.21E-04	1.34E-01	3.48E-02
Isopropylamine	Air	kg	0.00E+00	0.00E+00	4.75E-18	0.00E+00	1.48E-04
Kerosene	Air	kg	1.29E-06	1.11E-04	8.19E-07	2.28E-04	5.63E-05
Krypton-85	Air	Bq	0.00E+00	0.00E+00	7.62E-03	0.00E+00	1.66E+02
Krypton-85m	Air	Bq	0.00E+00	0.00E+00	3.23E-04	0.00E+00	1.11E+01
Krypton-87	Air	Bq	0.00E+00	0.00E+00	1.37E-04	0.00E+00	3.88E+00
Krypton-88	Air	Bq	0.00E+00	0.00E+00	1.32E-04	0.00E+00	4.05E+00
Krypton-89	Air	Bq	0.00E+00	0.00E+00	3.12E-05	0.00E+00	1.19E+00
Lactic acid	Air	kg	0.00E+00	0.00E+00	6.57E-17	0.00E+00	9.01E-05
Lanthanum-140	Air	Bq	0.00E+00	0.00E+00	1.19E-09	0.00E+00	5.00E-05
Lead	Air	kg	6.96E-07	4.36E-05	1.47E-06	1.90E-04	3.10E-05
Lead-210	Air	Bq	0.00E+00	0.00E+00	1.05E-04	0.00E+00	3.85E+00
m-Xylene	Air	kg	0.00E+00	0.00E+00	2.16E-11	0.00E+00	4.34E-07
Magnesium	Air	kg	1.06E-05	7.32E-04	5.47E-06	1.51E-03	4.96E-04
Manganese	Air	kg	7.92E-07	4.37E-05	5.84E-06	8.20E-05	6.57E-05
Manganese-54	Air	Bq	0.00E+00	0.00E+00	1.11E-10	0.00E+00	4.66E-06
Mercaptans, unspecified	Air	kg	7.20E-06	7.36E-05	1.06E-07	6.73E-05	2.39E-04
Mercury	Air	kg	1.46E-07	8.76E-06	6.73E-08	1.63E-05	1.30E-05
Metals, unspecified	Air	kg	2.48E-13	1.30E-04	7.79E-08	1.53E-04	4.28E-10
Methacrylic acid	Air	kg	0.00E+00	2.98E-09	0.00E+00	0.00E+00	0.00E+00
Methane	Air	kg	2.21E-01	1.67E+00	7.40E-03	4.31E+00	1.23E+00
Methane, biogenic	Air	kg	0.00E+00	1.39E-03	1.39E-04	1.61E-02	1.28E-03
Methane, bromo-, Halon 1001	Air	kg	5.31E-09	5.44E-08	7.89E-11	4.97E-08	1.76E-07
Methane, bromochlorodifluoro-, Halon 1211	Air	kg	0.00E+00	0.00E+00	3.54E-10	0.00E+00	2.92E-07
Methane, bromotrifluoro-, Halon 1301	Air	kg	0.00E+00	0.00E+00	5.77E-11	0.00E+00	8.80E-08
Methane, chlorodifluoro-, HCFC-22	Air	kg	0.00E+00	9.17E-06	1.22E-09	4.91E-13	1.11E-06
Methane, chlorotrifluoro-, CFC-13	Air	kg	0.00E+00	1.67E-07	2.44E-13	4.66E-12	0.00E+00
Methane, dichloro-, HCC-30	Air	kg	8.03E-07	2.31E-05	1.58E-07	4.66E-05	2.01E-04
Methane, dichlorodifluoro-, CFC-12	Air	kg	3.99E-09	2.65E-09	3.87E-11	9.09E-09	4.20E-06
Methane, dichlorofluoro-, HCFC-21	Air	kg	0.00E+00	0.00E+00	4.01E-20	0.00E+00	2.02E-16
Methane, fossil	Air	kg	2.47E-02	3.87E-01	5.57E-04	4.85E-01	2.95E-01
Methane, monochloro-, R-40	Air	kg	1.76E-08	1.80E-07	2.62E-10	1.65E-07	5.93E-07
Methane, tetrachloro-, CFC-10	Air	kg	3.99E-10	2.08E-06	2.49E-11	9.62E-07	2.28E-04
Methane, tetrafluoro-, CFC-14	Air	kg	0.00E+00	0.00E+00	5.19E-12	0.00E+00	2.01E-06
Methane, trichlorofluoro-, CFC-11	Air	kg	0.00E+00	0.00E+00	6.51E-20	0.00E+00	3.29E-16

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Methane, trifluoro-, HFC-23	Air	kg	0.00E+00	0.00E+00	1.28E-17	0.00E+00	6.44E-14
Methanesulfonic acid	Air	kg	0.00E+00	0.00E+00	4.51E-18	0.00E+00	8.24E-05
Methanol	Air	kg	0.00E+00	1.04E-01	2.47E-03	4.03E-01	3.98E-02
Methyl acetate	Air	kg	0.00E+00	0.00E+00	1.78E-19	0.00E+00	4.85E-05
Methyl acrylate	Air	kg	0.00E+00	0.00E+00	1.44E-16	0.00E+00	7.19E-13
Methyl amine	Air	kg	0.00E+00	0.00E+00	2.07E-17	0.00E+00	2.53E-05
Methyl borate	Air	kg	0.00E+00	0.00E+00	1.89E-17	0.00E+00	8.37E-06
Methyl ethyl ketone	Air	kg	1.30E-08	1.33E-07	1.93E-10	1.21E-07	4.31E-07
Methyl formate	Air	kg	0.00E+00	0.00E+00	4.74E-08	0.00E+00	1.75E-13
Methyl lactate	Air	kg	0.00E+00	0.00E+00	7.22E-17	0.00E+00	9.89E-05
Methyl methacrylate	Air	kg	6.64E-10	3.82E-09	9.87E-12	6.22E-09	2.21E-08
Methylamine	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-17
Methylene diisocyanate	Air	kg	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00
Metolachlor	Air	kg	0.00E+00	5.24E-08	3.12E-11	6.13E-08	0.00E+00
Metribuzin	Air	kg	0.00E+00	2.43E-10	1.45E-13	2.84E-10	0.00E+00
Molybdenum	Air	kg	0.00E+00	0.00E+00	9.73E-10	0.00E+00	1.01E-06
Monoethanolamine	Air	kg	0.00E+00	0.00E+00	1.24E-12	0.00E+00	2.80E-03
N-Nitrodimethylamine	Air	kg	0.00E+00	5.84E-03	7.00E-15	1.23E-03	1.29E-12
Naphthalene	Air	kg	1.50E-07	6.60E-06	3.73E-07	4.81E-05	1.23E-05
Nickel	Air	kg	8.86E-06	4.69E-05	3.37E-07	9.07E-05	6.51E-05
Nickel compounds	Air	kg	0.00E+00	9.17E-06	0.00E+00	0.00E+00	0.00E+00
Niobium-95	Air	Bq	0.00E+00	0.00E+00	1.32E-11	0.00E+00	5.53E-07
Nitrate	Air	kg	0.00E+00	0.00E+00	1.02E-10	0.00E+00	2.26E-06
Nitric oxide	Air	kg	0.00E+00	1.73E-04	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	Air	kg	0.00E+00	0.00E+00	3.97E-16	0.00E+00	8.57E-04
Nitrogen oxides	Air	kg	1.95E+00	2.37E+00	2.40E-02	4.87E+00	1.54E+00
Nitrogen, total	Air	kg	9.70E-04	6.41E-09	3.82E-12	7.50E-09	0.00E+00
Nitrous oxide	Air	kg	0.00E+00	9.03E-06	0.00E+00	0.00E+00	6.11E-02
NMVOC, non-methane volatile organic compounds, unspecified origin	Air	kg	6.78E-02	1.25E-01	7.55E-04	2.85E-01	1.34E-01
Noble gases, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	1.81E+02	0.00E+00	4.02E+06
Organic acids	Air	kg	9.92E-09	8.52E-07	6.28E-09	1.75E-06	4.32E-07
Organic substances, unspecified	Air	kg	5.98E-06	4.73E-03	5.23E-05	3.71E-03	1.20E-03
Other Organic	Air	kg	0.00E+00	1.32E-05	1.32E-06	1.53E-04	0.00E+00
Ozone	Air	kg	0.00E+00	0.00E+00	6.86E-09	0.00E+00	1.46E-04
PAH, polycyclic aromatic hydrocarbons	Air	kg	9.18E-05	7.89E-07	2.04E-07	2.32E-05	2.54E-05
Paraffins	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.36E-18
Paraquat	Air	kg	0.00E+00	1.06E-09	6.32E-13	1.24E-09	0.00E+00
Parathion, methyl	Air	kg	0.00E+00	8.01E-10	4.78E-13	9.37E-10	0.00E+00
Particulates	Air	kg	0.00E+00	8.97E-05	8.57E-08	2.27E-04	9.19E-05
Particulates, < 10 um	Air	kg	0.00E+00	4.35E-01	2.95E-03	1.07E+00	9.44E-02
Particulates, < 2.5 um	Air	kg	0.00E+00	2.47E-01	3.55E-03	7.52E-01	1.00E-01
Particulates, > 10 um	Air	kg	0.00E+00	2.47E-03	5.46E-03	4.55E-03	1.48E-02
Particulates, > 2.5 um, and < 10um	Air	kg	5.73E-02	3.62E-02	3.46E-04	1.00E-01	4.19E-02
Particulates, unspecified	Air	kg	1.35E-02	2.35E-01	1.74E-03	8.35E-01	1.37E-01
Pendimethalin	Air	kg	0.00E+00	5.45E-09	3.25E-12	6.38E-09	0.00E+00
Pentane	Air	kg	0.00E+00	0.00E+00	3.91E-07	0.00E+00	4.14E-04
Permethrin	Air	kg	0.00E+00	4.90E-10	2.92E-13	5.73E-10	0.00E+00
PFC (perfluorocarbons)	Air	kg	0.00E+00	9.17E-05	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	Air	kg	2.61E-09	1.80E-07	1.34E-09	3.71E-07	9.50E-08
Phenol	Air	kg	5.31E-10	8.71E-03	6.22E-05	9.56E-03	8.73E-02
Phenol, 2,4-dichloro-	Air	kg	0.00E+00	0.00E+00	1.90E-17	0.00E+00	1.31E-04
Phenol, pentachloro-	Air	kg	0.00E+00	0.00E+00	5.20E-12	0.00E+00	1.13E-07
Phenols, unspecified	Air	kg	4.10E-07	3.39E-06	1.83E-08	6.66E-06	1.67E-06

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Phorate	Air	kg	0.00E+00	2.51E-10	1.50E-13	2.94E-10	0.00E+00
Phosphate	Air	kg	2.21E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phosphine	Air	kg	0.00E+00	0.00E+00	1.09E-19	0.00E+00	5.48E-16
Phosphorus	Air	kg	0.00E+00	0.00E+00	7.67E-11	0.00E+00	5.76E-05
Phthalate, diisooctyl-	Air	kg	0.00E+00	1.09E-08	0.00E+00	0.00E+00	0.00E+00
Phthalate, dioctyl-	Air	kg	2.42E-09	1.40E-08	3.60E-11	2.27E-08	8.05E-08
Platinum	Air	kg	0.00E+00	0.00E+00	2.74E-16	0.00E+00	6.08E-12
Plutonium-238	Air	Bq	0.00E+00	0.00E+00	2.57E-12	0.00E+00	5.70E-08
Plutonium-alpha	Air	Bq	0.00E+00	0.00E+00	5.90E-12	0.00E+00	1.31E-07
Polonium-210	Air	Bq	0.00E+00	0.00E+00	1.85E-04	0.00E+00	6.42E+00
Polychlorinated biphenyls	Air	kg	0.00E+00	0.00E+00	3.78E-16	0.00E+00	1.36E-11
Polycyclic organic matter, unspecified	Air	kg	0.00E+00	4.26E-07	6.22E-13	1.19E-11	0.00E+00
Potassium	Air	kg	0.00E+00	1.32E-04	6.57E-07	1.55E-04	3.71E-03
Potassium-40	Air	Bq	0.00E+00	0.00E+00	2.38E-05	0.00E+00	8.13E-01
Propanal	Air	kg	1.26E-08	8.57E-06	1.03E-05	1.57E-02	1.39E-04
Propane	Air	kg	0.00E+00	0.00E+00	4.85E-07	0.00E+00	6.13E-04
Propene	Air	kg	1.54E-03	9.37E-03	3.26E-06	2.41E-02	9.71E-03
Propionic acid	Air	kg	0.00E+00	0.00E+00	4.51E-09	0.00E+00	4.15E-04
Propylamine	Air	kg	0.00E+00	0.00E+00	2.96E-17	0.00E+00	2.07E-13
Propylene glycol	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-03
Propylene oxide	Air	kg	0.00E+00	2.60E-07	6.13E-09	1.34E-05	7.05E-05
Protactinium-234	Air	Bq	0.00E+00	0.00E+00	2.56E-06	0.00E+00	5.95E-02
Pyrene	Air	kg	3.18E-10	2.20E-08	1.64E-10	4.54E-08	1.16E-08
Radioactive species, other beta emitters	Air	Bq	0.00E+00	0.00E+00	5.89E-06	0.00E+00	1.32E-01
Radioactive species, unspecified	Air	Bq	5.28E+04	3.75E+06	2.81E+04	7.77E+06	1.93E+06
Radionuclides (Including Radon)	Air	kg	7.23E-05	6.21E-03	4.58E-05	1.27E-02	3.15E-03
Radium-226	Air	Bq	0.00E+00	0.00E+00	1.09E-04	0.00E+00	3.89E+00
Radium-228	Air	Bq	0.00E+00	0.00E+00	1.54E-05	0.00E+00	1.68E+00
Radon-220	Air	Bq	0.00E+00	0.00E+00	1.04E-03	0.00E+00	2.28E+01
Radon-222	Air	Bq	0.00E+00	0.00E+00	3.39E+02	0.00E+00	7.64E+06
Ruthenium-103	Air	Bq	0.00E+00	0.00E+00	2.89E-12	0.00E+00	1.21E-07
Scandium	Air	kg	0.00E+00	0.00E+00	3.11E-11	0.00E+00	7.27E-07
Selenium	Air	kg	1.34E-06	8.75E-05	6.51E-07	1.81E-04	4.79E-05
Silicon	Air	kg	0.00E+00	0.00E+00	3.64E-09	0.00E+00	4.13E-04
Silicon tetrafluoride	Air	kg	0.00E+00	0.00E+00	6.90E-14	0.00E+00	5.83E-10
Silver	Air	kg	0.00E+00	0.00E+00	1.61E-12	0.00E+00	2.92E-08
Silver-110	Air	Bq	0.00E+00	0.00E+00	2.87E-11	0.00E+00	1.20E-06
Simazine	Air	kg	0.00E+00	3.44E-09	2.05E-12	4.03E-09	0.00E+00
Sodium	Air	kg	0.00E+00	3.05E-06	6.02E-08	3.57E-06	1.31E-04
Sodium chlorate	Air	kg	0.00E+00	0.00E+00	9.84E-13	0.00E+00	6.81E-09
Sodium dichromate	Air	kg	0.00E+00	0.00E+00	1.01E-15	0.00E+00	3.18E-08
Sodium formate	Air	kg	0.00E+00	0.00E+00	4.69E-14	0.00E+00	1.40E-09
Sodium hydroxide	Air	kg	0.00E+00	0.00E+00	1.27E-15	0.00E+00	6.36E-12
Strontium	Air	kg	0.00E+00	0.00E+00	1.43E-10	0.00E+00	7.12E-06
Styrene	Air	kg	8.30E-10	8.50E-09	1.27E-11	7.77E-09	2.90E-07
Sulfate	Air	kg	0.00E+00	0.00E+00	1.17E-08	0.00E+00	1.26E-02
Sulfur	Air	kg	0.00E+00	1.61E-05	9.60E-09	1.88E-05	0.00E+00
Sulfur dioxide	Air	kg	2.30E-01	4.37E+00	2.13E-02	1.01E+01	3.16E+00
Sulfur hexafluoride	Air	kg	0.00E+00	0.00E+00	8.32E-11	0.00E+00	2.07E-06
Sulfur monoxide	Air	kg	1.02E-01	6.27E-02	3.92E-04	1.31E-01	1.13E-01
Sulfur oxides	Air	kg	1.02E-02	7.30E-02	7.27E-04	1.61E-01	8.53E-02
Sulfur trioxide	Air	kg	0.00E+00	0.00E+00	3.19E-15	0.00E+00	4.88E-03
Sulfur, total reduced	Air	kg	0.00E+00	9.44E-06	4.64E-08	1.11E-05	2.54E-04
Sulfuric acid	Air	kg	0.00E+00	9.17E-08	2.66E-16	0.00E+00	1.33E-12

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Sulfuric acid, dimethyl ester	Air	kg	1.59E-09	1.63E-08	2.37E-11	1.49E-08	5.29E-08
t-Butyl methyl ether	Air	kg	1.16E-09	1.19E-08	1.73E-11	1.09E-08	3.93E-08
t-Butylamine	Air	kg	0.00E+00	0.00E+00	8.29E-18	0.00E+00	1.43E-04
Tar	Air	kg	7.51E-11	2.42E-09	1.44E-11	4.58E-09	1.19E-09
Terbufos	Air	kg	0.00E+00	8.56E-09	5.11E-12	1.00E-08	0.00E+00
Terpenes	Air	kg	0.00E+00	0.00E+00	1.58E-13	0.00E+00	5.73E-08
Thallium	Air	kg	0.00E+00	0.00E+00	2.39E-13	0.00E+00	3.71E-08
Thorium	Air	kg	0.00E+00	0.00E+00	2.04E-13	0.00E+00	4.41E-08
Thorium-228	Air	Bq	0.00E+00	0.00E+00	5.14E-06	0.00E+00	2.28E-01
Thorium-230	Air	Bq	0.00E+00	0.00E+00	9.58E-06	0.00E+00	1.37E+00
Thorium-232	Air	Bq	0.00E+00	0.00E+00	7.52E-06	0.00E+00	2.56E-01
Thorium-234	Air	Bq	0.00E+00	0.00E+00	2.56E-06	0.00E+00	5.95E-02
Tin	Air	kg	0.00E+00	0.00E+00	1.69E-11	0.00E+00	6.61E-08
Titanium	Air	kg	0.00E+00	0.00E+00	6.05E-10	0.00E+00	2.15E-05
TOC, Total Organic Carbon	Air	kg	0.00E+00	1.41E-02	7.44E-09	1.46E-05	0.00E+00
Toluene	Air	kg	2.44E-04	2.08E-03	5.87E-07	1.17E-04	2.72E-03
Toluene, 2-chloro-	Air	kg	0.00E+00	0.00E+00	1.18E-16	0.00E+00	3.92E-04
Toluene, 2,4-dinitro-	Air	kg	9.30E-12	9.51E-11	1.38E-13	8.70E-11	3.09E-10
Trichloroethane	Air	kg	0.00E+00	7.25E-08	1.37E-07	8.49E-08	0.00E+00
Trimethylamine	Air	kg	0.00E+00	0.00E+00	3.17E-19	0.00E+00	9.76E-15
Tungsten	Air	kg	0.00E+00	0.00E+00	3.50E-12	0.00E+00	7.89E-08
Uranium	Air	kg	0.00E+00	0.00E+00	2.71E-13	0.00E+00	5.83E-08
Uranium-234	Air	Bq	0.00E+00	0.00E+00	2.99E-05	0.00E+00	1.83E+00
Uranium-235	Air	Bq	0.00E+00	0.00E+00	1.45E-06	0.00E+00	3.26E-02
Uranium-238	Air	Bq	0.00E+00	0.00E+00	4.85E-05	0.00E+00	2.45E+00
Uranium alpha	Air	Bq	0.00E+00	0.00E+00	1.39E-04	0.00E+00	3.14E+00
Vanadium	Air	kg	0.00E+00	0.00E+00	1.52E-07	0.00E+00	6.18E-05
Vinyl acetate	Air	kg	2.52E-10	2.58E-09	3.75E-12	2.36E-09	8.38E-09
VOC, volatile organic compounds	Air	kg	6.37E-02	1.00E+00	5.30E-02	3.18E+00	4.25E-01
Water	Air	kg	0.00E+00	0.00E+00	8.55E-08	0.00E+00	4.88E-04
Wood (dust)	Air	kg	0.00E+00	3.63E-02	5.86E-03	1.02E+00	0.00E+00
Xenon-131m	Air	Bq	0.00E+00	0.00E+00	6.25E-04	0.00E+00	1.83E+01
Xenon-133	Air	Bq	0.00E+00	0.00E+00	1.96E-02	0.00E+00	6.00E+02
Xenon-133m	Air	Bq	0.00E+00	0.00E+00	9.05E-05	0.00E+00	2.12E+00
Xenon-135	Air	Bq	0.00E+00	0.00E+00	8.07E-03	0.00E+00	2.45E+02
Xenon-135m	Air	Bq	0.00E+00	0.00E+00	4.73E-03	0.00E+00	1.46E+02
Xenon-137	Air	Bq	0.00E+00	0.00E+00	8.55E-05	0.00E+00	3.25E+00
Xenon-138	Air	Bq	0.00E+00	0.00E+00	7.75E-04	0.00E+00	2.72E+01
Xylene	Air	kg	1.70E-04	1.21E-03	3.74E-07	6.95E-05	1.35E-04
Zinc	Air	kg	1.79E-05	1.83E-06	7.52E-09	1.46E-06	5.06E-05
Zinc-65	Air	Bq	0.00E+00	0.00E+00	5.54E-10	0.00E+00	2.33E-05
Zirconium	Air	kg	0.00E+00	0.00E+00	7.75E-16	0.00E+00	5.53E-09
Zirconium-95	Air	Bq	0.00E+00	0.00E+00	5.42E-10	0.00E+00	2.27E-05
1-Butanol	Water	kg	0.00E+00	0.00E+00	5.02E-09	0.00E+00	3.65E-04
1-Pentanol	Water	kg	0.00E+00	0.00E+00	1.23E-16	0.00E+00	8.56E-13
1-Pentene	Water	kg	0.00E+00	0.00E+00	9.26E-17	0.00E+00	6.47E-13
1-Propanol	Water	kg	0.00E+00	0.00E+00	1.69E-16	0.00E+00	1.23E-12
1,4-Butanediol	Water	kg	0.00E+00	0.00E+00	1.49E-17	0.00E+00	1.61E-04
2-Aminopropanol	Water	kg	0.00E+00	0.00E+00	1.89E-18	0.00E+00	2.07E-04
2-Hexanone	Water	kg	1.01E-06	3.07E-06	1.27E-08	8.74E-06	2.89E-06
2-Methyl-1-propanol	Water	kg	0.00E+00	0.00E+00	2.22E-16	0.00E+00	1.87E-04
2-Methyl-2-butene	Water	kg	0.00E+00	0.00E+00	2.05E-20	0.00E+00	1.44E-16
2-Methyl-4-chlorophenoxyacetic acid	Water	kg	0.00E+00	3.82E-12	2.28E-15	4.48E-12	0.00E+00
2-Propanol	Water	kg	0.00E+00	8.88E-09	4.37E-11	1.04E-08	8.22E-04

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
2,4-D	Water	kg	0.00E+00	2.05E-10	1.22E-13	2.40E-10	0.00E+00
4-Methyl-2-pentanone	Water	kg	6.51E-07	1.96E-06	8.15E-09	5.62E-06	1.86E-06
Acenaphthene	Water	kg	0.00E+00	0.00E+00	6.55E-13	0.00E+00	9.87E-10
Acenaphthylene	Water	kg	0.00E+00	0.00E+00	4.09E-14	0.00E+00	6.18E-11
Acetaldehyde	Water	kg	0.00E+00	6.12E-09	1.13E-08	6.22E-08	5.89E-03
Acetic acid	Water	kg	0.00E+00	0.00E+00	2.10E-11	0.00E+00	2.22E-02
Acetochlor	Water	kg	0.00E+00	2.84E-09	1.69E-12	3.32E-09	0.00E+00
Acetone	Water	kg	1.55E-06	4.67E-06	1.94E-08	1.34E-05	4.49E-04
Acetonitrile	Water	kg	0.00E+00	0.00E+00	3.73E-18	0.00E+00	6.82E-05
Acetyl chloride	Water	kg	0.00E+00	0.00E+00	9.63E-17	0.00E+00	6.73E-13
Acidity, unspecified	Water	kg	0.00E+00	3.02E-04	5.43E-12	6.34E-05	4.37E-05
Acids, unspecified	Water	kg	1.40E-09	1.26E-05	2.59E-08	1.48E-05	1.58E-04
Acrylate	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-14
Acrylate, ion	Water	kg	0.00E+00	0.00E+00	2.99E-16	0.00E+00	1.48E-12
Actinides, radioactive, unspecified	Water	Bq	0.00E+00	0.00E+00	3.06E-05	0.00E+00	6.79E-01
Alachlor	Water	kg	0.00E+00	2.80E-10	1.67E-13	3.27E-10	0.00E+00
Aluminium	Water	kg	1.16E-02	1.68E-02	1.26E-04	4.83E-02	5.13E-02
Ammonia	Water	kg	2.73E-03	6.97E-03	3.45E-05	1.87E-02	6.74E-03
Ammonia, as N	Water	kg	7.05E-10	2.27E-08	6.64E-06	4.30E-08	1.12E-08
Ammonium, ion	Water	kg	5.77E-07	1.21E-04	1.69E-05	9.32E-04	8.61E-02
Aniline	Water	kg	0.00E+00	0.00E+00	7.12E-16	0.00E+00	1.29E-03
Antimony	Water	kg	7.21E-06	9.16E-06	7.01E-08	2.75E-05	6.76E-05
Antimony-122	Water	Bq	0.00E+00	0.00E+00	8.28E-09	0.00E+00	3.48E-04
Antimony-124	Water	Bq	0.00E+00	0.00E+00	4.95E-06	0.00E+00	1.16E-01
Antimony-125	Water	Bq	0.00E+00	0.00E+00	4.53E-06	0.00E+00	1.06E-01
AOX, Adsorbable Organic Halogen as Cl	Water	kg	0.00E+00	0.00E+00	9.37E-11	0.00E+00	2.37E-05
Arsenic	Water	kg	8.26E-05	1.10E-04	4.98E-07	3.14E-04	1.07E-04
Arsenic, ion	Water	kg	0.00E+00	0.00E+00	5.07E-09	0.00E+00	7.60E-05
Atrazine	Water	kg	0.00E+00	5.54E-09	3.30E-12	6.48E-09	0.00E+00
Barite	Water	kg	0.00E+00	0.00E+00	1.37E-11	0.00E+00	9.93E-08
Barium	Water	kg	1.59E-01	2.15E-01	1.55E-03	6.44E-01	2.73E-01
Barium-140	Water	Bq	0.00E+00	0.00E+00	3.63E-08	0.00E+00	1.52E-03
Bentazone	Water	kg	0.00E+00	2.26E-11	1.35E-14	2.64E-11	0.00E+00
Benzene	Water	kg	2.60E-04	4.24E-02	3.93E-06	1.08E-01	7.21E-02
Benzene, 1-methyl-4-(1-methylethyl)-	Water	kg	1.55E-08	4.67E-08	1.94E-10	1.34E-07	4.42E-08
Benzene, 1,2-dichloro-	Water	kg	0.00E+00	0.00E+00	1.02E-15	0.00E+00	1.95E-03
Benzene, chloro-	Water	kg	0.00E+00	0.00E+00	1.64E-14	0.00E+00	2.90E-02
Benzene, ethyl-	Water	kg	1.46E-05	4.42E-05	1.86E-07	1.26E-04	4.56E-05
Benzene, pentamethyl-	Water	kg	1.16E-08	3.50E-08	1.45E-10	1.00E-07	3.31E-08
Benzenes, alkylated, unspecified	Water	kg	6.32E-06	8.75E-06	6.05E-08	2.41E-05	1.05E-05
Benzo(a)pyrene	Water	kg	0.00E+00	8.35E-13	4.20E-11	9.78E-13	0.00E+00
Benzoic acid	Water	kg	1.57E-04	4.77E-04	1.97E-06	1.36E-03	4.48E-04
Beryllium	Water	kg	2.22E-06	5.16E-06	2.64E-08	1.49E-05	2.64E-05
Biphenyl	Water	kg	4.09E-07	5.67E-07	3.92E-09	1.56E-06	6.77E-07
BOD5, Biological Oxygen Demand	Water	kg	2.81E-02	4.83E-01	5.19E-04	1.23E+00	7.99E-01
Borate	Water	kg	0.00E+00	0.00E+00	9.35E-15	0.00E+00	1.18E-02
Boron	Water	kg	4.86E-04	1.47E-03	6.16E-06	4.20E-03	1.88E-03
Bromate	Water	kg	0.00E+00	0.00E+00	5.51E-11	0.00E+00	1.60E-03
Bromide	Water	kg	3.32E-02	1.00E-01	4.16E-04	2.87E-01	3.94E-01
Bromine	Water	kg	0.00E+00	0.00E+00	7.42E-08	0.00E+00	1.68E-04
Bromoxynil	Water	kg	0.00E+00	2.99E-11	1.78E-14	3.50E-11	0.00E+00
Butene	Water	kg	0.00E+00	0.00E+00	5.55E-11	0.00E+00	5.90E-04
Butyl acetate	Water	kg	0.00E+00	0.00E+00	6.53E-09	0.00E+00	1.96E-05
Butyrolactone	Water	kg	0.00E+00	0.00E+00	1.82E-18	0.00E+00	9.11E-15

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Cadmium	Water	kg	1.99E-05	1.66E-05	7.71E-08	4.70E-05	1.60E-05
Cadmium, ion	Water	kg	0.00E+00	0.00E+00	1.72E-09	0.00E+00	1.01E-05
Calcium	Water	kg	4.98E-01	1.50E+00	6.23E-03	4.30E+00	1.45E+00
Calcium, ion	Water	kg	0.00E+00	0.00E+00	1.89E-05	0.00E+00	4.21E-01
Carbofuran	Water	kg	0.00E+00	4.23E-11	2.52E-14	4.95E-11	0.00E+00
Carbon disulfide	Water	kg	0.00E+00	0.00E+00	5.90E-15	0.00E+00	4.17E-11
Carbonate	Water	kg	0.00E+00	0.00E+00	4.03E-10	0.00E+00	1.43E-01
Carboxylic acids, unspecified	Water	kg	0.00E+00	0.00E+00	4.53E-07	0.00E+00	6.81E-04
Cerium-141	Water	Bq	0.00E+00	0.00E+00	1.45E-08	0.00E+00	6.09E-04
Cerium-144	Water	Bq	0.00E+00	0.00E+00	4.42E-09	0.00E+00	1.85E-04
Cesium	Water	kg	0.00E+00	0.00E+00	1.05E-10	0.00E+00	1.59E-07
Cesium-134	Water	Bq	0.00E+00	0.00E+00	4.23E-06	0.00E+00	9.33E-02
Cesium-136	Water	Bq	0.00E+00	0.00E+00	2.57E-09	0.00E+00	1.08E-04
Cesium-137	Water	Bq	0.00E+00	0.00E+00	3.52E-03	0.00E+00	7.82E+01
CFCs, unspecified	Water	kg	0.00E+00	8.88E-09	4.37E-11	1.04E-08	2.45E-07
Chloramine	Water	kg	0.00E+00	0.00E+00	1.61E-15	0.00E+00	1.97E-03
Chlorate	Water	kg	0.00E+00	0.00E+00	4.72E-10	0.00E+00	1.23E-02
Chloride	Water	kg	5.60E+00	1.69E+01	7.01E-02	4.83E+01	2.20E+01
Chlorinated solvents, unspecified	Water	kg	0.00E+00	0.00E+00	1.85E-12	0.00E+00	8.84E-06
Chlorine	Water	kg	0.00E+00	0.00E+00	1.28E-11	0.00E+00	8.44E-07
Chloroacetic acid	Water	kg	0.00E+00	0.00E+00	8.23E-14	0.00E+00	5.29E-02
Chloroacetyl chloride	Water	kg	0.00E+00	0.00E+00	2.52E-18	0.00E+00	2.76E-04
Chloroform	Water	kg	0.00E+00	1.91E-08	6.81E-17	0.00E+00	2.42E-04
Chlorosulfonic acid	Water	kg	0.00E+00	0.00E+00	1.36E-17	0.00E+00	2.48E-04
Chlorpyrifos	Water	kg	0.00E+00	3.26E-10	1.94E-13	3.81E-10	0.00E+00
Chromate	Water	kg	0.00E+00	1.18E-12	3.38E-14	1.38E-12	3.18E-11
Chromium	Water	kg	3.56E-04	2.34E-04	2.75E-06	9.36E-04	4.64E-04
Chromium-51	Water	Bq	0.00E+00	0.00E+00	4.94E-06	0.00E+00	1.61E-01
Chromium III	Water	kg	3.35E-05	1.80E-04	3.83E-07	3.10E-04	7.89E-05
Chromium VI	Water	kg	1.23E-06	8.18E-07	1.57E-08	2.80E-06	1.42E-04
Chromium, ion	Water	kg	0.00E+00	0.00E+00	2.97E-10	0.00E+00	7.91E-06
Cobalt	Water	kg	3.43E-06	1.04E-05	6.38E-08	2.96E-05	3.26E-04
Cobalt-57	Water	Bq	0.00E+00	0.00E+00	8.17E-08	0.00E+00	3.43E-03
Cobalt-58	Water	Bq	0.00E+00	0.00E+00	3.82E-05	0.00E+00	1.05E+00
Cobalt-60	Water	Bq	0.00E+00	0.00E+00	2.97E-05	0.00E+00	8.47E-01
COD, Chemical Oxygen Demand	Water	kg	5.22E-02	5.56E-01	7.42E-04	1.41E+00	8.48E-01
Copper	Water	kg	6.94E-05	1.25E-04	7.66E-07	3.24E-04	1.27E-04
Copper, ion	Water	kg	0.00E+00	0.00E+00	2.15E-08	0.00E+00	2.63E-04
Cumene	Water	kg	0.00E+00	6.10E-02	9.81E-07	1.55E-01	5.78E-02
Cyanazine	Water	kg	0.00E+00	4.88E-11	2.91E-14	5.71E-11	0.00E+00
Cyanide	Water	kg	1.12E-08	5.31E-08	5.88E-09	9.70E-08	2.74E-04
Decane	Water	kg	4.52E-06	1.37E-05	5.65E-08	3.90E-05	1.29E-05
Detergent, oil	Water	kg	1.34E-04	4.50E-04	1.76E-06	1.29E-03	4.15E-04
Dibenzofuran	Water	kg	2.95E-08	8.89E-08	3.69E-10	2.54E-07	8.40E-08
Dibenzothiophene	Water	kg	2.51E-08	7.37E-08	3.11E-10	2.11E-07	7.02E-08
Dicamba	Water	kg	0.00E+00	2.88E-10	1.72E-13	3.37E-10	0.00E+00
Dichromate	Water	kg	0.00E+00	0.00E+00	1.13E-15	0.00E+00	1.43E-10
Diethylamine	Water	kg	0.00E+00	0.00E+00	3.17E-16	0.00E+00	6.16E-04
Dimethenamid	Water	kg	0.00E+00	6.79E-10	4.05E-13	7.95E-10	0.00E+00
Dimethylamine	Water	kg	0.00E+00	0.00E+00	1.64E-16	0.00E+00	2.71E-03
Dipropylamine	Water	kg	0.00E+00	0.00E+00	2.01E-16	0.00E+00	2.76E-04
Dipropylthiocarbamic acid S-ethyl ester	Water	kg	0.00E+00	2.81E-10	1.67E-13	3.29E-10	0.00E+00
Dissolved organics	Water	kg	0.00E+00	1.93E-04	0.00E+00	4.05E-05	0.00E+00
Disulfoton	Water	kg	0.00E+00	1.68E-11	1.00E-14	1.96E-11	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Diuron	Water	kg	0.00E+00	4.71E-12	2.81E-15	5.51E-12	0.00E+00
DOC, Dissolved Organic Carbon	Water	kg	4.31E-12	1.12E-01	8.90E-06	2.85E-01	1.87E-01
Docosane	Water	kg	1.66E-07	5.00E-07	2.08E-09	1.43E-06	4.73E-07
Dodecane	Water	kg	8.57E-06	2.60E-05	1.07E-07	7.40E-05	2.44E-05
Eicosane	Water	kg	2.36E-06	7.15E-06	2.95E-08	2.04E-05	6.73E-06
Ethane, 1,2-dichloro-	Water	kg	0.00E+00	0.00E+00	1.60E-12	0.00E+00	1.07E-03
Ethanol	Water	kg	0.00E+00	0.00E+00	1.16E-08	0.00E+00	1.88E-02
Ethene	Water	kg	0.00E+00	0.00E+00	1.11E-10	0.00E+00	1.70E-04
Ethene, chloro-	Water	kg	0.00E+00	0.00E+00	1.25E-14	0.00E+00	3.13E-08
Ethyl acetate	Water	kg	0.00E+00	0.00E+00	3.36E-16	0.00E+00	8.44E-07
Ethylamine	Water	kg	0.00E+00	0.00E+00	1.42E-16	0.00E+00	5.70E-04
Ethylene diamine	Water	kg	0.00E+00	0.00E+00	2.98E-15	0.00E+00	2.02E-11
Ethylene oxide	Water	kg	0.00E+00	0.00E+00	2.27E-15	0.00E+00	9.23E-04
Fluorene	Water	kg	0.00E+00	2.69E-08	6.09E-14	1.16E-12	0.00E+00
Fluorene, 1-methyl-	Water	kg	1.76E-08	5.32E-08	2.21E-10	1.52E-07	5.03E-08
Fluorenes, alkylated, unspecified	Water	kg	3.66E-07	5.07E-07	3.50E-09	1.40E-06	6.06E-07
Fluoride	Water	kg	1.23E-01	8.06E-04	6.08E-06	1.65E-03	1.53E-02
Fluorine	Water	kg	1.83E-07	2.48E-07	1.79E-09	7.61E-07	3.18E-07
Fluosilicic acid	Water	kg	0.00E+00	0.00E+00	1.21E-12	0.00E+00	4.70E-07
Formaldehyde	Water	kg	0.00E+00	0.00E+00	4.01E-06	0.00E+00	1.10E-02
Formamide	Water	kg	0.00E+00	0.00E+00	2.24E-16	0.00E+00	1.57E-12
Formate	Water	kg	0.00E+00	0.00E+00	2.56E-15	0.00E+00	4.40E-02
Formic acid	Water	kg	0.00E+00	0.00E+00	6.51E-17	0.00E+00	4.55E-13
Furan	Water	kg	0.00E+00	3.26E-10	1.60E-12	3.81E-10	8.76E-09
Glutaraldehyde	Water	kg	0.00E+00	0.00E+00	1.69E-15	0.00E+00	1.23E-11
Glyphosate	Water	kg	0.00E+00	6.11E-10	3.64E-13	7.15E-10	0.00E+00
Heat, waste	Water	MJ	0.00E+00	0.00E+00	1.83E-03	0.00E+00	2.35E+01
Hexadecane	Water	kg	9.35E-06	2.84E-05	1.17E-07	8.08E-05	2.67E-05
Hexanoic acid	Water	kg	3.25E-05	9.87E-05	4.08E-07	2.81E-04	9.28E-05
Hydrocarbons, aliphatic, alkanes, unspecified	Water	kg	0.00E+00	0.00E+00	1.37E-08	0.00E+00	2.06E-05
Hydrocarbons, aliphatic, unsaturated	Water	kg	0.00E+00	0.00E+00	1.26E-09	0.00E+00	2.32E-04
Hydrocarbons, aromatic	Water	kg	0.00E+00	0.00E+00	5.56E-08	0.00E+00	8.43E-05
Hydrocarbons, unspecified	Water	kg	5.39E-12	3.26E-07	2.12E-09	3.81E-07	3.36E-04
Hydrogen-3, Tritium	Water	Bq	0.00E+00	0.00E+00	8.07E+00	0.00E+00	1.79E+05
Hydrogen peroxide	Water	kg	0.00E+00	0.00E+00	1.79E-13	0.00E+00	8.01E-06
Hydrogen sulfide	Water	kg	0.00E+00	0.00E+00	2.45E-10	0.00E+00	3.49E-06
Hydroxide	Water	kg	0.00E+00	0.00E+00	9.71E-15	0.00E+00	1.09E-04
Hypochlorite	Water	kg	0.00E+00	0.00E+00	4.37E-10	0.00E+00	9.59E-06
Iodide	Water	kg	0.00E+00	0.00E+00	1.06E-08	0.00E+00	1.17E-01
Iodine-131	Water	Bq	0.00E+00	0.00E+00	8.96E-07	0.00E+00	2.17E-02
Iodine-133	Water	Bq	0.00E+00	0.00E+00	2.28E-08	0.00E+00	9.56E-04
Iron	Water	kg	2.36E-02	4.17E-02	2.69E-04	1.19E-01	4.73E-02
Iron-59	Water	Bq	0.00E+00	0.00E+00	6.26E-09	0.00E+00	2.63E-04
Iron, ion	Water	kg	0.00E+00	0.00E+00	2.35E-06	0.00E+00	4.22E-02
Isopropylamine	Water	kg	0.00E+00	0.00E+00	1.14E-17	0.00E+00	3.56E-04
Lactic acid	Water	kg	0.00E+00	0.00E+00	1.58E-16	0.00E+00	2.16E-04
Lanthanum-140	Water	Bq	0.00E+00	0.00E+00	3.86E-08	0.00E+00	1.62E-03
Lead	Water	kg	1.03E-04	1.79E-04	9.53E-07	5.14E-04	2.38E-04
Lead-210	Water	Bq	0.00E+00	0.00E+00	7.11E-05	0.00E+00	1.22E+00
Lead-210/kg	Water	kg	1.61E-14	4.88E-14	2.02E-16	1.39E-13	4.59E-14
Lithium	Water	kg	3.54E-02	4.14E-01	9.53E-04	1.14E+00	3.08E-01
Lithium, ion	Water	kg	0.00E+00	0.00E+00	4.22E-13	0.00E+00	3.93E-08
m-Xylene	Water	kg	4.69E-06	1.42E-05	5.88E-08	4.05E-05	1.34E-05
Magnesium	Water	kg	9.73E-02	2.94E-01	1.23E-03	8.41E-01	5.60E-01

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Manganese	Water	kg	1.72E-04	1.78E-03	1.23E-05	4.06E-03	1.26E-02
Manganese-54	Water	Bq	0.00E+00	0.00E+00	2.36E-06	0.00E+00	6.46E-02
Mercury	Water	kg	7.50E-07	2.31E-07	1.87E-09	6.18E-07	7.32E-06
Metallic ions, unspecified	Water	kg	6.58E-11	9.28E-09	3.95E-11	1.24E-08	3.08E-04
Methane, dichloro-, HCC-30	Water	kg	0.00E+00	0.00E+00	2.40E-14	0.00E+00	3.01E-04
Methane, monochloro-, R-40	Water	kg	6.24E-09	1.88E-08	7.81E-11	5.39E-08	1.78E-08
Methanol	Water	kg	0.00E+00	0.00E+00	1.28E-08	0.00E+00	2.77E-03
Methyl acetate	Water	kg	0.00E+00	0.00E+00	4.26E-19	0.00E+00	1.16E-04
Methyl acrylate	Water	kg	0.00E+00	0.00E+00	2.80E-15	0.00E+00	1.40E-11
Methyl amine	Water	kg	0.00E+00	0.00E+00	4.96E-17	0.00E+00	6.06E-05
Methyl ethyl ketone	Water	kg	1.25E-08	3.76E-08	1.56E-10	1.08E-07	3.56E-08
Methyl formate	Water	kg	0.00E+00	0.00E+00	1.89E-08	0.00E+00	7.00E-14
Methylamine	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.27E-17
Metolachlor	Water	kg	0.00E+00	2.24E-09	1.34E-12	2.63E-09	0.00E+00
Metribuzin	Water	kg	0.00E+00	1.04E-11	6.21E-15	1.22E-11	0.00E+00
Molybdenum	Water	kg	3.56E-06	1.08E-05	4.93E-08	3.08E-05	9.01E-05
Molybdenum-99	Water	Bq	0.00E+00	0.00E+00	1.33E-08	0.00E+00	5.59E-04
n-Hexacosane	Water	kg	1.03E-07	3.12E-07	1.29E-09	8.93E-07	2.95E-07
Naphthalene	Water	kg	2.82E-06	8.54E-06	3.50E-08	2.43E-05	8.03E-06
Naphthalene, 2-methyl-	Water	kg	2.45E-06	7.44E-06	3.07E-08	2.12E-05	7.00E-06
Naphthalenes, alkylated, unspecified	Water	kg	1.04E-07	1.43E-07	9.91E-10	3.95E-07	1.71E-07
Nickel	Water	kg	6.01E-05	9.08E-05	4.45E-07	2.62E-04	9.59E-05
Nickel, ion	Water	kg	0.00E+00	0.00E+00	7.55E-08	0.00E+00	1.33E-03
Niobium-95	Water	Bq	0.00E+00	0.00E+00	3.84E-07	0.00E+00	9.14E-03
Nitrate	Water	kg	4.72E-13	1.06E-06	6.87E-07	1.24E-06	7.99E-02
Nitrate compounds	Water	kg	1.90E-11	8.03E-10	3.66E-12	1.16E-09	3.02E-10
Nitric acid	Water	kg	4.27E-08	1.37E-06	8.20E-09	2.60E-06	6.78E-07
Nitrite	Water	kg	0.00E+00	0.00E+00	1.40E-10	0.00E+00	2.84E-05
Nitrobenzene	Water	kg	0.00E+00	0.00E+00	1.59E-15	0.00E+00	3.43E-03
Nitrogen	Water	kg	0.00E+00	0.00E+00	7.18E-07	0.00E+00	1.03E-03
Nitrogen, organic bound	Water	kg	0.00E+00	0.00E+00	3.04E-08	0.00E+00	3.85E-05
Nitrogen, total	Water	kg	1.44E-06	1.60E-04	9.70E-07	2.96E-04	2.73E-04
o-Cresol	Water	kg	4.46E-06	1.35E-05	5.58E-08	3.85E-05	1.27E-05
o-Xylene	Water	kg	0.00E+00	5.67E-08	1.30E-13	2.47E-12	4.62E-10
Octadecane	Water	kg	2.31E-06	7.01E-06	2.89E-08	2.00E-05	6.59E-06
Oils, unspecified	Water	kg	3.47E-03	1.03E-02	5.35E-05	2.79E-02	2.10E-02
Organic substances, unspecified	Water	kg	0.00E+00	6.49E-09	1.32E-10	7.60E-09	2.14E-04
p-Cresol	Water	kg	4.81E-06	1.46E-05	6.02E-08	4.15E-05	1.37E-05
p-Xylene	Water	kg	0.00E+00	5.67E-08	1.30E-13	2.47E-12	0.00E+00
PAH, polycyclic aromatic hydrocarbons	Water	kg	0.00E+00	0.00E+00	6.14E-10	0.00E+00	9.36E-07
Paraffins	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-17
Paraquat	Water	kg	0.00E+00	4.54E-11	2.71E-14	5.32E-11	0.00E+00
Parathion, methyl	Water	kg	0.00E+00	3.43E-11	2.05E-14	4.02E-11	0.00E+00
Pendimethalin	Water	kg	0.00E+00	2.33E-10	1.39E-13	2.73E-10	0.00E+00
Permethrin	Water	kg	0.00E+00	2.10E-11	1.25E-14	2.46E-11	0.00E+00
Phenanthrene	Water	kg	3.90E-08	7.65E-08	4.14E-10	2.15E-07	8.10E-08
Phenanthrenes, alkylated, unspecified	Water	kg	4.30E-08	5.95E-08	4.11E-10	1.64E-07	7.10E-08
Phenol	Water	kg	5.44E-05	4.23E-05	4.82E-07	1.26E-04	5.59E-03
Phenol, 2,4-dimethyl-	Water	kg	4.34E-06	1.32E-05	5.43E-08	3.75E-05	1.24E-05
Phenols, unspecified	Water	kg	2.23E-05	1.80E-04	4.63E-07	4.93E-04	1.40E-04
Phorate	Water	kg	0.00E+00	6.49E-12	3.87E-15	7.60E-12	0.00E+00
Phosphate	Water	kg	9.27E-02	2.15E-04	2.59E-06	9.30E-05	5.11E-02
Phosphorus	Water	kg	0.00E+00	1.82E-05	1.14E-08	2.13E-05	1.65E-03
Phosphorus compounds, unspecified	Water	kg	0.00E+00	1.20E-07	7.18E-11	1.41E-07	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Phosphorus, total	Water	kg	0.00E+00	1.07E-05	5.28E-08	1.26E-05	2.89E-04
Polonium-210	Water	Bq	0.00E+00	0.00E+00	8.47E-05	0.00E+00	1.34E+00
Potassium	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-03
Potassium-40	Water	Bq	0.00E+00	0.00E+00	5.97E-05	0.00E+00	1.26E+00
Potassium, ion	Water	kg	0.00E+00	0.00E+00	4.93E-06	0.00E+00	1.34E-01
Process solvents, unspecified	Water	kg	0.00E+00	3.26E-08	1.60E-10	3.81E-08	8.76E-07
Propanal	Water	kg	0.00E+00	0.00E+00	1.77E-16	0.00E+00	1.24E-12
Propene	Water	kg	0.00E+00	2.25E-02	3.62E-07	5.69E-02	2.47E-02
Propionic acid	Water	kg	0.00E+00	0.00E+00	4.96E-17	0.00E+00	9.87E-04
Propylamine	Water	kg	0.00E+00	0.00E+00	7.10E-17	0.00E+00	4.96E-13
Propylene oxide	Water	kg	0.00E+00	0.00E+00	8.35E-12	0.00E+00	1.69E-04
Protactinium-234	Water	Bq	0.00E+00	0.00E+00	4.72E-05	0.00E+00	1.07E+00
Radioactive species, alpha emitters	Water	Bq	0.00E+00	0.00E+00	7.92E-08	0.00E+00	6.54E-01
Radioactive species, Nuclides, unspecified	Water	Bq	8.38E+01	7.20E+03	5.31E+01	1.48E+04	4.06E+03
Radium-224	Water	Bq	0.00E+00	0.00E+00	5.26E-03	0.00E+00	7.94E+00
Radium-226	Water	Bq	0.00E+00	0.00E+00	3.79E-02	0.00E+00	6.77E+02
Radium-226/kg	Water	kg	5.60E-12	1.70E-11	7.01E-14	4.84E-11	1.60E-11
Radium-228	Water	Bq	0.00E+00	0.00E+00	1.05E-02	0.00E+00	1.59E+01
Radium-228/kg	Water	kg	2.86E-14	8.69E-14	3.59E-16	2.47E-13	8.17E-14
Rubidium	Water	kg	0.00E+00	0.00E+00	1.05E-09	0.00E+00	1.59E-06
Ruthenium-103	Water	Bq	0.00E+00	0.00E+00	2.81E-09	0.00E+00	1.18E-04
Scandium	Water	kg	0.00E+00	0.00E+00	1.97E-09	0.00E+00	3.60E-05
Selenium	Water	kg	1.60E-06	1.91E-05	1.44E-07	4.10E-05	5.92E-05
Silicon	Water	kg	0.00E+00	0.00E+00	1.39E-05	0.00E+00	2.46E-01
Silver	Water	kg	3.25E-04	9.81E-04	4.07E-06	2.81E-03	9.27E-04
Silver-110	Water	Bq	0.00E+00	0.00E+00	2.76E-05	0.00E+00	7.95E-01
Silver, ion	Water	kg	0.00E+00	0.00E+00	1.81E-10	0.00E+00	7.40E-07
Simazine	Water	kg	0.00E+00	1.47E-10	8.79E-14	1.73E-10	0.00E+00
Sodium	Water	kg	1.58E+00	4.76E+00	1.98E-02	1.36E+01	4.62E+00
Sodium-24	Water	Bq	0.00E+00	0.00E+00	1.01E-07	0.00E+00	4.23E-03
Sodium formate	Water	kg	0.00E+00	0.00E+00	1.13E-13	0.00E+00	3.36E-09
Sodium, ion	Water	kg	0.00E+00	0.00E+00	3.86E-05	0.00E+00	3.51E+00
Solids, inorganic	Water	kg	1.08E-10	3.49E-09	1.31E-05	6.62E-09	3.36E-02
Solved solids	Water	kg	0.00E+00	0.00E+00	8.41E-07	0.00E+00	3.63E-03
Strontium	Water	kg	8.45E-03	2.56E-02	1.06E-04	7.29E-02	2.95E-02
Strontium-89	Water	Bq	0.00E+00	0.00E+00	4.92E-07	0.00E+00	1.51E-02
Strontium-90	Water	Bq	0.00E+00	0.00E+00	2.67E-02	0.00E+00	5.78E+02
Styrene	Water	kg	0.00E+00	3.42E-09	2.40E-13	1.97E-09	1.81E-09
Sulfate	Water	kg	1.25E-02	1.35E-01	9.45E-04	3.04E-01	1.85E+00
Sulfide	Water	kg	6.31E-06	1.24E-04	2.70E-07	1.56E-04	2.97E-03
Sulfite	Water	kg	0.00E+00	0.00E+00	1.19E-09	0.00E+00	2.60E-05
Sulfur	Water	kg	4.10E-04	1.24E-03	5.16E-06	3.54E-03	7.50E-03
Sulfuric acid	Water	kg	0.00E+00	2.85E-10	2.32E-11	3.34E-10	7.67E-09
Surfactants	Water	kg	0.00E+00	2.67E-06	6.00E-12	1.15E-10	0.00E+00
Suspended solids, inorganic	Water	kg	0.00E+00	0.00E+00	2.01E-05	0.00E+00	5.10E-03
Suspended solids, unspecified	Water	kg	7.26E+00	2.20E+01	9.04E-02	6.13E+01	2.04E+01
t-Butyl methyl ether	Water	kg	0.00E+00	0.00E+00	2.25E-10	0.00E+00	4.71E-07
t-Butylamine	Water	kg	0.00E+00	0.00E+00	1.99E-17	0.00E+00	3.43E-04
Tar	Water	kg	1.07E-12	3.46E-11	2.07E-13	6.56E-11	1.71E-11
Technetium-99m	Water	Bq	0.00E+00	0.00E+00	3.09E-07	0.00E+00	1.29E-02
Tellurium-123m	Water	Bq	0.00E+00	0.00E+00	5.44E-07	0.00E+00	1.21E-02
Tellurium-132	Water	Bq	0.00E+00	0.00E+00	7.71E-10	0.00E+00	3.24E-05
Terbufos	Water	kg	0.00E+00	2.21E-10	1.32E-13	2.59E-10	0.00E+00
Tetradecane	Water	kg	3.76E-06	1.14E-05	4.70E-08	3.24E-05	1.07E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Thallium	Water	kg	1.52E-06	1.93E-06	1.47E-08	5.81E-06	4.00E-06
Thorium-228	Water	Bq	0.00E+00	0.00E+00	2.11E-02	0.00E+00	3.18E+01
Thorium-230	Water	Bq	0.00E+00	0.00E+00	6.44E-03	0.00E+00	1.46E+02
Thorium-232	Water	Bq	0.00E+00	0.00E+00	1.06E-05	0.00E+00	2.29E-01
Thorium-234	Water	Bq	0.00E+00	0.00E+00	4.72E-05	0.00E+00	1.07E+00
Tin	Water	kg	3.11E-05	6.17E-05	3.34E-07	1.79E-04	6.75E-05
Tin, ion	Water	kg	0.00E+00	0.00E+00	1.57E-09	0.00E+00	9.60E-06
Titanium	Water	kg	1.11E-04	1.41E-04	1.06E-06	4.23E-04	1.88E-04
Titanium, ion	Water	kg	0.00E+00	0.00E+00	3.21E-08	0.00E+00	8.73E-04
TOC, Total Organic Carbon	Water	kg	0.00E+00	1.13E-01	8.91E-06	2.85E-01	1.88E-01
Toluene	Water	kg	2.46E-04	7.42E-04	3.09E-06	2.12E-03	2.62E-03
Toluene, 2-chloro-	Water	kg	0.00E+00	0.00E+00	2.47E-16	0.00E+00	6.89E-04
Tributyltin compounds	Water	kg	0.00E+00	0.00E+00	1.05E-10	0.00E+00	2.99E-07
Triethylene glycol	Water	kg	0.00E+00	0.00E+00	3.95E-09	0.00E+00	3.32E-06
Trimethylamine	Water	kg	0.00E+00	0.00E+00	7.62E-19	0.00E+00	2.34E-14
Tungsten	Water	kg	0.00E+00	0.00E+00	2.02E-09	0.00E+00	6.83E-06
Uranium-234	Water	Bq	0.00E+00	0.00E+00	5.67E-05	0.00E+00	1.28E+00
Uranium-235	Water	Bq	0.00E+00	0.00E+00	9.35E-05	0.00E+00	2.11E+00
Uranium-238	Water	Bq	0.00E+00	0.00E+00	1.78E-04	0.00E+00	3.82E+00
Uranium alpha	Water	Bq	0.00E+00	0.00E+00	2.72E-03	0.00E+00	6.15E+01
Urea	Water	kg	0.00E+00	0.00E+00	2.04E-16	0.00E+00	1.44E-12
Vanadium	Water	kg	4.21E-06	1.32E-05	5.27E-08	3.63E-05	1.34E-05
Vanadium, ion	Water	kg	0.00E+00	0.00E+00	5.31E-09	0.00E+00	1.22E-04
VOC, volatile organic compounds, unspecified origin	Water	kg	0.00E+00	0.00E+00	3.70E-08	0.00E+00	5.82E-05
Waste water/m3	Water	m3	0.00E+00	2.68E-03	2.73E-05	3.14E-03	0.00E+00
Xylene	Water	kg	1.31E-04	3.87E-04	1.64E-06	1.11E-03	3.84E-04
Yttrium	Water	kg	1.04E-06	3.17E-06	1.31E-08	9.02E-06	2.98E-06
Zinc	Water	kg	2.69E-04	4.47E-04	3.19E-06	1.26E-03	5.96E-04
Zinc-65	Water	Bq	0.00E+00	0.00E+00	1.37E-06	0.00E+00	5.74E-02
Zinc, ion	Water	kg	0.00E+00	0.00E+00	1.39E-07	0.00E+00	1.48E-03
Zirconium-95	Water	Bq	0.00E+00	0.00E+00	1.58E-08	0.00E+00	6.65E-04
Waste in inert landfill	Waste	kg	0.00E+00	0.00E+00	0.00E+00	1.91E+01	0.00E+00
Waste to recycling	Waste	kg	0.00E+00	0.00E+00	0.00E+00	1.26E+01	5.81E+00
Waste, solid	Waste	kg	0.00E+00	3.84E-02	1.89E-04	4.49E-02	1.03E+00
2,4-D	Soil	kg	0.00E+00	0.00E+00	6.36E-14	0.00E+00	2.31E-08
Aclonifen	Soil	kg	0.00E+00	0.00E+00	6.30E-15	0.00E+00	1.49E-10
Aldrin	Soil	kg	0.00E+00	0.00E+00	3.25E-18	0.00E+00	1.63E-14
Aluminium	Soil	kg	0.00E+00	0.00E+00	5.13E-10	0.00E+00	5.36E-05
Antimony	Soil	kg	0.00E+00	0.00E+00	7.35E-18	0.00E+00	1.59E-13
Arsenic	Soil	kg	0.00E+00	0.00E+00	1.60E-13	0.00E+00	8.95E-09
Atrazine	Soil	kg	0.00E+00	0.00E+00	8.54E-19	0.00E+00	4.28E-15
Barium	Soil	kg	0.00E+00	0.00E+00	1.39E-12	0.00E+00	4.32E-09
Benomyl	Soil	kg	0.00E+00	0.00E+00	4.06E-16	0.00E+00	1.47E-10
Bentazone	Soil	kg	0.00E+00	0.00E+00	3.21E-15	0.00E+00	7.61E-11
Boron	Soil	kg	0.00E+00	0.00E+00	2.72E-13	0.00E+00	3.95E-10
Cadmium	Soil	kg	0.00E+00	0.00E+00	8.73E-13	0.00E+00	1.15E-08
Calcium	Soil	kg	0.00E+00	0.00E+00	6.86E-09	0.00E+00	2.83E-04
Carbetamide	Soil	kg	0.00E+00	0.00E+00	2.52E-15	0.00E+00	3.66E-11
Carbofuran	Soil	kg	0.00E+00	0.00E+00	2.22E-13	0.00E+00	8.06E-08
Carbon	Soil	kg	0.00E+00	0.00E+00	6.00E-10	0.00E+00	5.19E-04
Chloride	Soil	kg	0.00E+00	0.00E+00	9.56E-11	0.00E+00	1.64E-06
Chlorothalonil	Soil	kg	0.00E+00	0.00E+00	1.36E-12	0.00E+00	9.49E-09
Chromium	Soil	kg	0.00E+00	0.00E+00	7.29E-12	0.00E+00	2.75E-07

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Chromium VI	Soil	kg	0.00E+00	0.00E+00	3.34E-14	0.00E+00	2.38E-10
Cobalt	Soil	kg	0.00E+00	0.00E+00	4.29E-13	0.00E+00	3.22E-08
Copper	Soil	kg	0.00E+00	0.00E+00	4.04E-11	0.00E+00	6.05E-06
Cypermethrin	Soil	kg	0.00E+00	0.00E+00	3.15E-14	0.00E+00	1.14E-08
Fenpiclonil	Soil	kg	0.00E+00	0.00E+00	5.39E-14	0.00E+00	3.79E-10
Fluoride	Soil	kg	0.00E+00	0.00E+00	6.94E-14	0.00E+00	4.90E-10
Glyphosate	Soil	kg	0.00E+00	0.00E+00	4.47E-13	0.00E+00	1.60E-07
Heat, waste	Soil	MJ	0.00E+00	0.00E+00	4.73E-05	0.00E+00	6.80E-01
Iron	Soil	kg	0.00E+00	0.00E+00	9.09E-07	0.00E+00	1.02E-03
Lead	Soil	kg	0.00E+00	0.00E+00	2.33E-11	0.00E+00	2.83E-07
Linuron	Soil	kg	0.00E+00	0.00E+00	4.85E-14	0.00E+00	1.15E-09
Magnesium	Soil	kg	0.00E+00	0.00E+00	7.70E-10	0.00E+00	3.19E-05
Mancozeb	Soil	kg	0.00E+00	0.00E+00	1.77E-12	0.00E+00	1.23E-08
Manganese	Soil	kg	0.00E+00	0.00E+00	4.76E-10	0.00E+00	1.03E-05
Mercury	Soil	kg	0.00E+00	0.00E+00	3.16E-15	0.00E+00	4.15E-09
Metaldehyde	Soil	kg	0.00E+00	0.00E+00	8.24E-16	0.00E+00	9.32E-12
Metolachlor	Soil	kg	0.00E+00	0.00E+00	3.51E-13	0.00E+00	8.32E-09
Metribuzin	Soil	kg	0.00E+00	0.00E+00	6.24E-14	0.00E+00	4.34E-10
Molybdenum	Soil	kg	0.00E+00	0.00E+00	8.91E-14	0.00E+00	1.57E-08
Napropamide	Soil	kg	0.00E+00	0.00E+00	1.46E-15	0.00E+00	1.65E-11
Nickel	Soil	kg	0.00E+00	0.00E+00	8.20E-12	0.00E+00	1.11E-07
Oils, biogenic	Soil	kg	0.00E+00	0.00E+00	3.37E-11	0.00E+00	7.00E-07
Oils, unspecified	Soil	kg	0.00E+00	0.00E+00	7.46E-06	0.00E+00	1.19E-02
Orbencarb	Soil	kg	0.00E+00	0.00E+00	3.37E-13	0.00E+00	2.34E-09
Phosphorus	Soil	kg	0.00E+00	0.00E+00	2.32E-10	0.00E+00	4.66E-06
Pirimicarb	Soil	kg	0.00E+00	0.00E+00	3.04E-16	0.00E+00	7.20E-12
Potassium	Soil	kg	0.00E+00	0.00E+00	1.29E-09	0.00E+00	2.59E-05
Silicon	Soil	kg	0.00E+00	0.00E+00	1.97E-09	0.00E+00	1.26E-04
Sodium	Soil	kg	0.00E+00	0.00E+00	1.98E-12	0.00E+00	1.37E-08
Solids	Soil	kg	0.00E+00	0.00E+00	2.60E-06	0.00E+00	5.04E-03
Strontium	Soil	kg	0.00E+00	0.00E+00	3.38E-12	0.00E+00	3.83E-09
Sulfur	Soil	kg	0.00E+00	0.00E+00	2.23E-10	0.00E+00	5.00E-05
Sulfuric acid	Soil	kg	0.00E+00	0.00E+00	1.64E-19	0.00E+00	8.22E-16
Tebutam	Soil	kg	0.00E+00	0.00E+00	3.45E-15	0.00E+00	3.91E-11
Teflubenzuron	Soil	kg	0.00E+00	0.00E+00	4.16E-15	0.00E+00	2.89E-11
Thiram	Soil	kg	0.00E+00	0.00E+00	7.20E-16	0.00E+00	2.61E-10
Tin	Soil	kg	0.00E+00	0.00E+00	6.00E-15	0.00E+00	5.87E-08
Titanium	Soil	kg	0.00E+00	0.00E+00	3.27E-11	0.00E+00	6.55E-07
Vanadium	Soil	kg	0.00E+00	0.00E+00	9.36E-13	0.00E+00	1.88E-08
Zinc	Soil	kg	0.00E+00	0.00E+00	1.53E-09	0.00E+00	4.68E-06

18 APPENDIX C: SOUTHEAST I-JOIST LIFE-CYCLE IMPACT ASSESSMENT, ECONOMIC ALLOCATION

Cradle-to-gate LCI and LCIA results of economic allocation are presented in this section. The results for SE I-joists were presented by five life stages, (1) forestry operations, (2) OSB production, (3) FJL production, (4) LVL production, and (5) I-joist production. The overall cumulative energy consumption obtained from impact assessment using economic allocation was about 3% higher compared with the mass allocation method. The difference between the contribution of the life-cycle stages to the CPEC in economic and mass allocation was minor. For the impact assessment results of selected impact categories, the difference was lower than 10% and ranged between 3% and 10%.

Raw material energy consumption and CPEC for economic allocation are presented in Table 26 and Table 27, respectively. The majority of raw material energy consumption occurs during LVL production followed by OSB and I-joist production with a small portion arising from FJL production and forestry operations. Wood fuel consumption had the greatest share, about 25%, which was dominated by the LVL stage resulting from veneer input to LVL production. For LVL production, wood and natural gas were used to generate thermal energy for log conditioning and for drying and pressing veneers. The LVL stage consumed the most primary energy, whereas its share in the CPEC was about 60% for cradle-to-gate production of SE I-joists. At the I-joist stage, the primary energy source used was natural gas, about 40.2%, which was used to generate thermal energy for resin curing.

Table 26. Raw material energy consumption per kilometer I-joist produced, cradle-to-gate, economic allocation.

Fuel	Unit	Forestry operations	OSB production	FJL production	LVL production	I-joist production
Wood fuel, oven-dry	kg	0.00E+00	1.27E+02	1.31E+01	7.45E+02	1.01E+01
Gas, natural, in ground	kg	1.04E+01	1.57E+02	3.81E-01	3.43E+02	1.11E+02
Coal, in ground	kg	2.20E+00	1.67E+02	1.62E+00	3.25E+02	1.01E+02
Uranium oxide, in ore	kg	5.08E-05	4.72E-03	4.54E-05	9.16E-03	2.43E-03
Oil, crude, in ground	kg	3.43E+01	4.75E+01	4.58E-01	8.56E+01	5.54E+01

Table 32 (Appendix E) lists the air emissions and HAPs generated from I-joist production along with the ones reported by the mills themselves. Fossil and biogenic CO_2 released in the production of 1 km of I-joist were 1,371 and 2,601 kg, respectively. All waterborne emissions occurred off site (Table 32. Economic allocation inventory. Table 32, Appendix E). I-joist plants are zero-discharge facilities.

Table 27. Cumulative primary energy consumption per kilometer I-joist produced, cradle-to-gate, economic allocation.

Fuel	Percentage	Total	Forestry operations	OSB production	FJL production	LVL production	I-joist production
		MJ/km					
Wood fuel	25.1	1.87E+04	0.00E+00	2.66E+03	2.75E+02	1.56E+04	2.11E+02
Gas, natural, in ground	31.9	2.38E+04	3.97E+02	6.03E+03	1.46E+01	1.31E+04	4.25E+03
Coal, in ground	20.9	1.56E+04	5.77E+01	4.36E+03	4.24E+01	8.51E+03	2.65E+03
Oil, crude, in ground	13.6	1.02E+04	1.56E+03	2.16E+03	2.08E+01	3.89E+03	2.52E+03
Uranium oxide, in ore	8.4	6.25E+03	1.94E+01	1.80E+03	1.73E+01	3.49E+03	9.26E+02
Hydro	0.2	1.37E+02	2.35E-01	3.46E+01	2.96E-01	8.05E+01	2.11E+01
Wind	0.0	4.28E+00	0.00E+00	5.70E-01	2.58E-04	9.05E-01	2.81E+00
Solar	0.0	4.84E-02	0.00E+00	2.61E-03	2.76E-06	6.30E-03	3.95E-02
Geothermal	0.0	2.11E-01	0.00E+00	2.11E-01	3.87E-07	4.86E-06	0.00E+00
Total	100.0	7.47E+04	2.04E+03	1.70E+04	3.70E+02	4.47E+04	1.06E+04
Total, by percentage		100	2.7	22.8	0.5	59.8	14.2

Solid emissions were dominated by LVL and I-joist production stages. Solid emissions include ash generated at the wood boiler during veneer production for LVL production and primarily fuels and resins used (Table 28). A total of 108 kg/km solid waste was generated, which does not include the amount of recycled solid waste. Overall, 84% of the solid waste generated is landfilled.

Table 28. Waste to treatment (kg) per kilometer I-joist, cradle-to-gate, economic allocation.

Waste to treatment	Total	Forestry operations	OSB production	FJL production	LVL production	I-joist production
	kg/km					
Waste in inert landfill	9.06E+01	0.00E+00	1.17E+01	2.51E-04	7.77E+01	1.13E+00
Waste to recycling	1.76E+01	0.00E+00	0.00E+00	0.00E+00	1.12E+01	6.38E+00
Total waste	1.08E+02	0.00E+00	1.17E+01	2.51E-04	8.89E+01	7.51E+00

Table 29 shows environmental performance results for GWP, acidification, eutrophication, ozone depletion, and smog; energy consumption from nonrenewable and renewable sources; material resource consumption from renewable and nonrenewable resources; and solid waste. In addition, the contribution of major substances to the overall impact for eutrophication, acidification, smog, and global warming impact categories are provided in Appendix D. The data on solid waste generated during OSB and LVL production were obtained from Kaestner (2015) and Bergman and Alanya-Rosenbaum (2016), respectively.

Table 29. Environmental performance of 1 km of I-joist, cradle-to-gate, economic allocation.

Impact category	Unit	Total	Forestry operations	OSB production	FJL production	LVL production	I-joist production
Global warming	kg CO_2 eq	2.85E+03	1.29E+02	6.88E+02	5.47E+00	1.52E+03	5.01E+02
Acidification potential	kg SO_2 eq	2.78E+01	1.72E+00	6.77E+00	5.63E-02	1.43E+01	4.94E+00
Eutrophication potential	kg N eq	1.28E+00	3.14E-01	1.77E-01	1.69E-03	3.73E-01	4.15E-01
Ozone depletion potential	kg CFC-11 eq	1.95E-04	1.10E-08	2.39E-06	4.60E-09	8.23E-07	1.92E-04
Smog potential	kg O_3 eq	3.01E+02	4.87E+01	6.92E+01	1.11E+00	1.36E+02	4.55E+01
Total primary energy consumption	**MJ**	**7.47E+04**	**2.04E+03**	**1.70E+04**	**3.70E+02**	**4.47E+04**	**1.06E+04**
Nonrenewable fossil	MJ	4.96E+04	2.02E+03	1.26E+04	7.78E+01	2.55E+04	9.42E+03
Nonrenewable nuclear	MJ	6.25E+03	1.94E+01	1.80E+03	1.73E+01	3.49E+03	9.26E+02
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	1.41E+02	2.35E-01	3.54E+01	2.96E-01	8.14E+01	2.39E+01
Renewable, biomass	MJ	1.87E+04	0.00E+00	2.66E+03	2.75E+02	1.56E+04	2.11E+02
Material resources consumption (nonfuel resources)	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Nonrenewable materials	kg	1.49E+01	0.00E+00	6.67E+00	6.47E-04	7.57E+00	6.76E-01
Renewable materials	kg	3.98E+03	7.17E+02	2.40E+01	5.87E+01	3.16E+03	2.18E+01
Fresh water	L	1.24E+04	4.22E-01	1.52E+03	4.25E+01	5.80E+03	5.02E+03
Waste generated	**Unit**	**Total**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Solid waste	kg	1.08E+02	0.00E+00	1.17E+01	2.51E-04	8.89E+01	7.51E+00

19 APPENDIX D: SUBSTANCE CONTRIBUTION ANALYSIS

Table 30. Substance contribution analysis to acidification (kg SO_2 eq.) by life-cycle stage (total percentage basis and values are displayed).

		Mass allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartments		**100.00**	2%	9%	0.1%	19%	70%
Sulfur dioxide	Air	67	2.30E-01	4.37E+00	2.13E-02	1.01E+01	3.16E+00
Nitrogen oxides	Air	28	1.37E+00	1.66E+00	1.68E-02	3.41E+00	1.08E+00
Sulfur monoxide	Air	1.5	1.02E-01	6.27E-02	3.92E-04	1.31E-01	1.13E-01
Sulfur oxides	Air	1.2	1.02E-02	7.30E-02	7.27E-04	1.61E-01	8.53E-02
Other substances	Air	<1	8.77E-03	9.96E-02	1.07E-03	2.04E-01	6.43E-02
		Economic allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartments		**100.00**	6%	24%	0.2%	51%	18%
Sulfur dioxide	Air	68	2.30E-01	4.72E+00	2.95E-02	1.04E+01	3.47E+00
Nitrogen oxides	Air	28	1.37E+00	1.79E+00	2.37E-02	3.42E+00	1.18E+00
Sulfur monoxide	Air	1.5	1.02E-01	6.77E-02	5.18E-04	1.28E-01	1.24E-01
Sulfur oxides	Air	1.3	1.02E-02	7.85E-02	1.18E-03	1.76E-01	9.36E-02
Other substances	Air	<1	8.77E-03	1.08E-01	1.46E-03	2.06E-01	7.06E-02

Table 31. Substance contribution analysis to eutrophication (kg N eq.) by life-cycle stage (total percentage basis and values are displayed).

		Mass allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartments		**100.00**	26%	13%	0%	30%	31%
Nitrogen oxides	Air	39	8.65E-02	1.05E-01	1.06E-03	2.16E-01	6.83E-02
Phosphate	Air	28	2.21E-01	5.12E-04	6.16E-06	2.21E-04	1.22E-01
COD	Water	12	2.61E-03	2.78E-02	3.71E-05	7.05E-02	4.24E-02
BOD_5	Water	10	1.41E-03	2.41E-02	2.60E-05	6.15E-02	4.00E-02
Ammonium, ion	Water	6	4.50E-07	9.45E-05	1.32E-05	7.26E-04	6.71E-02
Ammonia	Water	2	2.13E-03	5.43E-03	2.68E-05	1.46E-02	5.25E-03
Nitrate	Water	2	1.12E-13	2.50E-07	1.63E-07	2.92E-07	1.89E-02
Other substances		<1	2.61E-03	6.50E-03	5.76E-05	1.70E-02	7.33E-03
		Economic allocation					
Substances	**Compartment type**	**Total (%)**	**Forestry operations**	**OSB production**	**FJL production**	**LVL production**	**I-joist production**
Total of all compartment		**100.00**	25%	14%	0.1%	29%	32%
Nitrogen oxides	Air	38	8.65E-02	1.13E-01	1.50E-03	2.16E-01	7.49E-02
Phosphate	Water	28	2.21E-01	5.38E-04	7.73E-06	2.49E-04	1.33E-01
COD	Water	12	2.61E-03	3.00E-02	5.26E-05	7.44E-02	4.65E-02
BOD_5	Water	11	1.41E-03	2.61E-02	3.64E-05	6.51E-02	4.38E-02
Ammonium, ion	Water	6	4.50E-07	1.02E-04	1.69E-05	6.86E-04	7.36E-02
Ammonia	Water	2	2.13E-03	5.87E-03	3.89E-05	1.50E-02	5.76E-03
Nitrate	Water	2	1.12E-13	2.50E-07	2.03E-07	3.30E-07	2.08E-02
Phosphorus	Water	1	0.00E+00	1.33E-04	1.11E-07	1.75E-04	1.32E-02
Other substances		<1	4.80E-04	9.22E-04	3.51E-05	1.48E-03	3.05E-03

20 APPENDIX E: SOUTHEAST I-JOIST LIFE-CYCLE INVENTORY FLOWS, ECONOMIC ALLOCATION

Table 32. Economic allocation inventory.

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Aluminium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.99E-05
Aluminium, 24% in bauxite, 11% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.46E-08	0.00E+00	1.05E-02
Anhydrite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.49E-06
Anhydrite, in ground	Raw	kg	0.00E+00	0.00E+00	6.65E-12	0.00E+00	3.60E-05
Barite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-04
Barite, 15% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.41E-09	0.00E+00	3.02E-02
Basalt	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-09
Basalt, in ground	Raw	kg	0.00E+00	0.00E+00	4.15E-11	0.00E+00	8.56E-07
Borax	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.22E-10
Borax, in ground	Raw	kg	0.00E+00	0.00E+00	3.64E-12	0.00E+00	7.92E-08
Bromine, 0.0023% in water	Raw	kg	0.00E+00	0.00E+00	7.93E-13	0.00E+00	4.36E-01
Cadmium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E-13
Cadmium, 0.30% in sulfide, Cd 0.18%, Pb, Zn, Ag, In, in ground	Raw	kg	0.00E+00	0.00E+00	1.26E-13	0.00E+00	6.87E-10
Calcite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-01
Calcite, in ground	Raw	kg	0.00E+00	0.00E+00	2.22E-05	0.00E+00	9.41E-01
Carbon dioxide, in air	Raw	kg	1.24E+04	1.08E+02	3.16E-02	1.25E+02	2.02E+00
Carbon, in organic matter, in soil	Raw	kg	0.00E+00	0.00E+00	3.51E-10	0.00E+00	1.12E-04
Carbon, organic, in soil or biomass stock	Raw	kg	0.00E+00	0.00E+00	0.00E+00	4.75E+03	8.88E+03
Cerium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.22E-24
Chromium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E-06
Chromium, 25.5% in chromite, 11.6% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.05E-09	0.00E+00	1.16E-04
Chrysotile	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.33E-09
Chrysotile, in ground	Raw	kg	0.00E+00	0.00E+00	1.30E-11	0.00E+00	3.33E-04
Cinnabar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.02E-07
Cinnabar, in ground	Raw	kg	0.00E+00	0.00E+00	1.22E-12	0.00E+00	3.07E-05
Clay, bentonite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.66E-05
Clay, bentonite, in ground	Raw	kg	0.00E+00	0.00E+00	5.71E-08	0.00E+00	1.47E-03
Clay, unspecified	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-03
Clay, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	2.90E-06	0.00E+00	2.16E-02
Coal, 26.4 MJ per kg	Raw	kg	2.20E+00	1.61E+02	1.62E+00	3.25E+02	8.95E+01
Coal, bituminous, 24.8 MJ per kg	Raw	kg	0.00E+00	1.18E-05	8.36E-06	1.05E-04	0.00E+00
Coal, bitumous, in ground	Raw	kg	0.00E+00	4.95E+00	0.00E+00	0.00E+00	0.00E+00
Coal, brown	Raw	kg	0.00E+00	1.07E-06	7.52E-07	9.45E-06	1.94E-02
Coal, brown, in ground	Raw	kg	0.00E+00	0.00E+00	3.25E-04	0.00E+00	6.26E+00
Coal, hard	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-01
Coal, hard, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	1.87E-04	0.00E+00	5.17E+00
Coal, lignite, in ground	Raw	kg	0.00E+00	4.11E-01	0.00E+00	0.00E+00	0.00E+00
Cobalt	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.26E-11
Cobalt, in ground	Raw	kg	0.00E+00	0.00E+00	4.54E-12	0.00E+00	2.55E-05
Colemanite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.64E-09
Colemanite, in ground	Raw	kg	0.00E+00	0.00E+00	1.03E-10	0.00E+00	7.10E-03
Copper ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-04
Copper, 0.99% in sulfide, Cu 0.36% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-08
Copper, 0.99% in sulfide, Cu 0.36% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.20E-11	0.00E+00	1.27E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Copper, 1.18% in sulfide, Cu 0.39% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.97E-09
Copper, 1.18% in sulfide, Cu 0.39% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.89E-11	0.00E+00	4.01E-05
Copper, 1.42% in sulfide, Cu 0.81% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-09
Copper, 1.42% in sulfide, Cu 0.81% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.62E-11	0.00E+00	1.06E-05
Copper, 2.19% in sulfide, Cu 1.83% and Mo 8.2E-3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-09
Copper, 2.19% in sulfide, Cu 1.83% and Mo 8.2E-3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.31E-10	0.00E+00	5.27E-05
Diatomite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-13
Diatomite, in ground	Raw	kg	0.00E+00	0.00E+00	4.51E-15	0.00E+00	8.84E-11
Dolomite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.96E-05
Dolomite, in ground	Raw	kg	0.00E+00	0.00E+00	1.88E-10	0.00E+00	3.16E-05
Energy, from biomass	Raw	MJ	0.00E+00	7.58E-01	1.39E-06	1.75E-05	0.00E+00
Energy, from gas, natural	Raw	MJ	0.00E+00	4.36E+01	0.00E+00	9.54E+00	0.00E+00
Energy, from hydro power	Raw	MJ	2.35E-01	3.46E+01	2.96E-01	8.05E+01	2.11E+01
Energy, from oil	Raw	MJ	0.00E+00	1.72E+01	0.00E+00	3.77E+00	0.00E+00
Energy, geothermal	Raw	MJ	0.00E+00	2.11E-01	3.87E-07	4.86E-06	0.00E+00
Energy, gross calorific value, in biomass	Raw	MJ	0.00E+00	0.00E+00	2.47E-04	0.00E+00	5.90E+00
Energy, gross calorific value, in biomass, primary forest	Raw	MJ	0.00E+00	0.00E+00	2.43E-08	0.00E+00	7.74E-03
Energy, kinetic (in wind), converted	Raw	MJ	0.00E+00	5.70E-01	2.58E-04	9.05E-01	2.81E+00
Energy, potential (in hydropower reservoir), converted	Raw	MJ	0.00E+00	0.00E+00	1.29E-03	0.00E+00	1.91E+01
Energy, recovered	Raw	MJ	0.00E+00	4.58E+01	1.07E-06	1.34E-05	0.00E+00
Energy, solar, converted	Raw	MJ	0.00E+00	2.61E-03	2.76E-06	6.30E-03	3.95E-02
Feldspar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-04
Feldspar, in ground	Raw	kg	0.00E+00	0.00E+00	2.26E-16	0.00E+00	2.09E-12
Fluorine	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-08
Fluorine, 4.5% in apatite, 1% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.85E-09	0.00E+00	1.86E-02
Fluorine, 4.5% in apatite, 3% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-09
Fluorine, 4.5% in apatite, 3% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.25E-09	0.00E+00	1.42E-02
Fluorspar	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.84E-06
Fluorspar, 92%, in ground	Raw	kg	0.00E+00	0.00E+00	9.65E-08	0.00E+00	3.03E-01
Gadolinium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.34E-29
Gallium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E-17
Gallium, 0.014% in bauxite, in ground	Raw	kg	0.00E+00	0.00E+00	6.63E-19	0.00E+00	3.82E-15
Gas, mine, off-gas, process, coal mining/m3	Raw	m3	0.00E+00	0.00E+00	1.82E-06	0.00E+00	4.75E-02
Gas, natural, 36.6 MJ per m3	Raw	m3	0.00E+00	4.52E-05	3.20E-05	4.02E-04	0.00E+00
Gas, natural, 36.7 MJ per m3, in ground	Raw	kg	0.00E+00	1.08E+01	0.00E+00	0.00E+00	0.00E+00
Gas, natural, 46.8 MJ per kg	Raw	kg	0.00E+00	1.79E-01	4.82E-05	2.04E-01	1.79E-02
Gas, natural, 49.8 MJ per kg, in ground (EMR)	Raw	kg	0.00E+00	7.76E+00	0.00E+00	0.00E+00	0.00E+00
Gas, natural, in ground	Raw	m3	0.00E+00	0.00E+00	8.68E-03	0.00E+00	1.07E+01
Gas, natural/m3	Raw	m3	1.04E+01	1.31E+02	3.73E-01	3.42E+02	1.00E+02
Gold	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.71E-14
Gold, Au 1.1E-4%, Ag 4.2E-3%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E-14
Gold, Au 1.1E-4%, Ag 4.2E-3%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.62E-16	0.00E+00	2.43E-12
Gold, Au 1.3E-4%, Ag 4.6E-5%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.27E-14
Gold, Au 1.3E-4%, Ag 4.6E-5%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.03E-15	0.00E+00	4.46E-12
Gold, Au 1.4E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.23E-15	0.00E+00	5.34E-12

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Gold, Au 2.1E-4%, Ag 2.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-13
Gold, Au 2.1E-4%, Ag 2.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.89E-15	0.00E+00	8.16E-12
Gold, Au 4.3E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-14
Gold, Au 4.3E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	4.67E-16	0.00E+00	2.02E-12
Gold, Au 4.9E-5%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.90E-14
Gold, Au 4.9E-5%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.12E-15	0.00E+00	4.84E-12
Gold, Au 6.7E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E-13
Gold, Au 6.7E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.73E-15	0.00E+00	7.50E-12
Gold, Au 7.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-13
Gold, Au 7.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.95E-15	0.00E+00	8.45E-12
Gold, Au 9.7E-4%, Ag 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.26E-15
Gold, Au 9.7E-4%, Ag 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.17E-16	0.00E+00	5.07E-13
Granite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-14
Granite, in ground	Raw	kg	0.00E+00	0.00E+00	1.59E-16	0.00E+00	9.42E-13
Gravel	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-04
Gravel, in ground	Raw	kg	0.00E+00	0.00E+00	1.13E-04	0.00E+00	1.11E-01
Gypsum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-05
Gypsum, in ground	Raw	kg	0.00E+00	0.00E+00	3.85E-10	0.00E+00	2.04E-06
Helium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.28E-16
Indium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-14
Indium, 0.005% in sulfide, In 0.003%, Pb, Zn, Ag, Cd, in ground	Raw	kg	0.00E+00	0.00E+00	2.13E-15	0.00E+00	1.14E-11
Iodine, 0.03% in water	Raw	kg	0.00E+00	0.00E+00	1.87E-13	0.00E+00	2.27E-01
Iron	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-03
Iron ore	Raw	kg	0.00E+00	1.27E-08	1.28E-05	1.68E-08	1.10E-04
Iron, 46% in ore, 25% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.38E-08	0.00E+00	1.73E-03
Kaolinite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E-07
Kaolinite, 24% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.65E-09	0.00E+00	1.93E-05
Kieserite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.63E-10
Kieserite, 25% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.75E-12	0.00E+00	6.64E-08
Lanthanum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E-23
Lead	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-07
Lead, 5.0% in sulfide, Pb 3.0%, Zn, Ag, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	2.65E-12	0.00E+00	1.31E-06
Limestone	Raw	kg	0.00E+00	6.67E+00	6.47E-04	7.57E+00	6.76E-01
Lithium, 0.15% in brine, in ground	Raw	kg	0.00E+00	0.00E+00	3.38E-15	0.00E+00	2.07E-11
Magnesite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-06
Magnesite, 60% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.89E-09	0.00E+00	2.55E-05
Magnesium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-13
Magnesium, 0.13% in water	Raw	kg	0.00E+00	0.00E+00	3.13E-15	0.00E+00	1.55E-11
Manganese	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E-07
Manganese, 35.7% in sedimentary deposit, 14.2% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.43E-11	0.00E+00	3.24E-02
Metamorphous rock, graphite containing	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.49E-09
Metamorphous rock, graphite containing, in ground	Raw	kg	0.00E+00	0.00E+00	4.41E-11	0.00E+00	1.51E-05
Molybdenum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.26E-09
Molybdenum, 0.010% in sulfide, Mo 8.2E-3% and Cu 1.83% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-10
Molybdenum, 0.010% in sulfide, Mo 8.2E-3% and Cu 1.83% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.43E-12	0.00E+00	9.79E-07
Molybdenum, 0.014% in sulfide, Mo 8.2E-3% and Cu 0.81% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-11

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Molybdenum, 0.014% in sulfide, Mo 8.2E-3% and Cu 0.81% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.45E-13	0.00E+00	1.40E-07
Molybdenum, 0.022% in sulfide, Mo 8.2E-3% and Cu 0.36% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-09
Molybdenum, 0.022% in sulfide, Mo 8.2E-3% and Cu 0.36% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.96E-11	0.00E+00	8.60E-06
Molybdenum, 0.025% in sulfide, Mo 8.2E-3% and Cu 0.39% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.63E-11
Molybdenum, 0.025% in sulfide, Mo 8.2E-3% and Cu 0.39% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.26E-12	0.00E+00	5.11E-07
Molybdenum, 0.11% in sulfide, Mo 4.1E-2% and Cu 0.36% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.95E-11	0.00E+00	1.74E-05
Neodymium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.10E-24
Nickel, 1.13% in sulfide, Ni 0.76% and Cu 0.76% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-08
Nickel, 1.13% in sulfide, Ni 0.76% and Cu 0.76% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	3.90E-06	0.00E+00	4.87E-04
Nickel, 1.98% in silicates, 1.04% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-05
Nickel, 1.98% in silicates, 1.04% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	8.60E-09	0.00E+00	1.77E-04
Nitrogen	Raw	kg	0.00E+00	8.32E-01	0.00E+00	0.00E+00	2.88E-03
Occupation, arable, conservation tillage	Raw	m2a	0.00E+00	1.35E-03	1.07E-06	1.78E-03	0.00E+00
Occupation, arable, conventional tillage	Raw	m2a	0.00E+00	1.48E-03	1.18E-06	1.96E-03	0.00E+00
Occupation, arable, non-irrigated	Raw	m2a	0.00E+00	0.00E+00	7.65E-09	0.00E+00	7.58E-05
Occupation, arable, reduced tillage	Raw	m2a	0.00E+00	9.08E-04	7.20E-07	1.20E-03	0.00E+00
Occupation, construction site	Raw	m2a	0.00E+00	0.00E+00	2.50E-08	0.00E+00	1.95E-03
Occupation, dump site	Raw	m2a	0.00E+00	0.00E+00	1.38E-06	0.00E+00	3.13E-02
Occupation, dump site, benthos	Raw	m2a	0.00E+00	0.00E+00	2.75E-11	0.00E+00	1.75E-07
Occupation, forest, intensive	Raw	m2a	0.00E+00	0.00E+00	2.60E-07	0.00E+00	6.55E-03
Occupation, forest, intensive, normal	Raw	m2a	0.00E+00	0.00E+00	3.68E-06	0.00E+00	6.64E-02
Occupation, forest, intensive, short-cycle	Raw	m2a	0.00E+00	0.00E+00	6.11E-09	0.00E+00	1.94E-03
Occupation, industrial area	Raw	m2a	0.00E+00	0.00E+00	3.86E-07	0.00E+00	8.57E-03
Occupation, industrial area, benthos	Raw	m2a	0.00E+00	0.00E+00	2.52E-13	0.00E+00	1.60E-09
Occupation, industrial area, built up	Raw	m2a	0.00E+00	0.00E+00	2.79E-10	0.00E+00	1.55E-06
Occupation, industrial area, vegetation	Raw	m2a	0.00E+00	0.00E+00	1.28E-10	0.00E+00	1.23E-06
Occupation, mineral extraction site	Raw	m2a	0.00E+00	0.00E+00	7.67E-07	0.00E+00	2.33E-02
Occupation, permanent crop, fruit, intensive	Raw	m2a	0.00E+00	0.00E+00	8.53E-09	0.00E+00	1.83E-05
Occupation, shrub land, sclerophyllous	Raw	m2a	0.00E+00	0.00E+00	1.28E-08	0.00E+00	6.40E-04
Occupation, traffic area, rail embankment	Raw	m2a	0.00E+00	0.00E+00	1.15E-10	0.00E+00	5.23E-07
Occupation, traffic area, rail network	Raw	m2a	0.00E+00	0.00E+00	1.27E-10	0.00E+00	5.87E-07
Occupation, traffic area, rail/road embankment	Raw	m2a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.15E-09
Occupation, traffic area, road embankment	Raw	m2a	0.00E+00	0.00E+00	4.06E-08	0.00E+00	7.64E-04
Occupation, traffic area, road network	Raw	m2a	0.00E+00	0.00E+00	3.50E-10	0.00E+00	2.08E-06
Occupation, urban, discontinuously built	Raw	m2a	0.00E+00	0.00E+00	1.41E-14	0.00E+00	7.89E-11
Occupation, water bodies, artificial	Raw	m2a	0.00E+00	0.00E+00	1.94E-06	0.00E+00	3.13E-02
Occupation, water courses, artificial	Raw	m2a	0.00E+00	0.00E+00	7.59E-07	0.00E+00	1.34E-02
Oil, crude	Raw	kg	3.43E+01	2.47E+01	4.55E-01	8.17E+01	4.84E+01
Oil, crude, 41 MJ per kg	Raw	kg	0.00E+00	1.33E+01	0.00E+00	2.91E+00	0.00E+00
Oil, crude, 42 MJ per kg	Raw	kg	0.00E+00	8.09E-01	6.94E-05	9.16E-01	7.19E-02
Oil, crude, 42.7 MJ per kg	Raw	kg	0.00E+00	2.36E-05	1.67E-05	2.10E-04	0.00E+00
Oil, crude, 43.7 MJ per kg, in ground	Raw	kg	0.00E+00	1.51E+00	0.00E+00	0.00E+00	0.00E+00
Oil, crude, 43.7 MJ per kg, in ground (EMR)	Raw	kg	0.00E+00	7.16E+00	0.00E+00	0.00E+00	0.00E+00
Oil, crude, in ground	Raw	kg	0.00E+00	0.00E+00	2.07E-03	0.00E+00	6.90E+00
Olivine	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E-06
Olivine, in ground	Raw	kg	0.00E+00	0.00E+00	2.35E-12	0.00E+00	1.25E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Oxygen	Raw	kg	0.00E+00	1.17E+01	4.33E-05	9.16E+00	3.32E+00
Palladium, Pd 2.0E-4%, Pt 4.8E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E-12
Palladium, Pd 7.3E-4%, Pt 2.5E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.54E-12
Pd, Pd 2.0E-4%, Pt 4.8E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.44E-12	0.00E+00	3.74E-09
Pd, Pd 7.3E-4%, Pt 2.5E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.87E-12	0.00E+00	8.98E-09
Peat	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E-05
Peat, in ground	Raw	kg	0.00E+00	0.00E+00	6.61E-08	0.00E+00	9.85E-04
Pesticides	Raw	kg	0.00E+00	8.93E-07	5.84E-09	1.18E-06	2.64E-05
Phosphate ore	Raw	kg	0.00E+00	8.49E-05	5.55E-07	1.12E-04	2.57E-03
Phosphorus	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-04
Phosphorus, 18% in apatite, 12% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.03E-09	0.00E+00	5.74E-02
Phosphorus, 18% in apatite, 4% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E-08
Phosphorus, 18% in apatite, 4% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.14E-08	0.00E+00	7.45E-02
Platinum, Pt 2.5E-4%, Pd 7.3E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.17E-14
Platinum, Pt 4.8E-4%, Pd 2.0E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-13
Potassium chloride	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-03
Praseodymium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-25
Pt, Pt 2.5E-4%, Pd 7.3E-4%, Rh 2.0E-5%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.62E-14	0.00E+00	8.60E-11
Pt, Pt 4.8E-4%, Pd 2.0E-4%, Rh 2.4E-5%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.02E-13	0.00E+00	3.08E-10
resin	Raw	kg	0.00E+00	6.25E+01	0.00E+00	0.00E+00	0.00E+00
Rh, Rh 2.0E-5%, Pt 2.5E-4%, Pd 7.3E-4%, Ni 2.3E+0%, Cu 3.2E+0% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	5.59E-14	0.00E+00	8.54E-11
Rh, Rh 2.4E-5%, Pt 4.8E-4%, Pd 2.0E-4%, Ni 3.7E-2%, Cu 5.2E-2% in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.75E-13	0.00E+00	2.67E-10
Rhenium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-13
Rhenium, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.30E-14	0.00E+00	1.61E-10
Rhodium, Rh 2.0E-5%, Pt 2.5E-4%, Pd 7.3E-4%, Ni 2.3E+0%, Cu 3.2E+0% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.06E-14
Rhodium, Rh 2.4E-5%, Pt 4.8E-4%, Pd 2.0E-4%, Ni 3.7E-2%, Cu 5.2E-2% in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-13
Roundwood at forest road	Raw	m3	1.17E+01	5.73E+00	0.00E+00	0.00E+00	0.00E+00
Salt, unspecified	Raw	kg	0.00E+00	7.99E+00	0.00E+00	0.00E+00	0.00E+00
Samarium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.02E-27
Sand	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E-04
Sand, quartz, in ground	Raw	kg	0.00E+00	9.89E-06	6.47E-08	1.31E-05	2.92E-04
Sand, unspecified, in ground	Raw	kg	0.00E+00	0.00E+00	1.50E-09	0.00E+00	4.70E-03
Scrap, external	Raw	kg	0.00E+00	3.47E-01	1.29E-03	4.58E-01	5.24E+00
Seed corn	Raw	kg	0.00E+00	4.79E-06	3.13E-08	6.32E-06	1.41E-04
Shale	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E-06
Shale, in ground	Raw	kg	0.00E+00	0.00E+00	1.88E-11	0.00E+00	1.02E-04
Silver, 0.007% in sulfide, Ag 0.004%, Pb, Zn, Cd, In	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.82E-13
Silver, 0.007% in sulfide, Ag 0.004%, Pb, Zn, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	1.25E-14	0.00E+00	5.41E-11
Silver, 3.2ppm in sulfide, Ag 1.2ppm, Cu and Te, in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-13
Silver, 3.2ppm in sulfide, Ag 1.2ppm, Cu and Te, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	8.90E-15	0.00E+00	3.86E-11
Silver, Ag 2.1E-4%, Au 2.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.81E-14

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Silver, Ag 2.1E-4%, Au 2.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	8.22E-16	0.00E+00	3.56E-12
Silver, Ag 4.2E-3%, Au 1.1E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-13
Silver, Ag 4.2E-3%, Au 1.1E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.88E-15	0.00E+00	8.13E-12
Silver, Ag 4.6E-5%, Au 1.3E-4%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-13
Silver, Ag 4.6E-5%, Au 1.3E-4%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.84E-15	0.00E+00	7.97E-12
Silver, Ag 9.7E-4%, Au 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.58E-14
Silver, Ag 9.7E-4%, Au 9.7E-4%, Zn 0.63%, Cu 0.38%, Pb 0.014%, in ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.21E-15	0.00E+00	5.26E-12
Sodium carbonate	Raw	kg	0.00E+00	1.15E-03	9.16E-07	1.52E-03	0.00E+00
Sodium chloride	Raw	kg	0.00E+00	2.29E+00	8.81E-05	5.72E+00	7.15E-01
Sodium chloride, in ground	Raw	kg	0.00E+00	0.00E+00	2.47E-05	0.00E+00	1.20E+01
Sodium nitrate	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.90E-13
Sodium nitrate, in ground	Raw	kg	0.00E+00	0.00E+00	8.43E-17	0.00E+00	3.81E-13
Sodium sulfate	Raw	kg	0.00E+00	6.27E-03	2.05E-05	8.28E-03	7.97E-02
Sodium sulphate, various forms, in ground	Raw	kg	0.00E+00	0.00E+00	2.38E-08	0.00E+00	4.19E-05
Stibnite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-14
Stibnite, in ground	Raw	kg	0.00E+00	0.00E+00	4.68E-16	0.00E+00	9.18E-12
Sulfur	Raw	kg	0.00E+00	3.38E-04	1.20E-06	4.46E-04	8.47E-03
Sulfur, in ground	Raw	kg	0.00E+00	0.00E+00	4.47E-10	0.00E+00	1.06E-01
Sylvinite, in ground	Raw	kg	0.00E+00	4.18E-05	2.73E-07	5.52E-05	1.23E-03
Sylvite, 25 % in sylvinite, in ground	Raw	kg	0.00E+00	0.00E+00	3.36E-10	0.00E+00	9.16E-02
Talc	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E-08
Talc, in ground	Raw	kg	0.00E+00	0.00E+00	4.67E-10	0.00E+00	4.48E-06
Tantalum	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.95E-13
Tantalum, 81.9% in tantalite, 1.6E-4% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	9.84E-15	0.00E+00	4.26E-11
Tellurium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.44E-14
Tellurium, 0.5ppm in sulfide, Te 0.2ppm, Cu and Ag, in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.34E-15	0.00E+00	5.79E-12
Tin	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.59E-11
Tin, 79% in cassiterite, 0.1% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.35E-13	0.00E+00	3.47E-09
TiO2, 54% in ilmenite, 2.6% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-06
TiO2, 54% in ilmenite, 2.6% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	6.16E-08	0.00E+00	4.18E-04
TiO2, 95% in rutile, 0.40% in crude ore	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.44E-10
TiO2, 95% in rutile, 0.40% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	2.82E-16	0.00E+00	1.49E-12
Transformation, from arable	Raw	m2	0.00E+00	0.00E+00	1.70E-11	0.00E+00	3.99E-06
Transformation, from arable, non-irrigated	Raw	m2	0.00E+00	0.00E+00	1.41E-08	0.00E+00	1.40E-04
Transformation, from arable, non-irrigated, fallow	Raw	m2	0.00E+00	0.00E+00	5.41E-12	0.00E+00	1.27E-06
Transformation, from dump site, inert material landfill	Raw	m2	0.00E+00	0.00E+00	2.79E-12	0.00E+00	5.53E-05
Transformation, from dump site, residual material landfill	Raw	m2	0.00E+00	0.00E+00	2.42E-09	0.00E+00	7.15E-05
Transformation, from dump site, sanitary landfill	Raw	m2	0.00E+00	0.00E+00	1.29E-10	0.00E+00	7.14E-07
Transformation, from dump site, slag compartment	Raw	m2	0.00E+00	0.00E+00	3.18E-12	0.00E+00	2.86E-07
Transformation, from forest	Raw	m2	0.00E+00	0.00E+00	2.10E-10	0.00E+00	8.63E-05
Transformation, from forest, extensive	Raw	m2	0.00E+00	0.00E+00	3.05E-08	0.00E+00	5.63E-04
Transformation, from forest, intensive, clear-cutting	Raw	m2	0.00E+00	0.00E+00	2.18E-10	0.00E+00	6.94E-05
Transformation, from industrial area	Raw	m2	0.00E+00	0.00E+00	1.77E-09	0.00E+00	2.02E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Transformation, from industrial area, benthos	Raw	m2	0.00E+00	0.00E+00	2.32E-15	0.00E+00	1.50E-11
Transformation, from industrial area, built up	Raw	m2	0.00E+00	0.00E+00	4.07E-12	0.00E+00	3.02E-08
Transformation, from industrial area, vegetation	Raw	m2	0.00E+00	0.00E+00	6.95E-12	0.00E+00	5.15E-08
Transformation, from mineral extraction site	Raw	m2	0.00E+00	0.00E+00	1.45E-08	0.00E+00	6.29E-04
Transformation, from pasture and meadow	Raw	m2	0.00E+00	0.00E+00	8.17E-09	0.00E+00	4.85E-04
Transformation, from pasture and meadow, intensive	Raw	m2	0.00E+00	0.00E+00	1.15E-11	0.00E+00	1.14E-07
Transformation, from sea and ocean	Raw	m2	0.00E+00	0.00E+00	2.76E-11	0.00E+00	1.75E-07
Transformation, from shrub land, sclerophyllous	Raw	m2	0.00E+00	0.00E+00	7.29E-09	0.00E+00	2.12E-04
Transformation, from tropical rain forest	Raw	m2	0.00E+00	0.00E+00	2.18E-10	0.00E+00	6.94E-05
Transformation, from unknown	Raw	m2	0.00E+00	0.00E+00	4.68E-08	0.00E+00	8.61E-04
Transformation, to arable	Raw	m2	0.00E+00	0.00E+00	1.34E-08	0.00E+00	2.67E-04
Transformation, to arable, non-irrigated	Raw	m2	0.00E+00	0.00E+00	1.41E-08	0.00E+00	1.40E-04
Transformation, to arable, non-irrigated, fallow	Raw	m2	0.00E+00	0.00E+00	1.65E-11	0.00E+00	1.46E-06
Transformation, to dump site	Raw	m2	0.00E+00	0.00E+00	1.07E-08	0.00E+00	2.37E-04
Transformation, to dump site, benthos	Raw	m2	0.00E+00	0.00E+00	2.75E-11	0.00E+00	1.75E-07
Transformation, to dump site, inert material landfill	Raw	m2	0.00E+00	0.00E+00	2.79E-12	0.00E+00	5.53E-05
Transformation, to dump site, residual material landfill	Raw	m2	0.00E+00	0.00E+00	2.42E-09	0.00E+00	7.15E-05
Transformation, to dump site, sanitary landfill	Raw	m2	0.00E+00	0.00E+00	1.29E-10	0.00E+00	7.14E-07
Transformation, to dump site, slag compartment	Raw	m2	0.00E+00	0.00E+00	3.18E-12	0.00E+00	2.86E-07
Transformation, to forest	Raw	m2	0.00E+00	0.00E+00	3.65E-09	0.00E+00	1.75E-04
Transformation, to forest, intensive	Raw	m2	0.00E+00	0.00E+00	1.73E-09	0.00E+00	4.36E-05
Transformation, to forest, intensive, clear-cutting	Raw	m2	0.00E+00	0.00E+00	2.18E-10	0.00E+00	6.94E-05
Transformation, to forest, intensive, normal	Raw	m2	0.00E+00	0.00E+00	2.84E-08	0.00E+00	5.13E-04
Transformation, to forest, intensive, short-cycle	Raw	m2	0.00E+00	0.00E+00	2.18E-10	0.00E+00	6.94E-05
Transformation, to heterogeneous, agricultural	Raw	m2	0.00E+00	0.00E+00	2.50E-12	0.00E+00	1.53E-08
Transformation, to industrial area	Raw	m2	0.00E+00	0.00E+00	4.11E-09	0.00E+00	8.62E-05
Transformation, to industrial area, benthos	Raw	m2	0.00E+00	0.00E+00	4.02E-14	0.00E+00	2.29E-10
Transformation, to industrial area, built up	Raw	m2	0.00E+00	0.00E+00	2.36E-10	0.00E+00	3.82E-06
Transformation, to industrial area, vegetation	Raw	m2	0.00E+00	0.00E+00	5.85E-12	0.00E+00	4.33E-08
Transformation, to mineral extraction site	Raw	m2	0.00E+00	0.00E+00	1.97E-08	0.00E+00	6.99E-04
Transformation, to pasture and meadow	Raw	m2	0.00E+00	0.00E+00	4.27E-11	0.00E+00	3.12E-04
Transformation, to permanent crop, fruit, intensive	Raw	m2	0.00E+00	0.00E+00	1.20E-10	0.00E+00	2.58E-07
Transformation, to sea and ocean	Raw	m2	0.00E+00	0.00E+00	2.32E-15	0.00E+00	1.50E-11
Transformation, to shrub land, sclerophyllous	Raw	m2	0.00E+00	0.00E+00	2.56E-09	0.00E+00	1.28E-04
Transformation, to traffic area, rail embankment	Raw	m2	0.00E+00	0.00E+00	2.67E-13	0.00E+00	1.22E-09
Transformation, to traffic area, rail network	Raw	m2	0.00E+00	0.00E+00	2.93E-13	0.00E+00	1.36E-09
Transformation, to traffic area, rail/road embankment	Raw	m2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-11
Transformation, to traffic area, road embankment	Raw	m2	0.00E+00	0.00E+00	3.09E-10	0.00E+00	5.78E-06
Transformation, to traffic area, road network	Raw	m2	0.00E+00	0.00E+00	3.91E-12	0.00E+00	2.35E-08
Transformation, to unknown	Raw	m2	0.00E+00	0.00E+00	1.83E-09	0.00E+00	2.12E-05
Transformation, to urban, discontinuously built	Raw	m2	0.00E+00	0.00E+00	2.80E-16	0.00E+00	1.57E-12
Transformation, to water bodies, artificial	Raw	m2	0.00E+00	0.00E+00	1.33E-08	0.00E+00	2.05E-04
Transformation, to water courses, artificial	Raw	m2	0.00E+00	0.00E+00	9.39E-09	0.00E+00	1.66E-04

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Ulexite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E-12
Ulexite, in ground	Raw	kg	0.00E+00	0.00E+00	3.44E-14	0.00E+00	1.91E-10
Uranium	Raw	kg	0.00E+00	3.25E-08	2.58E-11	4.30E-08	2.38E-04
Uranium oxide, 332 GJ per kg, in ore	Raw	kg	5.08E-05	4.72E-03	4.54E-05	9.16E-03	2.43E-03
Uranium, 2291 GJ per kg	Raw	kg	0.00E+00	2.72E-06	2.36E-10	3.08E-06	2.41E-07
Uranium, in ground	Raw	kg	0.00E+00	0.00E+00	1.30E-08	0.00E+00	2.75E-04
Vermiculite	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E-13
Vermiculite, in ground	Raw	kg	0.00E+00	0.00E+00	2.28E-14	0.00E+00	8.46E-11
Volume occupied, final repository for low-active radioactive waste	Raw	m3	0.00E+00	0.00E+00	2.69E-11	0.00E+00	5.32E-07
Volume occupied, final repository for radioactive waste	Raw	m3	0.00E+00	0.00E+00	6.79E-12	0.00E+00	1.33E-07
Volume occupied, reservoir	Raw	m3y	0.00E+00	0.00E+00	2.96E-05	0.00E+00	3.47E-01
Volume occupied, underground deposit	Raw	m3	0.00E+00	0.00E+00	2.19E-10	0.00E+00	9.78E-06
Water, consumptive use, unspecified origin/m3	Raw	kg	0.00E+00	1.91E-01	0.00E+00	0.00E+00	0.00E+00
Water, cooling, unspecified natural origin/kg	Raw	kg	0.00E+00	6.72E-01	2.56E-07	1.68E+00	0.00E+00
Water, cooling, unspecified natural origin/m3	Raw	m3	0.00E+00	6.35E-01	1.48E-02	2.04E+00	3.79E+00
Water, lake	Raw	m3	0.00E+00	0.00E+00	2.95E-08	0.00E+00	1.22E-03
Water, process, surface	Raw	kg	0.00E+00	2.32E+02	1.59E+01	7.59E+02	0.00E+00
Water, process, unspecified natural origin/kg	Raw	kg	0.00E+00	1.25E+01	4.39E-02	3.11E+01	0.00E+00
Water, process, unspecified natural origin/m3	Raw	m3	0.00E+00	1.90E-05	1.34E-05	1.69E-04	0.00E+00
Water, process, well	Raw	kg	0.00E+00	3.46E+02	1.10E+01	3.32E+02	0.00E+00
Water, process, well, in ground	Raw	kg	0.00E+00	0.00E+00	6.58E-03	0.00E+00	6.53E+00
Water, river	Raw	m3	0.00E+00	1.52E-05	7.38E-06	2.00E-05	1.33E-01
Water, salt, ocean	Raw	m3	0.00E+00	0.00E+00	7.86E-06	0.00E+00	2.36E-02
Water, salt, sole	Raw	m3	0.00E+00	0.00E+00	1.64E-06	0.00E+00	1.46E+02
Water, turbine use, unspecified natural origin	Raw	m3	0.00E+00	0.00E+00	8.03E-03	0.00E+00	1.42E+02
Water, unspecified natural origin, RoW	Raw	m3	0.00E+00	1.06E-04	2.56E-05	1.07E-03	0.00E+00
Water, unspecified natural origin, US	Raw	m3	0.00E+00	2.83E-04	7.38E-04	1.91E+00	0.00E+00
Water, unspecified natural origin/kg	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E+01
Water, unspecified natural origin/m3	Raw	m3	4.22E-04	2.88E-01	4.48E-05	7.19E-01	1.08E+00
Water, well, in ground	Raw	m3	0.00E+00	8.78E-05	1.95E-06	1.16E-04	3.17E-02
Water, well, in ground, US	Raw	m3	0.00E+00	5.30E-05	1.38E-04	3.57E-01	0.00E+00
Wood and wood waste, 20.9 MJ per kg, ovendry basis	Raw	kg	0.00E+00	1.22E+02	4.32E-02	7.38E+02	0.00E+00
Wood and wood waste, 20.9 MJ/kg,ovendry (burned at kiln)	Raw	kg	0.00E+00	1.89E+00	4.91E+00	2.49E+00	0.00E+00
Wood and wood waste, 20.9 MJ/kg,ovendry (burned at sawmill boiler)	Raw	kg	0.00E+00	3.14E+00	8.18E+00	4.14E+00	0.00E+00
Wood and wood waste, 9.5 MJ per kg	Raw	kg	0.00E+00	3.41E-01	2.23E-03	4.50E-01	1.01E+01
Wood for fiber, feedstock	Raw	kg	0.00E+00	7.32E-01	4.79E-03	9.67E-01	2.16E+01
Wood into sawmill logyard	Raw	m3	0.00E+00	4.69E-02	1.22E-01	6.19E-02	0.00E+00
Wood, feedstock	Raw	kg	0.00E+00	7.78E-01	6.17E-04	1.03E+00	0.00E+00
Wood, hard, NE-NC, standing	Raw	m3	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Wood, hard, standing	Raw	m3	0.00E+00	0.00E+00	6.67E-09	0.00E+00	1.17E-04
Wood, primary forest, standing	Raw	m3	0.00E+00	0.00E+00	2.26E-12	0.00E+00	7.18E-07
Wood, soft, standing	Raw	m3	0.00E+00	9.82E-04	2.56E-03	6.65E+00	3.12E-04
Wood, unspecified, standing/m3	Raw	m3	0.00E+00	0.00E+00	5.45E-14	0.00E+00	3.50E-07
Zinc	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E-07
Zinc, 9.0% in sulfide, Zn 5.3%, Pb, Ag, Cd, In, in ground	Raw	kg	0.00E+00	0.00E+00	6.73E-10	0.00E+00	1.46E-04
Zirconium	Raw	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.51E-13
Zirconium, 50% in zircon, 0.39% in crude ore, in ground	Raw	kg	0.00E+00	0.00E+00	1.35E-14	0.00E+00	5.83E-11
1-Butanol	Air	kg	0.00E+00	0.00E+00	6.74E-18	0.00E+00	9.60E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
1-Pentanol	Air	kg	0.00E+00	0.00E+00	6.38E-17	0.00E+00	3.91E-13
1-Pentene	Air	kg	0.00E+00	0.00E+00	4.82E-17	0.00E+00	2.96E-13
1-Propanol	Air	kg	0.00E+00	0.00E+00	4.78E-16	0.00E+00	3.19E-12
1,4-Butanediol	Air	kg	0.00E+00	0.00E+00	4.66E-17	0.00E+00	4.42E-04
2-Aminopropanol	Air	kg	0.00E+00	0.00E+00	9.58E-19	0.00E+00	5.61E-05
2-Butene, 2-methyl-	Air	kg	0.00E+00	0.00E+00	1.07E-20	0.00E+00	6.56E-17
2-Chloroacetophenone	Air	kg	2.32E-10	2.50E-09	4.72E-12	2.36E-09	8.47E-09
2-Methyl-1-propanol	Air	kg	0.00E+00	0.00E+00	1.16E-16	0.00E+00	8.57E-05
2-Methyl-4-chlorophenoxyacetic acid	Air	kg	0.00E+00	8.92E-11	7.08E-14	1.18E-10	0.00E+00
2-Nitrobenzoic acid	Air	kg	0.00E+00	0.00E+00	9.59E-19	0.00E+00	2.30E-04
2-Propanol	Air	kg	0.00E+00	0.00E+00	6.11E-14	0.00E+00	1.84E-04
2,4-D	Air	kg	0.00E+00	4.78E-09	3.79E-12	6.31E-09	0.00E+00
5-methyl Chrysene	Air	kg	2.12E-11	1.58E-09	1.54E-11	3.09E-09	8.49E-10
Acenaphthene	Air	kg	4.92E-10	3.67E-08	3.57E-10	7.16E-08	1.97E-08
Acenaphthylene	Air	kg	2.41E-10	1.80E-08	1.75E-10	3.51E-08	9.65E-09
Acetaldehyde	Air	kg	4.58E-04	2.45E-02	5.23E-04	6.25E-02	8.24E-04
Acetic acid	Air	kg	0.00E+00	0.00E+00	8.68E-08	0.00E+00	4.69E-03
Acetochlor	Air	kg	0.00E+00	6.63E-08	5.26E-11	8.75E-08	0.00E+00
Acetone	Air	kg	0.00E+00	7.33E-03	1.10E-08	0.00E+00	3.00E-04
Acetonitrile	Air	kg	0.00E+00	0.00E+00	2.37E-13	0.00E+00	7.54E-08
Acetophenone	Air	kg	4.98E-10	5.37E-09	1.01E-11	5.05E-09	1.81E-08
Acrolein	Air	kg	5.55E-05	7.23E-03	8.32E-05	5.77E-03	1.90E-05
Acrylic acid	Air	kg	0.00E+00	0.00E+00	1.58E-16	0.00E+00	6.95E-13
Actinides, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	2.18E-07	0.00E+00	3.51E-02
Aerosols, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	5.72E-06	0.00E+00	1.11E-01
Alachlor	Air	kg	0.00E+00	6.52E-09	5.17E-12	8.61E-09	0.00E+00
Aldehydes, unspecified	Air	kg	1.40E-03	1.08E-03	1.92E-05	3.46E-03	2.05E-03
Aluminium	Air	kg	0.00E+00	0.00E+00	8.63E-08	0.00E+00	8.35E-04
Ammonia	Air	kg	3.98E-03	7.38E-03	2.86E-04	1.21E-02	7.22E-03
Ammonium carbonate	Air	kg	0.00E+00	0.00E+00	1.26E-13	0.00E+00	1.27E-07
Ammonium chloride	Air	kg	2.70E-06	2.50E-04	2.41E-06	4.86E-04	1.29E-04
Aniline	Air	kg	0.00E+00	0.00E+00	3.71E-16	0.00E+00	3.50E-04
Anthracene	Air	kg	2.03E-10	1.51E-08	1.47E-10	2.95E-08	8.10E-09
Anthranilic acid	Air	kg	0.00E+00	0.00E+00	7.01E-19	0.00E+00	1.06E-04
Antimony	Air	kg	1.74E-08	1.34E-06	1.26E-08	2.56E-06	8.56E-07
Antimony-124	Air	Bq	0.00E+00	0.00E+00	2.57E-11	0.00E+00	9.46E-07
Antimony-125	Air	Bq	0.00E+00	0.00E+00	2.68E-10	0.00E+00	9.88E-06
Argon-41	Air	Bq	0.00E+00	0.00E+00	3.05E-03	0.00E+00	5.81E+01
Aromatics	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-06
Arsenic	Air	kg	5.38E-07	3.08E-05	2.94E-07	5.97E-05	1.95E-05
Arsine	Air	kg	0.00E+00	0.00E+00	1.84E-21	0.00E+00	8.10E-18
Ash	Air	kg	0.00E+00	1.21E-04	0.00E+00	2.64E-05	0.00E+00
Atrazine	Air	kg	0.00E+00	1.29E-07	1.02E-10	1.70E-07	0.00E+00
Barium	Air	kg	0.00E+00	7.08E-03	7.23E-09	9.86E-07	2.87E-05
Barium-140	Air	Bq	0.00E+00	0.00E+00	1.74E-08	0.00E+00	6.42E-04
Bentazone	Air	kg	0.00E+00	5.27E-10	4.18E-13	6.95E-10	0.00E+00
Benzal chloride	Air	kg	0.00E+00	0.00E+00	3.43E-22	0.00E+00	1.62E-14
Benzaldehyde	Air	kg	0.00E+00	0.00E+00	9.53E-14	0.00E+00	7.25E-10
Benzene	Air	kg	5.62E-04	2.04E-02	5.16E-06	4.75E-02	2.78E-02
Benzene, 1-methyl-2-nitro-	Air	kg	0.00E+00	0.00E+00	8.28E-19	0.00E+00	1.98E-04
Benzene, 1,2-dichloro-	Air	kg	0.00E+00	0.00E+00	1.23E-16	0.00E+00	2.58E-04
Benzene, chloro-	Air	kg	7.31E-10	7.87E-09	1.48E-11	7.41E-09	2.66E-08
Benzene, ethyl-	Air	kg	3.12E-09	6.96E-07	6.92E-09	1.46E-05	6.23E-06
Benzene, hexachloro-	Air	kg	0.00E+00	0.00E+00	5.42E-16	0.00E+00	4.35E-11

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Benzene, pentachloro-	Air	kg	0.00E+00	0.00E+00	9.37E-16	0.00E+00	9.90E-11
Benzo(a)anthracene	Air	kg	7.72E-11	5.75E-09	5.60E-11	1.12E-08	3.09E-09
Benzo(a)pyrene	Air	kg	3.67E-11	2.73E-09	4.65E-11	5.34E-09	3.19E-07
Benzo(b,j,k)fluoranthene	Air	kg	1.06E-10	7.91E-09	7.70E-11	1.55E-08	4.24E-09
Benzo(g,h,i)perylene	Air	kg	2.61E-11	1.94E-09	1.89E-11	3.79E-09	1.04E-09
Benzyl chloride	Air	kg	2.32E-08	2.50E-07	4.72E-10	2.36E-07	8.47E-07
Beryllium	Air	kg	2.69E-08	1.70E-06	1.55E-08	3.34E-06	9.28E-07
Biphenyl	Air	kg	1.64E-09	1.22E-07	1.19E-09	2.39E-07	6.56E-08
Boron	Air	kg	0.00E+00	0.00E+00	8.41E-09	0.00E+00	1.74E-04
Boron trifluoride	Air	kg	0.00E+00	0.00E+00	2.52E-23	0.00E+00	1.10E-19
Bromine	Air	kg	0.00E+00	0.00E+00	9.23E-10	0.00E+00	1.80E-05
Bromoform	Air	kg	1.30E-09	1.40E-08	2.63E-11	1.31E-08	4.72E-08
Bromoxynil	Air	kg	0.00E+00	1.16E-09	9.16E-13	1.52E-09	0.00E+00
BTEX (Benzene, Toluene, Ethylbenzene, and Xylene), unspecified ratio	Air	kg	2.55E-03	3.22E-02	9.18E-05	8.43E-02	2.44E-02
Butadiene	Air	kg	2.33E-05	2.10E-07	6.48E-08	5.49E-06	3.37E-06
Butane	Air	kg	0.00E+00	0.00E+00	4.03E-07	0.00E+00	4.10E-04
Butene	Air	kg	0.00E+00	0.00E+00	2.78E-09	0.00E+00	1.31E-03
Butyrolactone	Air	kg	0.00E+00	0.00E+00	9.47E-19	0.00E+00	4.16E-15
Cadmium	Air	kg	1.37E-07	6.20E-06	4.54E-08	1.24E-05	4.23E-06
Calcium	Air	kg	0.00E+00	0.00E+00	1.42E-08	0.00E+00	1.28E-04
Carbofuran	Air	kg	0.00E+00	9.87E-10	7.83E-13	1.30E-09	0.00E+00
Carbon-14	Air	Bq	0.00E+00	0.00E+00	2.32E-02	0.00E+00	4.61E+02
Carbon dioxide	Air	kg	4.29E+00	8.94E+00	6.12E-03	2.86E+00	1.86E+00
Carbon dioxide, biogenic	Air	kg	8.72E-02	1.23E+02	1.73E+01	1.22E+03	1.26E+01
Carbon dioxide, fossil	Air	kg	1.11E+02	6.22E+02	5.17E+00	1.39E+03	4.52E+02
Carbon dioxide, land transformation	Air	kg	0.00E+00	0.00E+00	7.04E-08	0.00E+00	2.31E-03
Carbon disulfide	Air	kg	4.32E-09	2.69E-07	6.04E-07	3.37E-07	5.20E-06
Carbon monoxide	Air	kg	3.04E-04	1.71E-01	3.38E-05	2.41E-01	1.69E-01
Carbon monoxide, biogenic	Air	kg	0.00E+00	1.22E+00	3.11E-02	3.00E+00	1.39E-04
Carbon monoxide, fossil	Air	kg	1.43E+00	6.08E-01	1.22E-02	1.91E+00	1.12E+00
Cerium-141	Air	Bq	0.00E+00	0.00E+00	4.23E-09	0.00E+00	1.56E-04
Cesium-134	Air	Bq	0.00E+00	0.00E+00	2.02E-10	0.00E+00	7.46E-06
Cesium-137	Air	Bq	0.00E+00	0.00E+00	3.59E-09	0.00E+00	1.32E-04
Chloramine	Air	kg	0.00E+00	0.00E+00	2.25E-16	0.00E+00	1.43E-04
Chloride	Air	kg	6.68E-11	2.32E-09	1.82E-11	4.16E-09	1.16E-09
Chlorinated fluorocarbons and hydrochlorinated fluorocarbons, unspecified	Air	kg	0.00E+00	4.82E-07	6.02E-10	1.10E-06	2.74E-06
Chlorine	Air	kg	0.00E+00	2.26E-05	1.14E-08	1.67E-05	4.14E-02
Chloroacetic acid	Air	kg	0.00E+00	0.00E+00	5.38E-16	0.00E+00	7.24E-04
Chloroform	Air	kg	1.96E-09	2.11E-08	4.01E-11	1.99E-08	2.46E-03
Chlorosilane, trimethyl-	Air	kg	0.00E+00	0.00E+00	2.34E-17	0.00E+00	4.35E-13
Chlorosulfonic acid	Air	kg	0.00E+00	0.00E+00	6.81E-18	0.00E+00	1.09E-04
Chlorpyrifos	Air	kg	0.00E+00	7.60E-09	6.03E-12	1.00E-08	0.00E+00
Chromium	Air	kg	3.92E-07	2.18E-05	1.93E-07	4.33E-05	2.16E-05
Chromium-51	Air	Bq	0.00E+00	0.00E+00	2.71E-10	0.00E+00	9.98E-06
Chromium VI	Air	kg	7.62E-08	5.68E-06	5.53E-08	1.11E-05	3.30E-06
Chrysene	Air	kg	9.65E-11	7.19E-09	7.00E-11	1.40E-08	3.86E-09
Cobalt	Air	kg	7.06E-07	9.23E-06	9.18E-08	1.76E-05	7.59E-06
Cobalt-58	Air	Bq	0.00E+00	0.00E+00	3.77E-10	0.00E+00	1.39E-05
Cobalt-60	Air	Bq	0.00E+00	0.00E+00	3.33E-09	0.00E+00	1.23E-04
Copper	Air	kg	7.11E-09	1.29E-06	7.08E-09	6.49E-07	3.20E-05
Cumene	Air	kg	1.76E-10	2.74E-02	1.06E-08	6.86E-02	2.64E-02
Cyanazine	Air	kg	0.00E+00	1.14E-09	9.03E-13	1.50E-09	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Cyanide	Air	kg	8.30E-08	8.95E-07	1.70E-09	8.42E-07	1.42E-04
Cyanoacetic acid	Air	kg	0.00E+00	0.00E+00	5.57E-18	0.00E+00	8.94E-05
Dicamba	Air	kg	0.00E+00	6.71E-09	5.32E-12	8.86E-09	0.00E+00
Diethylamine	Air	kg	0.00E+00	0.00E+00	1.65E-16	0.00E+00	2.82E-04
Dimethenamid	Air	kg	0.00E+00	1.58E-08	1.26E-11	2.09E-08	0.00E+00
Dimethyl ether	Air	kg	0.00E+00	2.19E-04	1.44E-07	4.96E-04	2.20E-06
Dimethyl malonate	Air	kg	0.00E+00	0.00E+00	6.99E-18	0.00E+00	1.12E-04
Dinitrogen monoxide	Air	kg	2.54E-02	4.66E-03	6.25E-05	1.60E-02	1.50E-02
Dioxin, 2,3,7,8 Tetrachlorodibenzo-p-	Air	kg	2.29E-12	5.16E-09	4.64E-12	6.85E-09	3.60E-11
Dioxins (unspec.)	Air	kg	0.00E+00	1.23E-14	3.21E-14	1.63E-14	0.00E+00
Dipropylamine	Air	kg	0.00E+00	0.00E+00	1.05E-16	0.00E+00	1.26E-04
Dipropylthiocarbamic acid S-ethyl ester	Air	kg	0.00E+00	1.09E-08	8.61E-12	1.43E-08	0.00E+00
Ethane	Air	kg	0.00E+00	0.00E+00	1.46E-06	0.00E+00	1.31E-03
Ethane, 1,1-difluoro-, HFC-152a	Air	kg	0.00E+00	0.00E+00	8.60E-17	0.00E+00	5.05E-13
Ethane, 1,1,1-trichloro-, HCFC-140	Air	kg	3.89E-09	9.48E-09	5.62E-11	1.44E-08	2.90E-08
Ethane, 1,1,1,2-tetrafluoro-, HFC-134a	Air	kg	0.00E+00	7.68E-07	7.78E-10	0.00E+00	7.57E-07
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	Air	kg	0.00E+00	0.00E+00	7.51E-18	0.00E+00	3.30E-14
Ethane, 1,2-dibromo-	Air	kg	3.99E-11	3.57E-08	8.78E-13	4.05E-10	1.45E-09
Ethane, 1,2-dichloro-	Air	kg	1.33E-09	1.43E-08	1.32E-10	1.35E-08	4.91E-04
Ethane, 1,2-dichloro-1,1,2-trifluoro-, HCFC-123	Air	kg	0.00E+00	7.68E-07	0.00E+00	0.00E+00	0.00E+00
Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	Air	kg	0.00E+00	0.00E+00	9.54E-12	0.00E+00	1.94E-07
Ethane, chloro-	Air	kg	1.39E-09	1.50E-08	2.83E-11	1.41E-08	5.08E-08
Ethane, hexafluoro-, HFC-116	Air	kg	0.00E+00	0.00E+00	7.21E-13	0.00E+00	2.45E-07
Ethanol	Air	kg	0.00E+00	0.00E+00	2.20E-08	0.00E+00	5.71E-04
Ethene	Air	kg	0.00E+00	0.00E+00	6.02E-09	0.00E+00	1.19E-03
Ethene, chloro-	Air	kg	0.00E+00	0.00E+00	5.11E-11	0.00E+00	2.70E-07
Ethene, tetrachloro-	Air	kg	4.93E-08	3.14E-06	3.04E-08	6.14E-06	1.69E-06
Ethene, trichloro-	Air	kg	0.00E+00	2.15E-13	4.17E-14	2.84E-13	6.34E-12
Ethyl acetate	Air	kg	0.00E+00	0.00E+00	2.84E-13	0.00E+00	2.32E-06
Ethyl cellulose	Air	kg	0.00E+00	0.00E+00	5.74E-16	0.00E+00	2.52E-12
Ethylamine	Air	kg	0.00E+00	0.00E+00	7.41E-17	0.00E+00	2.61E-04
Ethylene diamine	Air	kg	0.00E+00	0.00E+00	1.55E-15	0.00E+00	9.23E-12
Ethylene oxide	Air	kg	0.00E+00	6.26E-09	4.42E-09	5.55E-08	5.06E-06
Ethyne	Air	kg	0.00E+00	0.00E+00	6.79E-11	0.00E+00	4.83E-04
Fluoranthene	Air	kg	6.85E-10	5.11E-08	4.97E-10	9.97E-08	2.74E-08
Fluorene	Air	kg	8.78E-10	6.54E-08	6.37E-10	1.28E-07	3.51E-08
Fluoride	Air	kg	5.00E-05	2.16E-05	8.43E-08	2.60E-05	5.69E-05
Fluorine	Air	kg	0.00E+00	0.00E+00	6.70E-10	0.00E+00	1.33E-05
Fluosilicic acid	Air	kg	0.00E+00	0.00E+00	8.42E-13	0.00E+00	2.86E-07
Formaldehyde	Air	kg	7.11E-04	5.74E-02	7.17E-04	7.60E-02	5.60E-03
Formamide	Air	kg	0.00E+00	0.00E+00	1.17E-16	0.00E+00	7.16E-13
Formic acid	Air	kg	0.00E+00	0.00E+00	1.59E-12	0.00E+00	5.04E-07
Furan	Air	kg	4.25E-12	3.48E-10	3.87E-12	6.87E-10	1.43E-07
Glyphosate	Air	kg	0.00E+00	1.42E-08	1.13E-11	1.88E-08	0.00E+00
HAPs	Air	kg	0.00E+00	4.22E-04	5.16E-05	4.25E-03	0.00E+00
Heat, waste	Air	MJ	0.00E+00	2.90E+01	5.21E-01	7.43E+01	8.20E+02
Helium	Air	kg	0.00E+00	0.00E+00	5.21E-09	0.00E+00	7.14E-06
Heptane	Air	kg	0.00E+00	0.00E+00	2.75E-08	0.00E+00	3.66E-05
Hexane	Air	kg	2.22E-09	5.37E-07	1.40E-06	7.00E-07	1.28E-04
Hydrazine, methyl-	Air	kg	5.65E-09	6.07E-08	1.15E-10	5.72E-08	2.06E-07
Hydrocarbons, aliphatic, alkanes, cyclic	Air	kg	0.00E+00	0.00E+00	2.51E-12	0.00E+00	1.50E-05
Hydrocarbons, aliphatic, alkanes, unspecified	Air	kg	0.00E+00	0.00E+00	1.33E-07	0.00E+00	5.93E-03

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Hydrocarbons, aliphatic, unsaturated	Air	kg	0.00E+00	0.00E+00	4.20E-09	0.00E+00	1.55E-04
Hydrocarbons, aromatic	Air	kg	0.00E+00	0.00E+00	5.51E-08	0.00E+00	1.76E-04
Hydrocarbons, chlorinated	Air	kg	0.00E+00	0.00E+00	1.03E-10	0.00E+00	2.37E-04
Hydrocarbons, unspecified	Air	kg	1.56E-05	1.45E-03	1.39E-05	2.81E-03	3.03E-03
Hydrogen	Air	kg	0.00E+00	2.94E-05	6.11E-09	3.63E-05	1.29E-02
Hydrogen-3, Tritium	Air	Bq	0.00E+00	0.00E+00	1.35E-01	0.00E+00	2.62E+03
Hydrogen chloride	Air	kg	1.22E-03	8.67E-02	8.55E-04	1.70E-01	4.84E-02
Hydrogen fluoride	Air	kg	1.43E-04	1.08E-02	1.05E-04	2.11E-02	6.03E-03
Hydrogen peroxide	Air	kg	0.00E+00	0.00E+00	4.25E-16	0.00E+00	1.87E-12
Hydrogen sulfide	Air	kg	2.16E-12	7.51E-11	2.11E-07	1.34E-10	2.54E-04
Indeno(1,2,3-cd)pyrene	Air	kg	5.89E-11	4.39E-09	4.27E-11	8.57E-09	2.35E-09
Iodine	Air	kg	0.00E+00	0.00E+00	4.91E-10	0.00E+00	9.72E-06
Iodine-129	Air	Bq	0.00E+00	0.00E+00	2.36E-05	0.00E+00	4.59E-01
Iodine-131	Air	Bq	0.00E+00	0.00E+00	1.21E-03	0.00E+00	2.29E+01
Iodine-133	Air	Bq	0.00E+00	0.00E+00	4.79E-08	0.00E+00	5.38E-03
Iodine-135	Air	Bq	0.00E+00	0.00E+00	5.88E-08	0.00E+00	1.00E-02
Iron	Air	kg	0.00E+00	7.46E-07	3.05E-08	9.85E-07	3.71E-04
Isocyanic acid	Air	kg	0.00E+00	0.00E+00	2.23E-05	0.00E+00	1.06E-11
Isophorone	Air	kg	1.93E-08	2.08E-07	3.91E-10	1.95E-07	7.02E-07
Isoprene	Air	kg	2.19E-03	7.62E-02	5.96E-04	1.36E-01	3.82E-02
Isopropylamine	Air	kg	0.00E+00	0.00E+00	5.94E-18	0.00E+00	1.63E-04
Kerosene	Air	kg	1.29E-06	1.20E-04	1.15E-06	2.33E-04	6.18E-05
Krypton-85	Air	Bq	0.00E+00	0.00E+00	9.53E-03	0.00E+00	1.82E+02
Krypton-85m	Air	Bq	0.00E+00	0.00E+00	4.04E-04	0.00E+00	1.22E+01
Krypton-87	Air	Bq	0.00E+00	0.00E+00	1.72E-04	0.00E+00	4.26E+00
Krypton-88	Air	Bq	0.00E+00	0.00E+00	1.65E-04	0.00E+00	4.44E+00
Krypton-89	Air	Bq	0.00E+00	0.00E+00	3.90E-05	0.00E+00	1.30E+00
Lactic acid	Air	kg	0.00E+00	0.00E+00	8.22E-17	0.00E+00	9.88E-05
Lanthanum-140	Air	Bq	0.00E+00	0.00E+00	1.49E-09	0.00E+00	5.49E-05
Lead	Air	kg	6.96E-07	4.70E-05	1.96E-06	1.83E-04	3.40E-05
Lead-210	Air	Bq	0.00E+00	0.00E+00	1.31E-04	0.00E+00	4.22E+00
m-Xylene	Air	kg	0.00E+00	0.00E+00	2.70E-11	0.00E+00	4.76E-07
Magnesium	Air	kg	1.06E-05	7.91E-04	7.71E-06	1.55E-03	5.44E-04
Manganese	Air	kg	7.92E-07	4.64E-05	7.79E-06	8.48E-05	7.21E-05
Manganese-54	Air	Bq	0.00E+00	0.00E+00	1.39E-10	0.00E+00	5.11E-06
Mercaptans, unspecified	Air	kg	7.20E-06	7.75E-05	1.45E-07	7.29E-05	2.62E-04
Mercury	Air	kg	1.46E-07	9.45E-06	9.28E-08	1.67E-05	1.42E-05
Metals, unspecified	Air	kg	2.48E-13	1.30E-04	1.04E-07	1.72E-04	4.70E-10
Methacrylic acid	Air	kg	0.00E+00	3.22E-09	0.00E+00	0.00E+00	0.00E+00
Methane	Air	kg	2.21E-01	1.80E+00	1.04E-02	4.41E+00	1.35E+00
Methane, biogenic	Air	kg	0.00E+00	1.50E-03	1.83E-04	1.51E-02	1.40E-03
Methane, bromo-, Halon 1001	Air	kg	5.31E-09	5.73E-08	1.08E-10	5.39E-08	1.94E-07
Methane, bromochlorodifluoro-, Halon 1211	Air	kg	0.00E+00	0.00E+00	4.43E-10	0.00E+00	3.21E-07
Methane, bromotrifluoro-, Halon 1301	Air	kg	0.00E+00	0.00E+00	7.22E-11	0.00E+00	9.66E-08
Methane, chlorodifluoro-, HCFC-22	Air	kg	0.00E+00	9.91E-06	1.52E-09	4.62E-13	1.22E-06
Methane, chlorotrifluoro-, CFC-13	Air	kg	0.00E+00	1.81E-07	3.49E-13	4.38E-12	0.00E+00
Methane, dichloro-, HCC-30	Air	kg	8.03E-07	2.49E-05	2.23E-07	4.79E-05	2.21E-04
Methane, dichlorodifluoro-, CFC-12	Air	kg	3.99E-09	2.87E-09	5.82E-11	9.48E-09	4.61E-06
Methane, dichlorofluoro-, HCFC-21	Air	kg	0.00E+00	0.00E+00	5.01E-20	0.00E+00	2.22E-16
Methane, fossil	Air	kg	2.47E-02	4.18E-01	7.46E-04	4.96E-01	3.23E-01
Methane, monochloro-, R-40	Air	kg	1.76E-08	1.90E-07	3.58E-10	1.78E-07	6.50E-07
Methane, tetrachloro-, CFC-10	Air	kg	3.99E-10	2.24E-06	2.56E-11	1.03E-06	2.50E-04
Methane, tetrafluoro-, CFC-14	Air	kg	0.00E+00	0.00E+00	6.49E-12	0.00E+00	2.20E-06
Methane, trichlorofluoro-, CFC-11	Air	kg	0.00E+00	0.00E+00	8.14E-20	0.00E+00	3.61E-16

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Methane, trifluoro-, HFC-23	Air	kg	0.00E+00	0.00E+00	1.60E-17	0.00E+00	7.07E-14
Methanesulfonic acid	Air	kg	0.00E+00	0.00E+00	5.63E-18	0.00E+00	9.04E-05
Methanol	Air	kg	0.00E+00	1.12E-01	3.29E-03	4.12E-01	4.36E-02
Methyl acetate	Air	kg	0.00E+00	0.00E+00	2.22E-19	0.00E+00	5.32E-05
Methyl acrylate	Air	kg	0.00E+00	0.00E+00	1.79E-16	0.00E+00	7.89E-13
Methyl amine	Air	kg	0.00E+00	0.00E+00	2.58E-17	0.00E+00	2.77E-05
Methyl borate	Air	kg	0.00E+00	0.00E+00	2.37E-17	0.00E+00	9.19E-06
Methyl ethyl ketone	Air	kg	1.30E-08	1.40E-07	2.63E-10	1.31E-07	4.73E-07
Methyl formate	Air	kg	0.00E+00	0.00E+00	5.92E-08	0.00E+00	1.92E-13
Methyl lactate	Air	kg	0.00E+00	0.00E+00	9.02E-17	0.00E+00	1.08E-04
Methyl methacrylate	Air	kg	6.64E-10	3.94E-09	1.35E-11	6.73E-09	2.42E-08
Methylamine	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-17
Methylene diisocyanate	Air	kg	0.00E+00	3.39E-04	0.00E+00	0.00E+00	0.00E+00
Metolachlor	Air	kg	0.00E+00	5.24E-08	4.15E-11	6.91E-08	0.00E+00
Metribuzin	Air	kg	0.00E+00	2.43E-10	1.93E-13	3.20E-10	0.00E+00
Molybdenum	Air	kg	0.00E+00	0.00E+00	1.22E-09	0.00E+00	1.11E-06
Monoethanolamine	Air	kg	0.00E+00	0.00E+00	1.55E-12	0.00E+00	3.07E-03
N-Nitrodimethylamine	Air	kg	0.00E+00	6.32E-03	9.30E-15	1.38E-03	1.42E-12
Naphthalene	Air	kg	1.50E-07	7.05E-06	4.93E-07	4.56E-05	1.35E-05
Nickel	Air	kg	8.86E-06	5.07E-05	4.74E-07	9.34E-05	7.15E-05
Nickel compounds	Air	kg	0.00E+00	9.91E-06	0.00E+00	0.00E+00	0.00E+00
Niobium-95	Air	Bq	0.00E+00	0.00E+00	1.65E-11	0.00E+00	6.07E-07
Nitrate	Air	kg	0.00E+00	0.00E+00	1.28E-10	0.00E+00	2.48E-06
Nitric oxide	Air	kg	0.00E+00	1.88E-04	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	Air	kg	0.00E+00	0.00E+00	4.96E-16	0.00E+00	9.40E-04
Nitrogen oxides	Air	kg	1.95E+00	2.56E+00	3.38E-02	4.88E+00	1.69E+00
Nitrogen, total	Air	kg	9.70E-04	6.41E-09	5.08E-12	8.45E-09	0.00E+00
Nitrous oxide	Air	kg	0.00E+00	9.77E-06	0.00E+00	0.00E+00	6.71E-02
NMVOC, non-methane volatile organic compounds, unspecified origin	Air	kg	6.78E-02	1.35E-01	1.12E-03	2.99E-01	1.47E-01
Noble gases, radioactive, unspecified	Air	Bq	0.00E+00	0.00E+00	2.27E+02	0.00E+00	4.41E+06
Organic acids	Air	kg	9.92E-09	9.20E-07	8.86E-09	1.79E-06	4.74E-07
Organic substances, unspecified	Air	kg	5.98E-06	5.11E-03	6.76E-05	3.55E-03	1.32E-03
Other Organic	Air	kg	0.00E+00	1.42E-05	1.74E-06	1.43E-04	0.00E+00
Ozone	Air	kg	0.00E+00	0.00E+00	8.58E-09	0.00E+00	1.60E-04
PAH, polycyclic aromatic hydrocarbons	Air	kg	9.18E-05	8.45E-07	2.80E-07	2.24E-05	2.79E-05
Paraffins	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E-18
Paraquat	Air	kg	0.00E+00	1.06E-09	8.41E-13	1.40E-09	0.00E+00
Parathion, methyl	Air	kg	0.00E+00	8.01E-10	6.35E-13	1.06E-09	0.00E+00
Particulates	Air	kg	0.00E+00	9.70E-05	1.05E-07	2.42E-04	1.01E-04
Particulates, < 10 um	Air	kg	0.00E+00	4.70E-01	3.88E-03	1.02E+00	1.04E-01
Particulates, < 2.5 um	Air	kg	0.00E+00	2.67E-01	4.86E-03	7.32E-01	1.10E-01
Particulates, > 10 um	Air	kg	0.00E+00	2.58E-03	7.77E-03	4.90E-03	1.63E-02
Particulates, > 2.5 um, and < 10um	Air	kg	5.73E-02	3.90E-02	4.96E-04	1.02E-01	4.59E-02
Particulates, unspecified	Air	kg	1.35E-02	2.54E-01	2.46E-03	8.91E-01	1.51E-01
Pendimethalin	Air	kg	0.00E+00	5.45E-09	4.32E-12	7.19E-09	0.00E+00
Pentane	Air	kg	0.00E+00	0.00E+00	4.89E-07	0.00E+00	4.54E-04
Permethrin	Air	kg	0.00E+00	4.90E-10	3.88E-13	6.46E-10	0.00E+00
PFC (perfluorocarbons)	Air	kg	0.00E+00	9.91E-05	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	Air	kg	2.61E-09	1.94E-07	1.89E-09	3.79E-07	1.04E-07
Phenol	Air	kg	5.31E-10	9.41E-03	8.24E-05	8.42E-03	9.58E-02
Phenol, 2,4-dichloro-	Air	kg	0.00E+00	0.00E+00	2.37E-17	0.00E+00	1.44E-04
Phenol, pentachloro-	Air	kg	0.00E+00	0.00E+00	6.50E-12	0.00E+00	1.24E-07
Phenols, unspecified	Air	kg	4.10E-07	3.65E-06	2.60E-08	6.98E-06	1.84E-06

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Phorate	Air	kg	0.00E+00	2.51E-10	1.99E-13	3.31E-10	0.00E+00
Phosphate	Air	kg	2.21E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phosphine	Air	kg	0.00E+00	0.00E+00	1.37E-19	0.00E+00	6.01E-16
Phosphorus	Air	kg	0.00E+00	0.00E+00	9.59E-11	0.00E+00	6.32E-05
Phthalate, diisooctyl-	Air	kg	0.00E+00	1.17E-08	0.00E+00	0.00E+00	0.00E+00
Phthalate, dioctyl-	Air	kg	2.42E-09	1.44E-08	4.93E-11	2.46E-08	8.83E-08
Platinum	Air	kg	0.00E+00	0.00E+00	3.43E-16	0.00E+00	6.67E-12
Plutonium-238	Air	Bq	0.00E+00	0.00E+00	3.22E-12	0.00E+00	6.26E-08
Plutonium-alpha	Air	Bq	0.00E+00	0.00E+00	7.37E-12	0.00E+00	1.43E-07
Polonium-210	Air	Bq	0.00E+00	0.00E+00	2.31E-04	0.00E+00	7.04E+00
Polychlorinated biphenyls	Air	kg	0.00E+00	0.00E+00	4.72E-16	0.00E+00	1.49E-11
Polycyclic organic matter, unspecified	Air	kg	0.00E+00	4.60E-07	8.88E-13	1.12E-11	0.00E+00
Potassium	Air	kg	0.00E+00	1.32E-04	8.73E-07	1.75E-04	4.07E-03
Potassium-40	Air	Bq	0.00E+00	0.00E+00	2.97E-05	0.00E+00	8.92E-01
Propanal	Air	kg	1.26E-08	8.64E-06	1.37E-05	1.77E-02	1.53E-04
Propane	Air	kg	0.00E+00	0.00E+00	6.06E-07	0.00E+00	6.72E-04
Propene	Air	kg	1.54E-03	1.01E-02	4.28E-06	2.56E-02	1.06E-02
Propionic acid	Air	kg	0.00E+00	0.00E+00	5.64E-09	0.00E+00	4.55E-04
Propylamine	Air	kg	0.00E+00	0.00E+00	3.70E-17	0.00E+00	2.27E-13
Propylene glycol	Air	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E-03
Propylene oxide	Air	kg	0.00E+00	2.78E-07	3.14E-09	1.32E-05	7.74E-05
Protactinium-234	Air	Bq	0.00E+00	0.00E+00	3.20E-06	0.00E+00	6.53E-02
Pyrene	Air	kg	3.18E-10	2.37E-08	2.31E-10	4.64E-08	1.27E-08
Radioactive species, other beta emitters	Air	Bq	0.00E+00	0.00E+00	7.37E-06	0.00E+00	1.45E-01
Radioactive species, unspecified	Air	Bq	5.28E+04	4.05E+06	3.96E+04	7.93E+06	2.12E+06
Radionuclides (Including Radon)	Air	kg	7.23E-05	6.71E-03	6.46E-05	1.30E-02	3.46E-03
Radium-226	Air	Bq	0.00E+00	0.00E+00	1.36E-04	0.00E+00	4.27E+00
Radium-228	Air	Bq	0.00E+00	0.00E+00	1.93E-05	0.00E+00	1.84E+00
Radon-220	Air	Bq	0.00E+00	0.00E+00	1.29E-03	0.00E+00	2.50E+01
Radon-222	Air	Bq	0.00E+00	0.00E+00	4.23E+02	0.00E+00	8.39E+06
Ruthenium-103	Air	Bq	0.00E+00	0.00E+00	3.62E-12	0.00E+00	1.33E-07
Scandium	Air	kg	0.00E+00	0.00E+00	3.89E-11	0.00E+00	7.98E-07
Selenium	Air	kg	1.34E-06	9.45E-05	9.17E-07	1.85E-04	5.25E-05
Silicon	Air	kg	0.00E+00	0.00E+00	4.55E-09	0.00E+00	4.54E-04
Silicon tetrafluoride	Air	kg	0.00E+00	0.00E+00	8.63E-14	0.00E+00	6.39E-10
Silver	Air	kg	0.00E+00	0.00E+00	2.01E-12	0.00E+00	3.21E-08
Silver-110	Air	Bq	0.00E+00	0.00E+00	3.58E-11	0.00E+00	1.32E-06
Simazine	Air	kg	0.00E+00	3.44E-09	2.73E-12	4.54E-09	0.00E+00
Sodium	Air	kg	0.00E+00	3.05E-06	7.65E-08	4.03E-06	1.44E-04
Sodium chlorate	Air	kg	0.00E+00	0.00E+00	1.23E-12	0.00E+00	7.47E-09
Sodium dichromate	Air	kg	0.00E+00	0.00E+00	1.26E-15	0.00E+00	3.49E-08
Sodium formate	Air	kg	0.00E+00	0.00E+00	5.87E-14	0.00E+00	1.53E-09
Sodium hydroxide	Air	kg	0.00E+00	0.00E+00	1.59E-15	0.00E+00	6.97E-12
Strontium	Air	kg	0.00E+00	0.00E+00	1.79E-10	0.00E+00	7.81E-06
Styrene	Air	kg	8.30E-10	8.95E-09	1.73E-11	8.42E-09	3.19E-07
Sulfate	Air	kg	0.00E+00	0.00E+00	1.46E-08	0.00E+00	1.39E-02
Sulfur	Air	kg	0.00E+00	1.61E-05	1.28E-08	2.12E-05	0.00E+00
Sulfur dioxide	Air	kg	2.30E-01	4.72E+00	2.95E-02	1.04E+01	3.47E+00
Sulfur hexafluoride	Air	kg	0.00E+00	0.00E+00	1.04E-10	0.00E+00	2.28E-06
Sulfur monoxide	Air	kg	1.02E-01	6.77E-02	5.18E-04	1.28E-01	1.24E-01
Sulfur oxides	Air	kg	1.02E-02	7.85E-02	1.18E-03	1.76E-01	9.36E-02
Sulfur trioxide	Air	kg	0.00E+00	0.00E+00	3.99E-15	0.00E+00	5.35E-03
Sulfur, total reduced	Air	kg	0.00E+00	9.44E-06	6.17E-08	1.25E-05	2.79E-04
Sulfuric acid	Air	kg	0.00E+00	9.91E-08	3.32E-16	0.00E+00	1.46E-12

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Sulfuric acid, dimethyl ester	Air	kg	1.59E-09	1.72E-08	3.24E-11	1.62E-08	5.81E-08
t-Butyl methyl ether	Air	kg	1.16E-09	1.25E-08	2.37E-11	1.18E-08	4.32E-08
t-Butylamine	Air	kg	0.00E+00	0.00E+00	1.04E-17	0.00E+00	1.57E-04
Tar	Air	kg	7.51E-11	2.61E-09	2.04E-11	4.67E-09	1.31E-09
Terbufos	Air	kg	0.00E+00	8.56E-09	6.79E-12	1.13E-08	0.00E+00
Terpenes	Air	kg	0.00E+00	0.00E+00	1.98E-13	0.00E+00	6.29E-08
Thallium	Air	kg	0.00E+00	0.00E+00	2.99E-13	0.00E+00	4.07E-08
Thorium	Air	kg	0.00E+00	0.00E+00	2.55E-13	0.00E+00	4.84E-08
Thorium-228	Air	Bq	0.00E+00	0.00E+00	6.43E-06	0.00E+00	2.50E-01
Thorium-230	Air	Bq	0.00E+00	0.00E+00	1.20E-05	0.00E+00	1.50E+00
Thorium-232	Air	Bq	0.00E+00	0.00E+00	9.40E-06	0.00E+00	2.81E-01
Thorium-234	Air	Bq	0.00E+00	0.00E+00	3.20E-06	0.00E+00	6.53E-02
Tin	Air	kg	0.00E+00	0.00E+00	2.12E-11	0.00E+00	7.25E-08
Titanium	Air	kg	0.00E+00	0.00E+00	7.57E-10	0.00E+00	2.36E-05
TOC, Total Organic Carbon	Air	kg	0.00E+00	1.53E-02	9.90E-09	1.65E-05	0.00E+00
Toluene	Air	kg	2.44E-04	2.25E-03	7.77E-07	1.15E-04	2.98E-03
Toluene, 2-chloro-	Air	kg	0.00E+00	0.00E+00	1.48E-16	0.00E+00	4.30E-04
Toluene, 2,4-dinitro-	Air	kg	9.30E-12	1.00E-10	1.89E-13	9.43E-11	3.39E-10
Trichloroethane	Air	kg	0.00E+00	7.00E-08	1.82E-07	9.23E-08	0.00E+00
Trimethylamine	Air	kg	0.00E+00	0.00E+00	3.97E-19	0.00E+00	1.07E-14
Tungsten	Air	kg	0.00E+00	0.00E+00	4.38E-12	0.00E+00	8.65E-08
Uranium	Air	kg	0.00E+00	0.00E+00	3.39E-13	0.00E+00	6.40E-08
Uranium-234	Air	Bq	0.00E+00	0.00E+00	3.74E-05	0.00E+00	2.01E+00
Uranium-235	Air	Bq	0.00E+00	0.00E+00	1.81E-06	0.00E+00	3.58E-02
Uranium-238	Air	Bq	0.00E+00	0.00E+00	6.06E-05	0.00E+00	2.69E+00
Uranium alpha	Air	Bq	0.00E+00	0.00E+00	1.74E-04	0.00E+00	3.45E+00
Vanadium	Air	kg	0.00E+00	0.00E+00	1.90E-07	0.00E+00	6.77E-05
Vinyl acetate	Air	kg	2.52E-10	2.72E-09	5.13E-12	2.56E-09	9.20E-09
VOC, volatile organic compounds	Air	kg	6.37E-02	1.08E+00	7.12E-02	3.18E+00	4.66E-01
Water	Air	kg	0.00E+00	0.00E+00	1.07E-07	0.00E+00	5.36E-04
Wood (dust)	Air	kg	0.00E+00	3.89E-02	8.04E-03	8.34E-01	0.00E+00
Xenon-131m	Air	Bq	0.00E+00	0.00E+00	7.81E-04	0.00E+00	2.01E+01
Xenon-133	Air	Bq	0.00E+00	0.00E+00	2.45E-02	0.00E+00	6.58E+02
Xenon-133m	Air	Bq	0.00E+00	0.00E+00	1.13E-04	0.00E+00	2.33E+00
Xenon-135	Air	Bq	0.00E+00	0.00E+00	1.01E-02	0.00E+00	2.68E+02
Xenon-135m	Air	Bq	0.00E+00	0.00E+00	5.91E-03	0.00E+00	1.61E+02
Xenon-137	Air	Bq	0.00E+00	0.00E+00	1.07E-04	0.00E+00	3.56E+00
Xenon-138	Air	Bq	0.00E+00	0.00E+00	9.69E-04	0.00E+00	2.98E+01
Xylene	Air	kg	1.70E-04	1.31E-03	5.01E-07	6.77E-05	1.48E-04
Zinc	Air	kg	1.79E-05	1.91E-06	9.79E-09	1.63E-06	5.56E-05
Zinc-65	Air	Bq	0.00E+00	0.00E+00	6.93E-10	0.00E+00	2.55E-05
Zirconium	Air	kg	0.00E+00	0.00E+00	9.69E-16	0.00E+00	6.06E-09
Zirconium-95	Air	Bq	0.00E+00	0.00E+00	6.77E-10	0.00E+00	2.49E-05
1-Butanol	Water	kg	0.00E+00	0.00E+00	6.28E-09	0.00E+00	4.01E-04
1-Pentanol	Water	kg	0.00E+00	0.00E+00	1.53E-16	0.00E+00	9.39E-13
1-Pentene	Water	kg	0.00E+00	0.00E+00	1.16E-16	0.00E+00	7.10E-13
1-Propanol	Water	kg	0.00E+00	0.00E+00	2.11E-16	0.00E+00	1.35E-12
1,4-Butanediol	Water	kg	0.00E+00	0.00E+00	1.86E-17	0.00E+00	1.77E-04
2-Aminopropanol	Water	kg	0.00E+00	0.00E+00	2.36E-18	0.00E+00	2.27E-04
2-Hexanone	Water	kg	1.01E-06	3.32E-06	1.83E-08	8.98E-06	3.17E-06
2-Methyl-1-propanol	Water	kg	0.00E+00	0.00E+00	2.78E-16	0.00E+00	2.06E-04
2-Methyl-2-butene	Water	kg	0.00E+00	0.00E+00	2.57E-20	0.00E+00	1.57E-16
2-Methyl-4-chlorophenoxyacetic acid	Water	kg	0.00E+00	3.82E-12	3.03E-15	5.05E-12	0.00E+00
2-Propanol	Water	kg	0.00E+00	8.88E-09	5.81E-11	1.17E-08	9.02E-04

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
2,4-D	Water	kg	0.00E+00	2.05E-10	1.63E-13	2.70E-10	0.00E+00
4-Methyl-2-pentanone	Water	kg	6.51E-07	2.12E-06	1.18E-08	5.78E-06	2.04E-06
Acenaphthene	Water	kg	0.00E+00	0.00E+00	8.18E-13	0.00E+00	1.08E-09
Acenaphthylene	Water	kg	0.00E+00	0.00E+00	5.12E-14	0.00E+00	6.78E-11
Acetaldehyde	Water	kg	0.00E+00	6.58E-09	1.47E-08	5.84E-08	6.47E-03
Acetic acid	Water	kg	0.00E+00	0.00E+00	2.62E-11	0.00E+00	2.44E-02
Acetochlor	Water	kg	0.00E+00	2.84E-09	2.25E-12	3.75E-09	0.00E+00
Acetone	Water	kg	1.55E-06	5.05E-06	2.80E-08	1.37E-05	4.93E-04
Acetonitrile	Water	kg	0.00E+00	0.00E+00	4.67E-18	0.00E+00	7.49E-05
Acetyl chloride	Water	kg	0.00E+00	0.00E+00	1.20E-16	0.00E+00	7.38E-13
Acidity, unspecified	Water	kg	0.00E+00	3.26E-04	6.78E-12	7.14E-05	4.80E-05
Acids, unspecified	Water	kg	1.40E-09	1.26E-05	3.45E-08	1.67E-05	1.74E-04
Acrylate	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-14
Acrylate, ion	Water	kg	0.00E+00	0.00E+00	3.74E-16	0.00E+00	1.62E-12
Actinides, radioactive, unspecified	Water	Bq	0.00E+00	0.00E+00	3.83E-05	0.00E+00	7.45E-01
Alachlor	Water	kg	0.00E+00	2.80E-10	2.22E-13	3.69E-10	0.00E+00
Aluminium	Water	kg	1.16E-02	1.81E-02	1.88E-04	5.00E-02	5.63E-02
Ammonia	Water	kg	2.73E-03	7.53E-03	4.99E-05	1.92E-02	7.39E-03
Ammonia, as N	Water	kg	7.05E-10	2.45E-08	8.30E-06	4.38E-08	1.23E-08
Ammonium, ion	Water	kg	5.77E-07	1.31E-04	2.17E-05	8.80E-04	9.44E-02
Aniline	Water	kg	0.00E+00	0.00E+00	8.90E-16	0.00E+00	1.42E-03
Antimony	Water	kg	7.21E-06	9.90E-06	1.05E-07	2.85E-05	7.42E-05
Antimony-122	Water	Bq	0.00E+00	0.00E+00	1.04E-08	0.00E+00	3.82E-04
Antimony-124	Water	Bq	0.00E+00	0.00E+00	6.19E-06	0.00E+00	1.27E-01
Antimony-125	Water	Bq	0.00E+00	0.00E+00	5.67E-06	0.00E+00	1.16E-01
AOX, Adsorbable Organic Halogen as Cl	Water	kg	0.00E+00	0.00E+00	1.17E-10	0.00E+00	2.60E-05
Arsenic	Water	kg	8.26E-05	1.19E-04	7.25E-07	3.23E-04	1.18E-04
Arsenic, ion	Water	kg	0.00E+00	0.00E+00	6.34E-09	0.00E+00	8.34E-05
Atrazine	Water	kg	0.00E+00	5.54E-09	4.39E-12	7.31E-09	0.00E+00
Barite	Water	kg	0.00E+00	0.00E+00	1.72E-11	0.00E+00	1.09E-07
Barium	Water	kg	1.59E-01	2.33E-01	2.32E-03	6.65E-01	2.99E-01
Barium-140	Water	Bq	0.00E+00	0.00E+00	4.54E-08	0.00E+00	1.67E-03
Bentazone	Water	kg	0.00E+00	2.26E-11	1.79E-14	2.98E-11	0.00E+00
Benzene	Water	kg	2.60E-04	4.59E-02	4.72E-06	1.15E-01	7.91E-02
Benzene, 1-methyl-4-(1-methylethyl)-	Water	kg	1.55E-08	5.05E-08	2.80E-10	1.37E-07	4.84E-08
Benzene, 1,2-dichloro-	Water	kg	0.00E+00	0.00E+00	1.27E-15	0.00E+00	2.14E-03
Benzene, chloro-	Water	kg	0.00E+00	0.00E+00	2.04E-14	0.00E+00	3.18E-02
Benzene, ethyl-	Water	kg	1.46E-05	4.78E-05	2.67E-07	1.30E-04	5.01E-05
Benzene, pentamethyl-	Water	kg	1.16E-08	3.78E-08	2.10E-10	1.03E-07	3.63E-08
Benzenes, alkylated, unspecified	Water	kg	6.32E-06	9.46E-06	9.12E-08	2.49E-05	1.15E-05
Benzo(a)pyrene	Water	kg	0.00E+00	5.56E-14	5.58E-11	7.34E-14	0.00E+00
Benzoic acid	Water	kg	1.57E-04	5.15E-04	2.84E-06	1.39E-03	4.92E-04
Beryllium	Water	kg	2.22E-06	5.58E-06	3.84E-08	1.54E-05	2.90E-05
Biphenyl	Water	kg	4.09E-07	6.13E-07	5.90E-09	1.61E-06	7.42E-07
BOD5, Biological Oxygen Demand	Water	kg	2.81E-02	5.22E-01	7.27E-04	1.30E+00	8.77E-01
Borate	Water	kg	0.00E+00	0.00E+00	1.17E-14	0.00E+00	1.29E-02
Boron	Water	kg	4.86E-04	1.59E-03	8.87E-06	4.32E-03	2.07E-03
Bromate	Water	kg	0.00E+00	0.00E+00	6.89E-11	0.00E+00	1.76E-03
Bromide	Water	kg	3.32E-02	1.08E-01	6.00E-04	2.95E-01	4.32E-01
Bromine	Water	kg	0.00E+00	0.00E+00	9.28E-08	0.00E+00	1.84E-04
Bromoxynil	Water	kg	0.00E+00	2.99E-11	2.37E-14	3.94E-11	0.00E+00
Butene	Water	kg	0.00E+00	0.00E+00	6.94E-11	0.00E+00	6.48E-04
Butyl acetate	Water	kg	0.00E+00	0.00E+00	8.16E-09	0.00E+00	2.15E-05
Butyrolactone	Water	kg	0.00E+00	0.00E+00	2.27E-18	0.00E+00	9.99E-15

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Cadmium	Water	kg	1.99E-05	1.79E-05	1.12E-07	4.84E-05	1.76E-05
Cadmium, ion	Water	kg	0.00E+00	0.00E+00	2.16E-09	0.00E+00	1.10E-05
Calcium	Water	kg	4.98E-01	1.63E+00	9.00E-03	4.42E+00	1.59E+00
Calcium, ion	Water	kg	0.00E+00	0.00E+00	2.36E-05	0.00E+00	4.62E-01
Carbofuran	Water	kg	0.00E+00	4.23E-11	3.36E-14	5.59E-11	0.00E+00
Carbon disulfide	Water	kg	0.00E+00	0.00E+00	7.38E-15	0.00E+00	4.58E-11
Carbonate	Water	kg	0.00E+00	0.00E+00	5.04E-10	0.00E+00	1.56E-01
Carboxylic acids, unspecified	Water	kg	0.00E+00	0.00E+00	5.66E-07	0.00E+00	7.47E-04
Cerium-141	Water	Bq	0.00E+00	0.00E+00	1.81E-08	0.00E+00	6.68E-04
Cerium-144	Water	Bq	0.00E+00	0.00E+00	5.52E-09	0.00E+00	2.03E-04
Cesium	Water	kg	0.00E+00	0.00E+00	1.32E-10	0.00E+00	1.74E-07
Cesium-134	Water	Bq	0.00E+00	0.00E+00	5.29E-06	0.00E+00	1.02E-01
Cesium-136	Water	Bq	0.00E+00	0.00E+00	3.22E-09	0.00E+00	1.19E-04
Cesium-137	Water	Bq	0.00E+00	0.00E+00	4.40E-03	0.00E+00	8.58E+01
CFCs, unspecified	Water	kg	0.00E+00	8.88E-09	5.81E-11	1.17E-08	2.68E-07
Chloramine	Water	kg	0.00E+00	0.00E+00	2.01E-15	0.00E+00	2.16E-03
Chlorate	Water	kg	0.00E+00	0.00E+00	5.90E-10	0.00E+00	1.34E-02
Chloride	Water	kg	5.60E+00	1.83E+01	1.01E-01	4.97E+01	2.41E+01
Chlorinated solvents, unspecified	Water	kg	0.00E+00	0.00E+00	2.31E-12	0.00E+00	9.70E-06
Chlorine	Water	kg	0.00E+00	0.00E+00	1.61E-11	0.00E+00	9.26E-07
Chloroacetic acid	Water	kg	0.00E+00	0.00E+00	1.03E-13	0.00E+00	5.81E-02
Chloroacetyl chloride	Water	kg	0.00E+00	0.00E+00	3.15E-18	0.00E+00	3.03E-04
Chloroform	Water	kg	0.00E+00	2.06E-08	8.52E-17	0.00E+00	2.66E-04
Chlorosulfonic acid	Water	kg	0.00E+00	0.00E+00	1.70E-17	0.00E+00	2.72E-04
Chlorpyrifos	Water	kg	0.00E+00	3.26E-10	2.58E-13	4.30E-10	0.00E+00
Chromate	Water	kg	0.00E+00	1.18E-12	4.49E-14	1.56E-12	3.49E-11
Chromium	Water	kg	3.56E-04	2.53E-04	4.20E-06	9.88E-04	5.09E-04
Chromium-51	Water	Bq	0.00E+00	0.00E+00	6.17E-06	0.00E+00	1.76E-01
Chromium III	Water	kg	3.35E-05	1.94E-04	5.23E-07	3.02E-04	8.66E-05
Chromium VI	Water	kg	1.23E-06	8.84E-07	2.27E-08	2.92E-06	1.56E-04
Chromium, ion	Water	kg	0.00E+00	0.00E+00	3.72E-10	0.00E+00	8.68E-06
Cobalt	Water	kg	3.43E-06	1.12E-05	8.80E-08	3.05E-05	3.58E-04
Cobalt-57	Water	Bq	0.00E+00	0.00E+00	1.02E-07	0.00E+00	3.76E-03
Cobalt-58	Water	Bq	0.00E+00	0.00E+00	4.78E-05	0.00E+00	1.16E+00
Cobalt-60	Water	Bq	0.00E+00	0.00E+00	3.72E-05	0.00E+00	9.29E-01
COD, Chemical Oxygen Demand	Water	kg	5.22E-02	6.00E-01	1.05E-03	1.49E+00	9.30E-01
Copper	Water	kg	6.94E-05	1.35E-04	1.11E-06	3.33E-04	1.39E-04
Copper, ion	Water	kg	0.00E+00	0.00E+00	2.69E-08	0.00E+00	2.89E-04
Cumene	Water	kg	0.00E+00	6.60E-02	2.55E-08	1.65E-01	6.34E-02
Cyanazine	Water	kg	0.00E+00	4.88E-11	3.87E-14	6.44E-11	0.00E+00
Cyanide	Water	kg	1.12E-08	5.73E-08	7.76E-09	9.96E-08	3.01E-04
Decane	Water	kg	4.52E-06	1.48E-05	8.16E-08	4.01E-05	1.41E-05
Detergent, oil	Water	kg	1.34E-04	4.86E-04	2.52E-06	1.32E-03	4.55E-04
Dibenzofuran	Water	kg	2.95E-08	9.60E-08	5.32E-10	2.61E-07	9.22E-08
Dibenzothiophene	Water	kg	2.51E-08	7.96E-08	4.50E-10	2.17E-07	7.70E-08
Dicamba	Water	kg	0.00E+00	2.88E-10	2.28E-13	3.80E-10	0.00E+00
Dichromate	Water	kg	0.00E+00	0.00E+00	1.42E-15	0.00E+00	1.57E-10
Diethylamine	Water	kg	0.00E+00	0.00E+00	3.96E-16	0.00E+00	6.76E-04
Dimethenamid	Water	kg	0.00E+00	6.79E-10	5.39E-13	8.96E-10	0.00E+00
Dimethylamine	Water	kg	0.00E+00	0.00E+00	2.04E-16	0.00E+00	2.98E-03
Dipropylamine	Water	kg	0.00E+00	0.00E+00	2.52E-16	0.00E+00	3.03E-04
Dipropylthiocarbamic acid S-ethyl ester	Water	kg	0.00E+00	2.81E-10	2.23E-13	3.70E-10	0.00E+00
Dissolved organics	Water	kg	0.00E+00	2.09E-04	0.00E+00	4.57E-05	0.00E+00
Disulfoton	Water	kg	0.00E+00	1.68E-11	1.33E-14	2.21E-11	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Diuron	Water	kg	0.00E+00	4.71E-12	3.73E-15	6.21E-12	0.00E+00
DOC, Dissolved Organic Carbon	Water	kg	4.31E-12	1.22E-01	8.91E-06	3.04E-01	2.06E-01
Docosane	Water	kg	1.66E-07	5.40E-07	3.00E-09	1.47E-06	5.19E-07
Dodecane	Water	kg	8.57E-06	2.81E-05	1.55E-07	7.60E-05	2.68E-05
Eicosane	Water	kg	2.36E-06	7.73E-06	4.26E-08	2.09E-05	7.38E-06
Ethane, 1,2-dichloro-	Water	kg	0.00E+00	0.00E+00	2.00E-12	0.00E+00	1.18E-03
Ethanol	Water	kg	0.00E+00	0.00E+00	1.44E-08	0.00E+00	2.06E-02
Ethene	Water	kg	0.00E+00	0.00E+00	1.39E-10	0.00E+00	1.86E-04
Ethene, chloro-	Water	kg	0.00E+00	0.00E+00	1.56E-14	0.00E+00	3.44E-08
Ethyl acetate	Water	kg	0.00E+00	0.00E+00	4.20E-16	0.00E+00	9.26E-07
Ethylamine	Water	kg	0.00E+00	0.00E+00	1.78E-16	0.00E+00	6.25E-04
Ethylene diamine	Water	kg	0.00E+00	0.00E+00	3.72E-15	0.00E+00	2.22E-11
Ethylene oxide	Water	kg	0.00E+00	0.00E+00	2.83E-15	0.00E+00	1.01E-03
Fluorene	Water	kg	0.00E+00	2.91E-08	8.69E-14	1.09E-12	0.00E+00
Fluorene, 1-methyl-	Water	kg	1.76E-08	5.75E-08	3.19E-10	1.56E-07	5.52E-08
Fluorenes, alkylated, unspecified	Water	kg	3.66E-07	5.48E-07	5.28E-09	1.45E-06	6.64E-07
Fluoride	Water	kg	1.23E-01	8.71E-04	8.55E-06	1.69E-03	1.68E-02
Fluorine	Water	kg	1.83E-07	2.68E-07	2.68E-09	7.86E-07	3.49E-07
Fluosilicic acid	Water	kg	0.00E+00	0.00E+00	1.52E-12	0.00E+00	5.15E-07
Formaldehyde	Water	kg	0.00E+00	0.00E+00	5.01E-06	0.00E+00	1.21E-02
Formamide	Water	kg	0.00E+00	0.00E+00	2.80E-16	0.00E+00	1.72E-12
Formate	Water	kg	0.00E+00	0.00E+00	3.19E-15	0.00E+00	4.83E-02
Formic acid	Water	kg	0.00E+00	0.00E+00	8.14E-17	0.00E+00	4.99E-13
Furan	Water	kg	0.00E+00	3.26E-10	2.13E-12	4.30E-10	9.61E-09
Glutaraldehyde	Water	kg	0.00E+00	0.00E+00	2.12E-15	0.00E+00	1.34E-11
Glyphosate	Water	kg	0.00E+00	6.11E-10	4.84E-13	8.06E-10	0.00E+00
Heat, waste	Water	MJ	0.00E+00	0.00E+00	2.29E-03	0.00E+00	2.58E+01
Hexadecane	Water	kg	9.35E-06	3.06E-05	1.69E-07	8.30E-05	2.93E-05
Hexanoic acid	Water	kg	3.25E-05	1.07E-04	5.88E-07	2.89E-04	1.02E-04
Hydrocarbons, aliphatic, alkanes, unspecified	Water	kg	0.00E+00	0.00E+00	1.71E-08	0.00E+00	2.26E-05
Hydrocarbons, aliphatic, unsaturated	Water	kg	0.00E+00	0.00E+00	1.58E-09	0.00E+00	2.54E-04
Hydrocarbons, aromatic	Water	kg	0.00E+00	0.00E+00	6.94E-08	0.00E+00	9.25E-05
Hydrocarbons, unspecified	Water	kg	5.39E-12	3.26E-07	2.78E-09	4.30E-07	3.69E-04
Hydrogen-3, Tritium	Water	Bq	0.00E+00	0.00E+00	1.01E+01	0.00E+00	1.96E+05
Hydrogen peroxide	Water	kg	0.00E+00	0.00E+00	2.24E-13	0.00E+00	8.79E-06
Hydrogen sulfide	Water	kg	0.00E+00	0.00E+00	3.06E-10	0.00E+00	3.83E-06
Hydroxide	Water	kg	0.00E+00	0.00E+00	1.21E-14	0.00E+00	1.20E-04
Hypochlorite	Water	kg	0.00E+00	0.00E+00	5.46E-10	0.00E+00	1.05E-05
Iodide	Water	kg	0.00E+00	0.00E+00	1.32E-08	0.00E+00	1.28E-01
Iodine-131	Water	Bq	0.00E+00	0.00E+00	1.12E-06	0.00E+00	2.38E-02
Iodine-133	Water	Bq	0.00E+00	0.00E+00	2.85E-08	0.00E+00	1.05E-03
Iron	Water	kg	2.36E-02	4.51E-02	3.99E-04	1.23E-01	5.19E-02
Iron-59	Water	Bq	0.00E+00	0.00E+00	7.83E-09	0.00E+00	2.88E-04
Iron, ion	Water	kg	0.00E+00	0.00E+00	2.94E-06	0.00E+00	4.63E-02
Isopropylamine	Water	kg	0.00E+00	0.00E+00	1.43E-17	0.00E+00	3.91E-04
Lactic acid	Water	kg	0.00E+00	0.00E+00	1.97E-16	0.00E+00	2.37E-04
Lanthanum-140	Water	Bq	0.00E+00	0.00E+00	4.83E-08	0.00E+00	1.78E-03
Lead	Water	kg	1.03E-04	1.93E-04	1.40E-06	5.29E-04	2.61E-04
Lead-210	Water	Bq	0.00E+00	0.00E+00	8.88E-05	0.00E+00	1.34E+00
Lead-210/kg	Water	kg	1.61E-14	5.28E-14	2.91E-16	1.43E-13	5.04E-14
Lithium	Water	kg	3.54E-02	4.47E-01	1.27E-03	1.16E+00	3.38E-01
Lithium, ion	Water	kg	0.00E+00	0.00E+00	5.27E-13	0.00E+00	4.31E-08
m-Xylene	Water	kg	4.69E-06	1.54E-05	8.48E-08	4.17E-05	1.47E-05
Magnesium	Water	kg	9.73E-02	3.18E-01	1.77E-03	8.64E-01	6.14E-01

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Manganese	Water	kg	1.72E-04	1.92E-03	1.73E-05	4.16E-03	1.38E-02
Manganese-54	Water	Bq	0.00E+00	0.00E+00	2.95E-06	0.00E+00	7.09E-02
Mercury	Water	kg	7.50E-07	2.50E-07	2.72E-09	6.38E-07	8.03E-06
Metallic ions, unspecified	Water	kg	6.58E-11	9.45E-09	5.36E-11	1.35E-08	3.38E-04
Methane, dichloro-, HCC-30	Water	kg	0.00E+00	0.00E+00	3.00E-14	0.00E+00	3.31E-04
Methane, monochloro-, R-40	Water	kg	6.24E-09	2.03E-08	1.13E-10	5.53E-08	1.95E-08
Methanol	Water	kg	0.00E+00	0.00E+00	1.60E-08	0.00E+00	3.04E-03
Methyl acetate	Water	kg	0.00E+00	0.00E+00	5.33E-19	0.00E+00	1.28E-04
Methyl acrylate	Water	kg	0.00E+00	0.00E+00	3.51E-15	0.00E+00	1.54E-11
Methyl amine	Water	kg	0.00E+00	0.00E+00	6.20E-17	0.00E+00	6.65E-05
Methyl ethyl ketone	Water	kg	1.25E-08	4.07E-08	2.25E-10	1.11E-07	3.90E-08
Methyl formate	Water	kg	0.00E+00	0.00E+00	2.36E-08	0.00E+00	7.68E-14
Methylamine	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-17
Metolachlor	Water	kg	0.00E+00	2.24E-09	1.78E-12	2.96E-09	0.00E+00
Metribuzin	Water	kg	0.00E+00	1.04E-11	8.25E-15	1.37E-11	0.00E+00
Molybdenum	Water	kg	3.56E-06	1.17E-05	7.02E-08	3.16E-05	9.88E-05
Molybdenum-99	Water	Bq	0.00E+00	0.00E+00	1.67E-08	0.00E+00	6.14E-04
n-Hexacosane	Water	kg	1.03E-07	3.37E-07	1.87E-09	9.18E-07	3.24E-07
Naphthalene	Water	kg	2.82E-06	9.23E-06	5.05E-08	2.50E-05	8.81E-06
Naphthalene, 2-methyl-	Water	kg	2.45E-06	8.04E-06	4.43E-08	2.18E-05	7.68E-06
Naphthalenes, alkylated, unspecified	Water	kg	1.04E-07	1.55E-07	1.49E-09	4.09E-07	1.88E-07
Nickel	Water	kg	6.01E-05	9.82E-05	6.52E-07	2.70E-04	1.05E-04
Nickel, ion	Water	kg	0.00E+00	0.00E+00	9.44E-08	0.00E+00	1.46E-03
Niobium-95	Water	Bq	0.00E+00	0.00E+00	4.80E-07	0.00E+00	1.00E-02
Nitrate	Water	kg	4.72E-13	1.06E-06	8.59E-07	1.39E-06	8.77E-02
Nitrate compounds	Water	kg	1.90E-11	8.68E-10	5.18E-12	1.18E-09	3.31E-10
Nitric acid	Water	kg	4.27E-08	1.48E-06	1.16E-08	2.65E-06	7.43E-07
Nitrite	Water	kg	0.00E+00	0.00E+00	1.75E-10	0.00E+00	3.11E-05
Nitrobenzene	Water	kg	0.00E+00	0.00E+00	1.99E-15	0.00E+00	3.77E-03
Nitrogen	Water	kg	0.00E+00	0.00E+00	8.97E-07	0.00E+00	1.13E-03
Nitrogen, organic bound	Water	kg	0.00E+00	0.00E+00	3.80E-08	0.00E+00	4.22E-05
Nitrogen, total	Water	kg	1.44E-06	1.70E-04	1.36E-06	3.07E-04	2.99E-04
o-Cresol	Water	kg	4.46E-06	1.46E-05	8.05E-08	3.96E-05	1.39E-05
o-Xylene	Water	kg	0.00E+00	6.13E-08	1.85E-13	2.32E-12	5.07E-10
Octadecane	Water	kg	2.31E-06	7.57E-06	4.18E-08	2.05E-05	7.23E-06
Oils, unspecified	Water	kg	3.47E-03	1.12E-02	7.57E-05	2.87E-02	2.31E-02
Organic substances, unspecified	Water	kg	0.00E+00	6.49E-09	1.75E-10	8.56E-09	2.35E-04
p-Cresol	Water	kg	4.81E-06	1.58E-05	8.69E-08	4.27E-05	1.50E-05
p-Xylene	Water	kg	0.00E+00	6.13E-08	1.85E-13	2.32E-12	0.00E+00
PAH, polycyclic aromatic hydrocarbons	Water	kg	0.00E+00	0.00E+00	7.67E-10	0.00E+00	1.03E-06
Paraffins	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-17
Paraquat	Water	kg	0.00E+00	4.54E-11	3.60E-14	6.00E-11	0.00E+00
Parathion, methyl	Water	kg	0.00E+00	3.43E-11	2.72E-14	4.53E-11	0.00E+00
Pendimethalin	Water	kg	0.00E+00	2.33E-10	1.85E-13	3.08E-10	0.00E+00
Permethrin	Water	kg	0.00E+00	2.10E-11	1.66E-14	2.77E-11	0.00E+00
Phenanthrene	Water	kg	3.90E-08	8.27E-08	6.13E-10	2.22E-07	8.89E-08
Phenanthrenes, alkylated, unspecified	Water	kg	4.30E-08	6.43E-08	6.19E-10	1.69E-07	7.79E-08
Phenol	Water	kg	5.44E-05	4.57E-05	7.37E-07	1.31E-04	6.13E-03
Phenol, 2,4-dimethyl-	Water	kg	4.34E-06	1.42E-05	7.84E-08	3.85E-05	1.36E-05
Phenols, unspecified	Water	kg	2.23E-05	1.95E-04	6.30E-07	5.05E-04	1.53E-04
Phorate	Water	kg	0.00E+00	6.49E-12	5.15E-15	8.57E-12	0.00E+00
Phosphate	Water	kg	9.27E-02	2.26E-04	3.25E-06	1.05E-04	5.61E-02
Phosphorus	Water	kg	0.00E+00	1.82E-05	1.52E-08	2.40E-05	1.81E-03
Phosphorus compounds, unspecified	Water	kg	0.00E+00	1.20E-07	9.54E-11	1.59E-07	0.00E+00

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Phosphorus, total	Water	kg	0.00E+00	1.07E-05	7.02E-08	1.42E-05	3.17E-04
Polonium-210	Water	Bq	0.00E+00	0.00E+00	1.06E-04	0.00E+00	1.47E+00
Potassium	Water	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-03
Potassium-40	Water	Bq	0.00E+00	0.00E+00	7.47E-05	0.00E+00	1.38E+00
Potassium, ion	Water	kg	0.00E+00	0.00E+00	6.16E-06	0.00E+00	1.47E-01
Process solvents, unspecified	Water	kg	0.00E+00	3.26E-08	2.13E-10	4.30E-08	9.61E-07
Propanal	Water	kg	0.00E+00	0.00E+00	2.22E-16	0.00E+00	1.36E-12
Propene	Water	kg	0.00E+00	2.43E-02	9.68E-09	6.07E-02	2.71E-02
Propionic acid	Water	kg	0.00E+00	0.00E+00	6.20E-17	0.00E+00	1.08E-03
Propylamine	Water	kg	0.00E+00	0.00E+00	8.87E-17	0.00E+00	5.44E-13
Propylene oxide	Water	kg	0.00E+00	0.00E+00	1.04E-11	0.00E+00	1.85E-04
Protactinium-234	Water	Bq	0.00E+00	0.00E+00	5.90E-05	0.00E+00	1.17E+00
Radioactive species, alpha emitters	Water	Bq	0.00E+00	0.00E+00	9.90E-08	0.00E+00	7.17E-01
Radioactive species, Nuclides, unspecified	Water	Bq	8.38E+01	7.78E+03	7.49E+01	1.51E+04	4.45E+03
Radium-224	Water	Bq	0.00E+00	0.00E+00	6.58E-03	0.00E+00	8.71E+00
Radium-226	Water	Bq	0.00E+00	0.00E+00	4.73E-02	0.00E+00	7.43E+02
Radium-226/kg	Water	kg	5.60E-12	1.84E-11	1.01E-13	4.97E-11	1.75E-11
Radium-228	Water	Bq	0.00E+00	0.00E+00	1.32E-02	0.00E+00	1.75E+01
Radium-228/kg	Water	kg	2.86E-14	9.39E-14	5.18E-16	2.54E-13	8.96E-14
Rubidium	Water	kg	0.00E+00	0.00E+00	1.32E-09	0.00E+00	1.74E-06
Ruthenium-103	Water	Bq	0.00E+00	0.00E+00	3.51E-09	0.00E+00	1.30E-04
Scandium	Water	kg	0.00E+00	0.00E+00	2.46E-09	0.00E+00	3.95E-05
Selenium	Water	kg	1.60E-06	2.07E-05	2.04E-07	4.19E-05	6.49E-05
Silicon	Water	kg	0.00E+00	0.00E+00	1.73E-05	0.00E+00	2.70E-01
Silver	Water	kg	3.25E-04	1.06E-03	5.87E-06	2.88E-03	1.02E-03
Silver-110	Water	Bq	0.00E+00	0.00E+00	3.44E-05	0.00E+00	8.72E-01
Silver, ion	Water	kg	0.00E+00	0.00E+00	2.26E-10	0.00E+00	8.12E-07
Simazine	Water	kg	0.00E+00	1.47E-10	1.17E-13	1.95E-10	0.00E+00
Sodium	Water	kg	1.58E+00	5.15E+00	2.85E-02	1.40E+01	5.07E+00
Sodium-24	Water	Bq	0.00E+00	0.00E+00	1.26E-07	0.00E+00	4.64E-03
Sodium formate	Water	kg	0.00E+00	0.00E+00	1.41E-13	0.00E+00	3.68E-09
Sodium, ion	Water	kg	0.00E+00	0.00E+00	4.82E-05	0.00E+00	3.85E+00
Solids, inorganic	Water	kg	1.08E-10	3.77E-09	1.64E-05	6.75E-09	3.69E-02
Solved solids	Water	kg	0.00E+00	0.00E+00	1.05E-06	0.00E+00	3.98E-03
Strontium	Water	kg	8.45E-03	2.77E-02	1.53E-04	7.50E-02	3.24E-02
Strontium-89	Water	Bq	0.00E+00	0.00E+00	6.15E-07	0.00E+00	1.66E-02
Strontium-90	Water	Bq	0.00E+00	0.00E+00	3.33E-02	0.00E+00	6.34E+02
Styrene	Water	kg	0.00E+00	3.69E-09	3.06E-13	2.11E-09	1.99E-09
Sulfate	Water	kg	1.25E-02	1.46E-01	1.33E-03	3.12E-01	2.03E+00
Sulfide	Water	kg	6.31E-06	1.26E-04	3.70E-07	1.73E-04	3.26E-03
Sulfite	Water	kg	0.00E+00	0.00E+00	1.48E-09	0.00E+00	2.86E-05
Sulfur	Water	kg	4.10E-04	1.34E-03	7.44E-06	3.64E-03	8.23E-03
Sulfuric acid	Water	kg	0.00E+00	2.85E-10	3.08E-11	3.76E-10	8.41E-09
Surfactants	Water	kg	0.00E+00	2.89E-06	8.56E-12	1.08E-10	0.00E+00
Suspended solids, inorganic	Water	kg	0.00E+00	0.00E+00	2.52E-05	0.00E+00	5.59E-03
Suspended solids, unspecified	Water	kg	7.26E+00	2.38E+01	1.31E-01	6.31E+01	2.24E+01
t-Butyl methyl ether	Water	kg	0.00E+00	0.00E+00	2.82E-10	0.00E+00	5.17E-07
t-Butylamine	Water	kg	0.00E+00	0.00E+00	2.49E-17	0.00E+00	3.76E-04
Tar	Water	kg	1.07E-12	3.74E-11	2.93E-13	6.69E-11	1.87E-11
Technetium-99m	Water	Bq	0.00E+00	0.00E+00	3.86E-07	0.00E+00	1.42E-02
Tellurium-123m	Water	Bq	0.00E+00	0.00E+00	6.80E-07	0.00E+00	1.33E-02
Tellurium-132	Water	Bq	0.00E+00	0.00E+00	9.64E-10	0.00E+00	3.55E-05
Terbufos	Water	kg	0.00E+00	2.21E-10	1.76E-13	2.92E-10	0.00E+00
Tetradecane	Water	kg	3.76E-06	1.23E-05	6.79E-08	3.33E-05	1.18E-05

Substance	Compart-ment	Unit	Forest operations	OSB	FJL	LVL	I-joists
Thallium	Water	kg	1.52E-06	2.09E-06	2.21E-08	6.01E-06	4.39E-06
Thorium-228	Water	Bq	0.00E+00	0.00E+00	2.63E-02	0.00E+00	3.48E+01
Thorium-230	Water	Bq	0.00E+00	0.00E+00	8.05E-03	0.00E+00	1.60E+02
Thorium-232	Water	Bq	0.00E+00	0.00E+00	1.32E-05	0.00E+00	2.51E-01
Thorium-234	Water	Bq	0.00E+00	0.00E+00	5.90E-05	0.00E+00	1.17E+00
Tin	Water	kg	3.11E-05	6.66E-05	4.94E-07	1.85E-04	7.40E-05
Tin, ion	Water	kg	0.00E+00	0.00E+00	1.97E-09	0.00E+00	1.05E-05
Titanium	Water	kg	1.11E-04	1.52E-04	1.60E-06	4.37E-04	2.07E-04
Titanium, ion	Water	kg	0.00E+00	0.00E+00	4.02E-08	0.00E+00	9.58E-04
TOC, Total Organic Carbon	Water	kg	0.00E+00	1.22E-01	8.92E-06	3.04E-01	2.07E-01
Toluene	Water	kg	2.46E-04	8.02E-04	4.45E-06	2.18E-03	2.88E-03
Toluene, 2-chloro-	Water	kg	0.00E+00	0.00E+00	3.09E-16	0.00E+00	7.56E-04
Tributyltin compounds	Water	kg	0.00E+00	0.00E+00	1.31E-10	0.00E+00	3.29E-07
Triethylene glycol	Water	kg	0.00E+00	0.00E+00	4.94E-09	0.00E+00	3.64E-06
Trimethylamine	Water	kg	0.00E+00	0.00E+00	9.52E-19	0.00E+00	2.57E-14
Tungsten	Water	kg	0.00E+00	0.00E+00	2.53E-09	0.00E+00	7.50E-06
Uranium-234	Water	Bq	0.00E+00	0.00E+00	7.08E-05	0.00E+00	1.40E+00
Uranium-235	Water	Bq	0.00E+00	0.00E+00	1.17E-04	0.00E+00	2.32E+00
Uranium-238	Water	Bq	0.00E+00	0.00E+00	2.23E-04	0.00E+00	4.19E+00
Uranium alpha	Water	Bq	0.00E+00	0.00E+00	3.40E-03	0.00E+00	6.74E+01
Urea	Water	kg	0.00E+00	0.00E+00	2.55E-16	0.00E+00	1.58E-12
Vanadium	Water	kg	4.21E-06	1.42E-05	7.60E-08	3.73E-05	1.47E-05
Vanadium, ion	Water	kg	0.00E+00	0.00E+00	6.64E-09	0.00E+00	1.34E-04
VOC, volatile organic compounds, unspecified origin	Water	kg	0.00E+00	0.00E+00	4.62E-08	0.00E+00	6.39E-05
Waste water/m3	Water	m3	0.00E+00	2.68E-03	3.63E-05	3.54E-03	0.00E+00
Xylene	Water	kg	1.31E-04	4.18E-04	2.36E-06	1.14E-03	4.22E-04
Yttrium	Water	kg	1.04E-06	3.42E-06	1.89E-08	9.27E-06	3.27E-06
Zinc	Water	kg	2.69E-04	4.83E-04	4.74E-06	1.30E-03	6.54E-04

21 APPENDIX F: PRODUCTION FACILITY SURVEY QUESTIONNAIRES

CORRIM SURVEY

The Consortium for Research on Renewable Industrial Materials (CORRIM)

Laminated Veneer Lumber (LVL) and Composite I-Joist Plants

2014

The information from this survey will be used in a project by CORRIM, a consortium of universities, industry, and government groups. In collaboration with the USDA Forest Service Forest Products Laboratory, APA-The Engineered Wood Association, and the American Wood Council, CORRIM is updating life-cycle assessment data that describes environmental impacts of building materials. This CORRIM survey is designed specifically for LVL and composite I-joist plants. There are three sections for this survey. The three sections are the LVL plant (pg. 3-11), the veneer mill (pg. 12-19), and the I-joist plant (pg. 20-29). Please complete the section(s) that apply to your facilities. Emission data are requested for each section.

Questions will be concentrated on **annual production**, electricity production and usage, fuel consumption, material flows, and environmental emissions. We realize that you may not have all the information requested, especially when it comes to specific equipment/processing groups or what we call 'machine centers'. The data you are able to provide will be appreciated.

Your data will be confidential; only weight-averaged values based on production for the industry will be reported.

Company: _____

Facility Site (city, state): _____

Should we have a follow-up question about the data, please provide the name and the following information for the contact in your company.

Name: _____ Title: _____

Telephone: _____ Email: _____

Please send the complete survey to the following email or address by March 3rd. If you have questions about the survey, contact:

Rick Bergman
Research Forest Products Technologist,
USDA Forest Service Forest Products Laboratory
One Gifford Pinchot Dr,
Madison, WI 53726-2398
(608) 231-9477 (ph) / (608) 231-9508 (fax)
rbergman@fs.fed.us

General Plant Information

Yes	No	Equipment in mill
O	O	Veneer dryer (for redry)
O	O	conventional steam, #: _____
O	O	high temp (>212F) steam # _____
O	O	direct fire, # _____
O	O	continuous, # _____
O	O	other:_____
O	O	Hot pressing
O	O	Hot press(es), #_____
		year built or updated:_____
O	O	heating system
O	O	hot oil (fired by nat. gas)
O	O	microwave
O	O	radio-frequency
		pressure (psig) _____
		temperature (°F) _____
		press time (min:sec) _____
O	O	Precipitator
O	O	Bag house
O	O	Other pollution controls?
O	O	Layup of LVL billets
O	O	Resin
O	O	phenol-formaldehyde
O	O	other _____
O	O	other _____
		Inputs
O	O	PLV
O	O	veneer
O	O	Sawing/trimming of LVL
O	O	Resaw
O	O	Rip saw
O	O	In-line moisture meter
O	O	Automatic grading (visual grades)
O	O	Manual grading (visual grades)
O	O	Machine grading (MSR grades)
O	O	End Trim
O	O	Wrap LVL, material _____
O	O	Steel strapping
O	O	Plastic strapping
O	O	Cardboard corners
O	O	other:_____
O	O	other:_____
O	O	other:_____
O	O	Bag house
O	O	Other pollution control

Yes	No	Equipment in mill (continued)
O	O	Boiler / cogen
O	O	wood boiler(s), #_____
O	O	gas boiler(s), #_____
O	O	oil boiler(s), #_____
O	O	propane boiler(s), #_____
O	O	Cogeneration unit
O	O	Bag house
O	O	Other pollution control?
O	O	Precipitator
O	O	other:_____
O	O	other:_____
O	O	other:_____
O	O	Buy steam
O	O	Sell electricity
O	O	Routing/shaping of web and flanges
O	O	Router(s), # _____
		Flanges
O	O	LSL
O	O	LVL
O	O	Lumber
O	O	Lumber (finger-jointed)
O	O	Assembly of I-joist
O	O	Resin
O	O	phenol-resorcinol-formaldehyde
O	O	emulsified polyurethane
O	O	other _____
		% MC (dry basis) _____
O	O	Sawing/curing of I-joists
O	O	Ripsaw
O	O	Oven(s), # _____
		Fuel source_____
O	O	Wrap LVL, material _____
O	O	Steel strapping
O	O	Plastic strapping
O	O	Cardboard corners
O	O	other:_____
O	O	Bag house
O	O	Other pollution control

LVL Plant Annual Wood Production Data

Reporting year _____ Starting month _____ Ending month _____

LVL Annual Production				
(Please provide units of measurement if different than stated)				Total Production
1.	Annual LVL production, 2012		ft^3	
	Annual LVL production, 2012		MSF 3/8 in. basis	
	Annual LVL production, 2012		Tons (%MC)	
2.	Veneer			
	a. Produced Veneer:			
	i. Used in Mill		MSF 3/8 in. basis	
	ii. Sold		MSF 3/8 in. basis	
	b. Purchased Veneer:			
	i. Dry		MSF 3/8 in. basis	
	ii. Green		MSF 3/8 in. basis	
	c. Sold Veneer			
	i. Dry		MSF 3/8 in. basis	
	ii. Green		MSF 3/8 in. basis	
	d. Purchased Parallel Laminated Veneer (PLV)		MSF 3/8 in. basis	
Transportation method(s) and average delivery distance for purchased veneer				
	Truck (% of total)		Average delivery miles	
	Rail (% of total)		Average delivery miles	
	Other (% of total)		Average delivery miles	
	Total (%)	100%		
Transportation method(s) and average delivery distance for purchased PLV				
	Truck (% of total)		Average delivery miles	
	Rail (% of total)		Average delivery miles	
	Other (% of total)		Average delivery miles	
	Total (%)	100%		

3. If you either peel/dry or dry veneer on-site, please be sure to complete the next section on veneer mills.

LVL Plant Annual Power and Fuel Consumption

If you have completed a 2012 Annual Fuel and Energy Survey for AF&PA, you may want to attach the survey and skip to the next section entitled "Other Annual Production." The first section refers to energy generation (non-transport fuel). (Please provide units of measurement if different)

Fuel	Unit	Quantity
Purchased electricity	kWh	
Purchased steam	lbs (°F)	
Wood Fuel *Self-generated*	Tons / (%MC)	/
Wood Fuel *Purchased*	Tons / (%MC)	/
Natural Gas	1000 ft^3	
Kerosene (fuel oil #1)	Gallons	
Fuel oil #2	Gallons	
Residual fuel oil #6 (Bunker C)	Gallons	
Diesel	Gallons	
Gasoline	Gallons	
Liquid Propane Gas	Gallons	
Total electricity for LVL plant	kWh	

If your facility produces any of the following for use on-site or for sale, please fill out the table. Enter N/A if not applicable.

Energy	Unit	Quantity (used on-site)	Quantity (sold off-site)
Electricity	kWh		
Steam	lbs (°F)		

If your facility has a boiler, please provide the following. Otherwise, enter N/A as applicable.

Boiler	Boiler size (million BTU/hr)	Boiler fuel	Boiler fuel unit	Quantity	Electricity to operate boiler (kWh)
#1					
#2					
#3					
#4					

LVL Plant Annual Transportation Fuel Use On-site

(includes all fuels for yard equipment, forklifts, and carriers)

Type	Total Quantity	Percent of total by unit process (percentage or volume)					Units	
		Veneer / PLV prep	Layup	Boiler	Hot press	Saw/ trimmer	Support vehicles	
Off-road diesel								Gallons
On-road diesel								Gallons
Propane								Gallons
Gasoline								Gallons
Electricity								kWh
Other								

Other LVL Plant Annual Use Data

Formulation and usage of resin, fillers, and other components			
Component Type	Percent of Solid by Weight (range is ok)		Total annual use (lbs.)
Phenol formaldehyde			
Extender and filler			
Catalyst (NaOH)			
Water			
Other (please specify)			
Other (please specify)			
Transportation method and distance for resin			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		
Transportation method and distance for extender and filler			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		
Transportation method and distance for catalysts			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	

Other (% of total)		Average delivery miles	
Total (%)	100%		

Source of Heat for Press: direct or in-direct (circle one)			
Thermal Fluid (Hot Oil) heated by	Units		
Natural Gas	1000 ft^3		
Electricity	kWh		
Steam	lbs		
Radio Frequency	kWh		
Microwave Frequency	kWh		
Other	?		

LVL Plant Annual Wood Residue Production

Wood residues are any wood material produced in conjunction with making LVL and are called co-products in this survey. For each of the co-products produced at your plant, please indicate the weight (tons) of **annual** wood residue production for the reporting period that are shipped to other users, used internally as fuel or for the production of another co-product at your facility, stockpiled for future use or land filled (estimates are acceptable). If zero, enter a dash (-). Please state units if other than tons like cubic yards. The final column (Total Quantity) should equal the sum of the individual rows.

Estimate amount of wood residue produced per Msf of LVL _____tons/Msf LVL

Wood residue	**Moisture Content (wet basis)**	**Sold (Shipped)**	**Used Internally (as fuel)**	**Used Internally (other uses)**	**Landfill**	**Inventory**	**Total Quantity**
	(%)	tons	tons	tons	tons	tons	Tons
Veneer loss							
PLV loss							
Lay-up scrap							
Panel trim							
Sawdust (sawing and trimming)							
Sawdust (rip saw)							
Tested LVL, used							
Other							

LVL Plant Ancillary Material Inputs

Ancillary Material	Used		Amount	How amount was found? Mark one[1]		Where the ancillary material is emitted as a percent (estimation is ok)					
	Yes	No		M	E	Veneer / PLV prep	Layup	Boiler	Hot press	Saw/ trimmer	Comments
Hydraulic fluids	O	O	lb/yr	O	O	%	%	%	%	%	
Greases	O	O	lb/yr	O	O	%	%	%	%	%	
Motor Oil	O	O	lb/yr	O	O	%	%	%	%	%	
Plastic wrapping	O	O	lb/yr	O	O	%	%	%	%	%	
Cardboard packaging	O	O	lb/yr	O	O	%	%	%	%	%	
Steel strapping	O	O	lb/yr	O	O	%	%	%	%	%	
Plastic strapping	O	O	lb/yr	O	O	%	%	%	%	%	
Potable water	O	O	gal/yr	O	O	%	%	%	%	%	
Paints	O	O	lb/yr	O	O	%	%	%	%	%	
Waxes	O	O	lb/yr	O	O	%	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	%	

[1] Estimated (E) / Measured (M)

LVL Plant Air Emissions

If air emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount	How amount was found?[1]			Sampling method or source[2]	Where the substance is emitted as a percent (estimation is ok)				
	Yes	No		M	E	PV		Veneer / PLV prep	Layup	Boiler	Hot press	Saw/ trimmer
Dust	O	O	lb/yr	O	O	O		%	%	%	%	%
Particulate	O	O	lb/yr	O	O	O		%	%	%	%	%
Particulate, PM10[3]	O	O	lb/yr	O	O	O		%	%	%	%	%
Particulate, PM2.5[4]	O	O	lb/yr	O	O	O		%	%	%	%	%
VOC	O	O	lb/yr	O	O	O		%	%	%	%	%
Sulfur dioxide	O	O	lb/yr	O	O	O		%	%	%	%	%
Carbon monoxide	O	O	lb/yr	O	O	O		%	%	%	%	%
Nitrous oxide	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Total	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Methanol	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Formaldehyde	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Acetaldehyde	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Propionaldehyde	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Acrolein	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Phenol	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: Acetone	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
HAP: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other organic[5]: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other inorganic[6]: ____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement

[2] Sampling methods might be Method 25A, Method 5, NCASI 105. Estimates might be based on AP42, Standard Air Contaminate Discharge Permit or other source.

[3] PM10 is particulate matter up to 10 micrometers in size

[4] PM2.5 is particulate matter up to 2.5 micrometers in size

[5] Non-HAP organics that are not included in VOC value.

[6] Inorganics such as chlorine, mercury sulfur.

LVL Plant Water Emissions

If water emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount[2]	How amount was found Mark one[3]			Sampling method or source[1]	Where the substance is emitted as a percent (estimation is ok)				
	Yes	No		M	E	PV		Veneer / PLV prep	Layup	Boiler	Hot press	Saw/ trimmer
Suspended solids	O	O	lb/yr	O	O	O		%	%	%	%	%
BOD	O	O	lb/yr	O	O	O		%	%	%	%	%
COD	O	O	lb/yr	O	O	O		%	%	%	%	%
Oil and grease	O	O	lb/yr	O	O	O		%	%	%	%	%
HAPs	O	O	lb/yr	O	O	O		%	%	%	%	%
Chemicals in boiler blowdown (if not included above)	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%	%

[1] Sampling methods is type of water test or how estimate was obtained.

[2] Report the mass of material, not the mass of material and water.

[3] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

LVL Plant Solid Waste Production

If annual solid waste summary is available, please provide as an alternative to the following table.
Check here if summary is attached ☐

Material	Amount[2] (lb/yr)	Where material is going? Landfill (L) or recycled (R) Mark one	How amount was found? Mark one[1]			Where the solid waste is emitted as a percent (estimation is ok)				
			M	E	PV	Veneer / LVL prep	Layup	Boiler	Hot press	Saw/ trimmer
Discarded Wood		L / R	O	O	O	%	%	%	%	%
Discarded Bark		L / R	O	O	O	%	%	%	%	%
Dirt and rocks		L / R	O	O	O	%	%	%	%	%
Ash		L / R	O	O	O	%	%	%	%	%
Plastic wrap		L / R	O	O	O	%	%	%	%	%
Metal strapping		L / R	O	O	O	%	%	%	%	%
Plastic strapping		L / R	O	O	O	%	%	%	%	%
Other metals		L / R	O	O	O	%	%	%	%	%
Other organics		L / R	O	O	O	%	%	%	%	%
Other non-organics		L / R	O	O	O	%	%	%	%	%
Other: _____		L / R	O	O	O	%	%	%	%	%
Other: _____		L / R	O	O	O	%	%	%	%	%
Other: _____		L / R	O	O	O	%	%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

[2] Report the mass of material, for example, report wood separately from dirt and rocks.

LVL Plant Annual Water Use

Type	Total Quantity	Percent of total by unit process (percentage or volume; estimation is ok)					Units
		Veneer / LVL prep	Layup	Boiler	Hot press	Saw/ trimmer	
Input							
Surface water							Gallons
Groundwater							Gallons
Municipal water							Gallons
Output							
Water discharged							Gallons
Water recycled							Gallons

Recycling rate of water helps reduce the water footprint.

What percent of water is recycled?		%
Was water measured or estimated?		

LVL Plant Emission Control Device (ECD)

The following is a chart of emission control devices. Please fill in all information related to the control devices.

Emission Control Device (ECD)- Type, Electricity, Fuel Usage					
	ECD 1	ECD 2	ECD 3	ECD 4	ECD 5
Equipment controlled (i.e., boiler, press, dryer, etc.)					
Type					
Model					
Year Installed					
Electricity used to operate ECD; either kWh or % of total plant use					
Natural Gas used to operate ECD; either $ft.^3$ or % of total plant use					

Machine Center Breakdown for Electricity and Fuel Use

Fill in all that apply and for which you have data. If you **do not** have given machines center such as the co-generator, either draw **a line** through that row and **write N/A**.

Machine Center	**Model/Type** **Year Installed**	**Annual electricity** **kWh or % of the total use for mill**	**Fuel Usage** **% of total use for mill**
Co-generator			
Lay-up			
Press(es)			
#1			
#2			
#3			
#4			
Billet Cuts			
Rip Saw			

If you do not peel or dry veneer or produce I-joists, congratulations you have completed the survey! However, if you do, please complete the following pages.

Veneer Mill Annual Wood Production Data

Please fill in all the information that pertains just to your plant.

Type of veneer dryer: Longitudinal, Cross flow, Jet, Rotary (circle one)

Log scale: Dolye, International, Scribner, Weight base (circle one)

Total volume of incoming softwood logs	_____	thousand BF/year
Total volume of incoming green veneer	_____	thousand ft^2 3/8" basis/year
Total volume of veneer produced on-site	_____	thousand ft^2 3/8" basis/year
Total volume of veneer produced on-site used on-site	_____	thousand ft^2 3/8" basis/year

Please complete the following table showing the breakdown of the ***individual tree species*** and approximate ***sizes*** processed by your mill by species and the average log diameter. If less than 2% of total, use category labeled "Other".

Species	% of total log input into veneer mill	Log Diameter* (in)
Total	100%	

*Please provide individual log diameters if known otherwise please state the average or range of logs processed at your facility in bottom row under Log Diameter

Wood species processed into veneer and approximate percentage of total:

Species	Volume (Msf 3/8")	%MC (wet basis)	Percent
Total			100%

MILEAGE: Over the Road _____% By Rail_____%

Total number of log deliveries made to this facility annually	_____	# per year
Average one-way mileage travel to this facility to deliver logs	_____	miles

Veneer Mill Annual Transportation Fuel Use On-site

(includes all fuels for yard equipment, forklifts, and carriers)

Type	Total Quantity	Percent of total by unit process (percentage or volume)					Units
		Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying	Support Vehicle	
Off-road diesel							Gallons
On-road diesel							Gallons
Propane							Gallons
Gasoline							Gallons
Electricity							kWh
Other							

Veneer Mill Annual (Non-Transportation) Fuel Use

(boilers, cogeneration units, etc.)

Fuel	Unit	Quantity
Total electricity for veneer mill	kWh	
Purchased steam	lbs (°F)	
Wood Fuel *Self-generated*	Tons / (%MC)	/
Wood Fuel *Purchased*	Tons / (%MC)	/
Natural Gas	1000 ft^3	
Kerosene (fuel oil #1)	Gallons	
Fuel oil #2	Gallons	
Residual fuel oil #6 (Bunker C)	Gallons	
Diesel	Gallons	
Gasoline	Gallons	
Liquid Propane Gas	Gallons	

If your facility has a boiler, please provide the following. Otherwise, enter N/A as applicable.

Boiler	Boiler size (million BTU/hr)	Boiler Fuel	Boiler Fuel Unit	Quantity	Electricity to operate boiler (kWh)
#1					
#2					
#3					
#4					

Veneer Mill Machine Center Breakdown

Fill in all that apply and for which you have data. If you do not have a given machine center, draw a line through that row and write None. Please provide units.

Machine Center	Model/Type Year Installed	Annual Electricity Usage kWh or % of total electricity use for mill **(Estimation is ok)**	Fuel Usage % of total use for mill **(Estimation is ok)**
Bucking & Debarking			
Log Conditioning			
Peeling & Clipping			
Drying			
Energy Generation			
Emissions control			
Total veneer mill			

Veneer Mill Annual Wood Residue Production

This is a general material flow survey for veneer mills. Wood residues are any wood material produced in conjunction with making LVL and are called co-products in this survey. This survey is designed to trace all wood components generated during production.

Estimate amount of wood residue produced per Msf of veneer _____tons/Msf veneer

Wood residue	Moisture Content (wet basis) (%)	Sold (Shipped) tons	Used Internally (as fuel) tons	Used Internally (other uses) tons	Landfill tons	Total Quantity Tons
Bark, green						
Roundup wood, green						
Peeler core, green						
Clippings, green						
Veneer downfall						
Trim , green						
Chips, green						
Hogged material						
Waste gate material						
Clippings, green						
Other						

For dryer(s), check heat source and give the annual fuel consumption: indirect or direct (circle one)		
Heat source		
☐ Steam	lbs	
☐ Natural gas direct-fired	ft^3	
☐ Wood fuel	Tons (%MC)	/
☐ Other		

Veneer moisture content information		
Average moisture content into dryer	% ovendry basis	
Average moisture content out of dryer	% ovendry basis	
Redry rate	%	

Transportation method and distance for veneer logs			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Veneer Mill Ancillary Material Inputs

Ancillary Material	Used		Amount	How amount was found? Mark one[1]		Where the ancillary material is emitted as a percent (estimation is ok)				
	Yes	No		M	E	Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying	Comments
Hydraulic fluids	O	O	lb/yr	O	O	%	%	%	%	
Greases	O	O	lb/yr	O	O	%	%	%	%	
Motor Oil	O	O	lb/yr	O	O	%	%	%	%	
Plastic wrapping	O	O	lb/yr	O	O	%	%	%	%	
Cardboard packaging	O	O	lb/yr	O	O	%	%	%	%	
Steel strapping	O	O	lb/yr	O	O	%	%	%	%	
Plastic strapping	O	O	lb/yr	O	O	%	%	%	%	
Potable water	O	O	gal/yr	O	O	%	%	%	%	
Paints	O	O	lb/yr	O	O	%	%	%	%	
Waxes	O	O	lb/yr	O	O	%	%	%	%	
Runners	O	O	lb/yr	O	O	%	%	%	%	
Boiler chemicals	O	O	lb/yr	O	O	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	
Other: _____	O	O	lb/yr	O	O	%	%	%	%	

[1] Estimated (E) / Measured (M)

Veneer Mill Air Emissions

If air emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount	How amount was found? Mark one[1]			Sampling method or source[2]	Where the substance is emitted as a percent (estimation is ok)			
	Yes	No		M	E	PV		Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying
Dust	O	O	lb/yr	O	O	O		%	%	%	%
Particulate	O	O	lb/yr	O	O	O		%	%	%	%
Particulate, PM10[3]	O	O	lb/yr	O	O	O		%	%	%	%
Particulate, PM2.5[4]	O	O	lb/yr	O	O	O		%	%	%	%
VOC	O	O	lb/yr	O	O	O		%	%	%	%
Sulfur dioxide	O	O	lb/yr	O	O	O		%	%	%	%
Carbon monoxide	O	O	lb/yr	O	O	O		%	%	%	%
Nitrous oxide	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Total	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Methanol	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Formaldehyde	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Acetaldehyde	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Propionaldehyde	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Acrolein	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Phenol	O	O	lb/yr	O	O	O		%	%	%	%
HAP: Acetone	O	O	lb/yr	O	O	O		%	%	%	%
HAP: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other organic[5]: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other inorganic[6]: ____	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement

[2] Sampling methods might be Method 25A, Method 5, NCASI 105. Estimates might be based on AP42, Standard Air Contaminate Discharge Permit or other source.

[3] PM10 is particulate matter up to 10 micrometers in size

[4] PM2.5 is particulate matter up to 2.5 micrometers in size

[5] Non-HAP organics that are not included in VOC value.

[6] Inorganics such as chlorine, mercury sulfur.

Veneer Mill Water Emissions

If water emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount[2]	How amount was found? Mark one[3]			Sampling method or source[1]	Where the substance is emitted as a percent (Estimation is ok)			
	Yes	No		M	E	PV		Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying
Suspended solids	O	O	lb/yr	O	O	O		%	%	%	%
BOD	O	O	lb/yr	O	O	O		%	%	%	%
COD	O	O	lb/yr	O	O	O		%	%	%	%
Oil and grease	O	O	lb/yr	O	O	O		%	%	%	%
HAPs	O	O	lb/yr	O	O	O		%	%	%	%
Chemicals in boiler blowdown (if not included above)	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%
Other: _____	O	O	lb/yr	O	O	O		%	%	%	%

[1] Sampling methods is type of water test or how estimate was obtained.

[2] Report the mass of material, not the mass of material and water.

[3] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

Veneer Mill Solid waste

If annual solid waste summary is available, please provide as an alternative to the following table. Check here if summary is attached □

Material	Amount[2] (lb/yr)	Where material is going? Landfill (L) or recycled (R)	How amount was found? Mark one[1]	Where the solid waste is emitted as a percent (estimation is ok)			
				Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying
Discarded Wood		L / R	M / E / PV	%	%	%	%
Discarded Bark		L / R	M / E / PV	%	%	%	%
Dirt and rocks		L / R	M / E / PV	%	%	%	%
Ash		L / R	M / E / PV	%	%	%	%
Plastic wrap		L / R	M / E / PV	%	%	%	%
Plastic strapping		L / R	M / E / PV	%	%	%	%
Metal strapping		L / R	M / E / PV	%	%	%	%
Plastic bags		L / R	M / E / PV	%	%	%	%
Other metals		L / R	M / E / PV	%	%	%	%
Other organics		L / R	M / E / PV	%	%	%	%
Other non organics		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

[2] Report the mass of material, for example, report wood separately from dirt and rocks.

Veneer Mill Annual Water Use

Type	Total Quantity	Percent of total by unit process (percentage or volume)				Units
		Bucking & Debarking	Block Conditioning	Peeling & Clipping	Drying	
Input						
Surface water						Gallons
Groundwater						Gallons
Municipal water						Gallons
Output						
Water discharged						Gallons
Water recycled						Gallons

Recycling rate of water helps reduce the water footprint.

What percent of water is recycled?		%
Was water measured or estimated?		

2012 Composite I-joists Annual Production Plant Data

Please fill in all information relevant to producing I-joists. Please provide the data on an annual basis for the year which the data is reported.

Annual I-Joists Production for 2012

Product (Series)	Amount (lin.ft.)	Joist Depth (in.)	Flange dim. (in. x in.)

I-joists Construction-Web

Material	Percent of total	Annual consumption (MSF 3/8")
OSB		
Plywood		
Total	100%	

Transportation Method and Delivery Distance for OSB

Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Transportation Method and Delivery Distance for plywood

Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Estimate amount of wood residue produced per Msf of I-joist _____tons/Msf I-joist

Wood residue	**Moisture Content (wet basis)** (%)	**Sold (Shipped)** tons	**Used Internally (as fuel)** tons	**Used Internally (other uses)** tons	**Landfill** tons	**Inventory** tons	**Total Quantity** Tons
Sawdust, dry							
Other							
Other							

I-joists Construction-Flange		
Material	Percent of total	Annual consumption (MSF 3/8")
LVL		
LSL		
Lumber (finger-jointed)		
Total	100%	

Transportation Method and Delivery Distance for LVL			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Transportation Method and Delivery Distance for LSL			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Transportation Method and Delivery Distance for lumber (finger-jointed)			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Annual Resin Consumption Data

Resin consumption is comprised of three different scenarios: 1) web-joint, 2) flange finger-joint, and 3) I-joist (web to flange)

1. Web-joint resin consumption	
Resin type	
Percent water	

Transportation Method and Delivery Distance for web-joint resin			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

- Please include the amount of resin used in the web-joints of the I-joist in this section. Please state whether weight is given as wet or dry weight.

- If you use the same resin for the web-joint, finger-joint, and web to flange-joint, complete the following table with total resin use and check this box ☐ ☐

- Otherwise, fill in resin use for web-joint only and then proceed to fill out resin data for flange finger-joints and I-joist (web to flange).

Formulation and usage of web-joint resin, fillers, and other components			
Component Type	Range % of Solid by Weight	Total Annual Use (lbs.)	Circle one
Resin			Wet or dry
Extender and filler			Wet or dry
Catalyst (NaOH)			Wet or dry
Water			
Other (please specify)			Wet or dry
Resin loss (lbs)			Wet or dry

2. Flange finger-joint resin consumption			
Resin type			
Percent water			
Transportation Method and Delivery Distance for flange finger-joint resin			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Formulation and usage of flange finger-joint resin, fillers, and other components			
Component Type	Range % of Solid by Weight	Total Annual Use (lbs.)	Circle one
Resin			Wet or dry
Extender and filler			Wet or dry
Catalyst (NaOH)			Wet or dry
Water			
Other (please specify)			Wet or dry
Resin loss (lbs)			Wet or dry

3. I-joist (web-to-flange) resin consumption	
Resin type	
Percent water	

Transportation Method and Delivery Distance for I-joist (web-to-flange) resin			
Truck (% of total)		Average delivery miles	
Rail (% of total)		Average delivery miles	
Other (% of total)		Average delivery miles	
Total (%)	100%		

Formulation and usage of I-joist (web-to-flange) resin, fillers, and other components			
Component Type	Range % of Solid by Weight	Total Annual Use (lbs.)	Circle one
Resin			Wet or dry
Extender and filler			Wet or dry
Catalyst (NaOH)			Wet or dry
Water			
Other (please specify)			Wet or dry
Resin loss (lbs)			Wet or dry

I-joist Plant Annual (Non-Transportation) Fuel Use

(boilers, cogeneration units, etc.)

Fuel	Unit	Quantity
Total electricity for I-joist plant	kWh	
Purchased steam	lbs (°F)	
Wood Fuel *Self-generated*	Tons / (%MC)	/
Wood Fuel *Purchased*	Tons / (%MC)	/
Natural Gas	1000 ft^3	
Kerosene (fuel oil #1)	Gallons	
Fuel oil #2	Gallons	
Residual fuel oil #6 (Bunker C)	Gallons	
Diesel	Gallons	
Gasoline	Gallons	
Liquid Propane Gas	Gallons	

If your facility has a boiler, please provide the following. Otherwise, enter N/A as applicable.

Boiler	Boiler size (million BTU/hr)	Boiler Fuel	Boiler Fuel Unit	Quantity	Electricity to operate boiler (kWh)
#1					
#2					
#3					

For oven(s), check heat source and give the annual fuel consumption: indirect or direct (circle one)		
Heat source		
☐ Steam	lbs	
☐ Natural gas direct-fired	ft^3	
☐ Wood fuel	Tons (%MC)	/
☐ Other		

I-Joist Plant Annual Transportation Fuel Use On-site

(includes all fuels for yard equipment, forklifts, and carriers)

Type	Total Quantity	Percent of total by unit process (percentage or volume)					
		Routing / shaping	Assembly	Sawing	Curing	Support vehicles	Units
Off-road diesel							Gallons
On-road diesel							Gallons
Propane							Gallons
Gasoline							Gallons
Electricity							kWh
Other							

Machine Center Breakdown for Electricity and Fuel Use

Fill in all that apply and for which you have data. If you **do not** have a given machine center that is listed here, either **draw a line** through that row and **write N/A**.

Machine Center	Model/Type Year Installed	Annual Electricity kWh or % of the Total Use for Mill	Fuel Usage % of Total Use for Mill
OSB/Plywood saws			
LVL/FJ lumber saws			
Web joint shaper/router			
I-joist assembler			
I-joist saw			
Other (please specify)			
Curing Oven			
Steam			
Electricity			
Natural Gas			

I-joist Plant Ancillary Material Inputs

Ancillary Material	Used		Amount	How amount was found? Circle one[1]	Where the ancillary material is emitted as a percent (estimation is ok)				
	Yes	No			Routing / shaping	Assembly	Sawing	Curing	Comments
Hydraulic fluids	O	O	lb/yr	M / E	%	%	%	%	
Greases	O	O	lb/yr	M / E	%	%	%	%	
Motor Oil	O	O	lb/yr	M / E	%	%	%	%	
Plastic wrapping	O	O	lb/yr	M / E	%	%	%	%	
Cardboard packaging	O	O	lb/yr	M / E	%	%	%	%	
Steel strapping	O	O	lb/yr	M / E	%	%	%	%	
Plastic strapping	O	O	lb/yr	M / E	%	%	%	%	
Potable water	O	O	gal/yr	M / E	%	%	%	%	
Paints	O	O	lb/yr	M / E	%	%	%	%	
Waxes	O	O	lb/yr	M / E	%	%	%	%	
Plastic strapping	O	O	lb/yr	M / E	%	%	%	%	
Runners	O	O	lb/yr	M / E	%	%	%	%	
Boiler chemicals	O	O	lb/yr	M / E	%	%	%	%	
Other: _____	O	O	lb/yr	M / E	%	%	%	%	
Other: _____	O	O	lb/yr	M / E	%	%	%	%	
Other: _____	O	O	lb/yr	M / E	%	%	%	%	

[1] Estimated (E) / Measured (M)

I-joist Plant Air Emissions

If air emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount	How amount was found? Circle one[1]	Sampling method or source[2]	Where the substance is emitted as a percent (estimation is ok)			
	Yes	No				Routing / shaping	Assembly	Sawing	Curing
Dust	O	O	lb/yr	M / E / PV		%	%	%	%
Particulate	O	O	lb/yr	M / E / PV		%	%	%	%
Particulate, PM10[3]	O	O	lb/yr	M / E / PV		%	%	%	%
Particulate, PM2.5[4]	O	O	lb/yr	M / E / PV		%	%	%	%
VOC	O	O	lb/yr	M / E / PV		%	%	%	%
Sulfur dioxide	O	O	lb/yr	M / E / PV		%	%	%	%
Carbon monoxide	O	O	lb/yr	M / E / PV		%	%	%	%
Nitrous oxide	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Total	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Methanol	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Formaldehyde	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Acetaldehyde	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Propionaldehyde	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Acrolein	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Phenol	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: Acetone	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: _____	O	O	lb/yr	M / E / PV		%	%	%	%
HAP: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other organic[5]: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other inorganic[6]: ____	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement

[2] Sampling methods might be Method 25A, Method 5, NCASI 105. Estimates might be based on AP42, Standard Air Contaminate Discharge Permit or other source.

[3] PM10 is particulate matter up to 10 micrometers in size

[4] PM2.5 is particulate matter up to 2.5 micrometers in size

[5] Non-HAP organics that are not included in VOC value.

[6] Inorganics such as chlorine, mercury sulfur.

I-joist Plant Water Emissions

If water emission inventories are available, please provide as an alternative to the following table. Check here if inventory is attached ☐

Substance	Emit		Amount[2]	How amount was found? Circle one[3]	Sampling method or source[1]	Where the substance is emitted as a percent (estimation is ok)			
	Yes	No				Routing / shaping	Assembly	Sawing	Curing
Suspended solids	O	O	lb/yr	M / E / PV		%	%	%	%
BOD	O	O	lb/yr	M / E / PV		%	%	%	%
COD	O	O	lb/yr	M / E / PV		%	%	%	%
Oil and grease	O	O	lb/yr	M / E / PV		%	%	%	%
HAPs	O	O	lb/yr	M / E / PV		%	%	%	%
Chemicals in boiler blowdown (if not included above)	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%
Other: _____	O	O	lb/yr	M / E / PV		%	%	%	%

[1] Sampling methods is type of water test or how estimate was obtained.

[2] Report the mass of material, not the mass of material and water.

[3] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

I-joist Plant Solid waste

If annual solid waste summary is available, please provide as an alternative to the following table. Check here if summary is attached ☐

Material	Amount[2] (lb/yr)	Where material is going? Landfill (L) or recycled (R)	How amount was found? Circle one[1]	Where the solid waste is emitted as a percent (estimation is ok)			
				Routing / shaping	Assembly	Sawing	Curing
Discarded Wood		L / R	M / E / PV	%	%	%	%
Discarded Bark		L / R	M / E / PV	%	%	%	%
Dirt and rocks		L / R	M / E / PV	%	%	%	%
Ash		L / R	M / E / PV	%	%	%	%
Plastic wrap		L / R	M / E / PV	%	%	%	%
Metal strapping		L / R	M / E / PV	%	%	%	%
Cardboard packaging		L / R	M / E / PV	%	%	%	%
Plastic bags		L / R	M / E / PV	%	%	%	%
Other metals		L / R	M / E / PV	%	%	%	%
Other organics		L / R	M / E / PV	%	%	%	%
Other non organics		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%
Other: _____		L / R	M / E / PV	%	%	%	%

[1] Estimated (E) / Measured (M)/ Permit value (PV): For example, from landfill fees, a permit, or measurement.

[2] Report the mass of material, for example, report wood separately from dirt and rocks.

I-joist Plant Annual Water Use

Type	Total Quantity	Percent of total by unit process (percentage or volume)				Units
		Routing / shaping	Assembly	Sawing	Curing	
Input						
Surface water						Gallons
Groundwater						Gallons
Municipal water						Gallons
Output						
Water discharged						Gallons
Water recycled						Gallons

Recycling rate of water helps reduce the water footprint.

What percent of water is recycled?		%
Was water measured or estimated? M/E		

Annual Emission Control Device and Environmental Emission

The following is a chart of emission control devices and a listing of chemical compounds that are observed and/or permitted. Please fill in all information related to the control devices. Then list all compounds that are collected and known for the mill for all control device sources. If you recently applied for air permit, use those numbers. Fill in all that apply and for which you have data.

Annual Emission Control Device (ECD)- Electricity and Fuel Usage

	ECD 1	ECD 2	ECD 3	ECD 4	ECD 5
Equipment controlled (i.e., boiler, press, dryer, etc.)					
Type					
Model					
Year Installed					
Electricity used to operate ECD; either kWh or % of total plant use					
Natural gas used to operate ECD; either ft^3 or % of total plant use					