

TSCA Chemical Data Reporting

Fact Sheet: Kraft Pulp and Paper Process

This fact sheet provides guidance on Chemical Data Reporting (CDR) rule requirements related to Kraft pulp and paper mill chemical recovery processes. Specifically, this fact sheet seeks to provide guidance for Kraft pulp and paper mill facilities to accurately characterize reportable chemical streams as required under the CDR rule (40 CFR 711).

The primary goal of this document is to help the regulated community comply with the CDR rule requirements. This document does not substitute for that rule, nor is it a rule itself. It does not impose legally binding requirements on the regulated community or on the U.S. Environmental Protection Agency (EPA).

The CDR rule, issued under the Toxic Substances Control Act (TSCA), requires manufacturers (including importers) to give EPA information on the chemicals they manufacture domestically or import into the United States. EPA uses the data, which provides important screening-level exposure related information, to help assess the potential human health and environmental effects of these chemicals and makes the non-confidential business information it receives available to the public.

Kraft Pulping Process under the CDR Rule

Kraft pulp and paper sites may be required to report manufactured chemical substances under the CDR rule. Reporting under the CDR rule is based on the manufacture (including import) of chemical substances (see 40 CFR 711.8). It is important to note as well that the act of processing or using one chemical substance may result in the manufacture of another chemical substance. In such cases, persons who process or use chemical substances may be subject to reporting requirements under CDR: not with respect to the chemical substance that they processed or used, but with respect to the chemical substance *that they manufactured*.

Typically, the Kraft pulping cycle manufactures chemical substances that may be considered products, byproducts, or intermediates. This fact sheet describes the Kraft pulping process and how to determine whether certain chemical substances are exempt from CDR reporting. In April 2020, EPA added two new byproduct exemptions to the CDR rule.¹ This fact sheet includes a discussion of those new exemptions as well as already-existing exemptions associated with intermediates and byproducts.

¹ *Toxic Substances Control Act (TSCA) Chemical Data Reporting Revisions Under TSCA Section 8(a)* ([Docket ID No. EPA-HQ-OPPT-2018-0321-0118](#)).

1. What is a product?

For the purposes of CDR, a *product* is considered to be a chemical substance that is intentionally manufactured (e.g., for distribution into commerce or for the manufacturer's own use) for commercial purposes (i.e., with the purpose of obtaining an immediate or eventual commercial advantage for the manufacturer or importer). As a process input, a product would serve a specific commercial function.

2. What is a byproduct?

A *byproduct* is "a chemical substance produced without a separate commercial intent during the manufacture, processing, use, or disposal of another chemical substance(s) or mixture(s)." See 40 CFR 704.3, referenced by 40 CFR 711.3.

A byproduct is manufactured for commercial purposes since it is part of the manufacture of a chemical product for a commercial purpose, regardless of whether the byproduct itself has commercial value.²

3. What is an intermediate?

An *intermediate* is "any chemical substance that is consumed, in whole or in part, in chemical reactions used for the intentional manufacture of other chemical substances or mixtures, or that is intentionally present for the purpose of altering the rates of such chemical reactions." See 40 CFR 704.3, referenced by 40 CFR 711.3.

In considering whether a chemical substance is an intermediate, EPA generally thinks of an intermediate as a kind of "building block" precursor chemical used to make what is, at least to some degree, a structurally related product. A reaction sequence containing an intermediate could be represented as $A \rightarrow B \rightarrow C$, where A is an initial feedstock that is transformed into B which is then transformed into C, the product. The product C is built upon the chemical structure/composition of B, which is built upon the chemical structure/composition of A. Substance B therefore can be considered an intermediate for making C. There may be reagents or other reactants involved in transforming A to B or B to C, but such reagents or other reactants are not typically viewed as intermediates because they are not themselves chemically transformed into the intended chemical products and they are not added to alter the rate of a reaction, instead they are often added to cause a desired chemical transformation.

4. What is a non-isolated intermediate?

A *non-isolated intermediate* is "any intermediate that is not intentionally removed from the equipment

² *Manufacture for commercial purposes* means: (1) To import, produce, or manufacture with the purpose of obtaining an immediate or eventual commercial advantage for the manufacturer, and includes among other things, such "manufacture" of any amount of a chemical substance or mixture:

(i) For commercial distribution, including for test marketing.

(ii) For use by the manufacturer, including use for product research and development, or as an intermediate.

(2) Manufacture for commercial purposes also applies to substances that are produced coincidentally during the manufacture, processing, use, or disposal of another substance or mixture, including both byproducts that are separated from that other substance or mixture and impurities that remain in that substance or mixture. Such byproducts and impurities may, or may not, in themselves have commercial value. They are nonetheless produced for the purpose of obtaining a commercial advantage since they are part of the manufacture of a chemical product for a commercial purpose. (40 CFR 704.3, referenced by 40 CFR 711.3)

in which it is manufactured, including the reaction vessel in which it is manufactured, equipment which is ancillary to the reaction vessel, and any equipment through which the substance passes during a continuous flow process, but not including tanks or other vessels in which the substance is stored after its manufacture. Mechanical or gravity transfer through a closed system is not considered to be intentional removal, but storage or transfer to shipping containers isolates the substance by removing it from process equipment in which it is manufactured.” See 40 CFR 704.3, referenced by 40 CFR 711.3.

Note that accumulating a chemical in any vessel, regardless of whether it is a flow-through in-line vessel, for reasons that are not necessary to the process's technical/chemical success but rather to keep the operation moving in the case of an unexpected interruption in the supply as a matter of plant convenience, is considered by EPA to be storage and isolation.

Intermediates and Byproducts under the CDR Rule

Reporting under the CDR rule may also extend to chemical intermediates and byproducts that are manufactured in the course of typical Kraft pulp and paper activities, including in relation to chemical recovery processes inherent to the manufacturing cycle. This section discusses the reporting requirements under the CDR rule for intermediates and byproducts generated during the Kraft pulping cycle. This document does not cover chemicals from other processes which may be used in paper production. Table 1 identifies representative examples of reportable and non-reportable intermediates and byproducts from Kraft pulp and paper activities.

1. When is a byproduct reportable?

A byproduct is generally reportable when it is *used* for a non-exempt commercial purpose.

Even though a byproduct was manufactured for commercial purposes, it might or might not be used for particular commercial purposes after it is manufactured. The manufacture of a byproduct is exempt from reporting if the byproduct is not “used for commercial purposes.” (40 CFR 720.30(h)(2), referenced by § 711.10(c))³

There are other circumstances where a byproduct may be exempt:

- The manufacture of a byproduct is also exempt from reporting if its only commercial purpose is for use by public or private organizations that:
 - (1) Burn it as a fuel,
 - (2) Dispose of it as a waste, including in a landfill or for enriching soil, or
 - (3) Extract component chemical substances from it for commercial purposes. (This exclusion only applies to the byproduct; it does not apply to the component substances extracted from the byproduct.) (40 CFR 720.30(g), referenced by § 711.10(c))

³ Note that “commercial purpose” refers to the broad definition in 40 CFR 704.3 (“the purpose of obtaining an immediate or eventual commercial advantage”). It is not synonymous with the narrower definition of “commercial use” at 40 CFR 711.3, which is only intended for further subcategorizing reportable uses (in Part III reporting) between industrial, commercial, and consumer settings.

- For certain listed manufacturing processes, the listed byproducts are exempt when recycled or otherwise used within a site-limited, physically enclosed system that is part of the same overall manufacturing process from which the byproduct substance was generated, and when the site is reporting the byproduct or a different chemical substance that was manufactured from the recycled byproduct or manufactured in the same overall manufacturing process (40 CFR 711.10(d)(1)). For the Kraft pulp and paper industry, EPA listed three of the industries byproduct streams as potentially exempt: black liquor, black liquor oxidized, and calcium carbonate.

- The manufacturing of byproducts may be exempt from reporting if the byproducts are manufactured solely in certain equipment (i.e., (i) Pollution control equipment or (ii) Boilers used to generate heat or electricity for that site) when that equipment is not integral to the chemical manufacturing processes of the site (40 CFR 711.10(d)(2)).

Listed Manufacturing Processes:

As of 2022, the listed manufacturing processes and certain related byproduct substances are:

- Portland cement manufacturing, and
- Kraft pulping process (40 CFR 711.10(d)(1)(i)).

The public may petition for amendments to this list of industrial processes and associated byproducts (40 CFR 711.10(d)(1)(ii)). For more information, see www.epa.gov/cdr.

2. When is an intermediate reportable?

Intermediates are reportable under the CDR rule unless the chemical substance or chemical process stream meets the regulatory definition of a non-isolated intermediate or is otherwise exempted at 40 CFR 720.30 (h) (referenced by 40 CFR 711.10(c)). For example, in the Kraft pulp and paper industry green liquor is not reportable when it is manufactured and used in a continuous process and in a manner that it is non-isolated. See Table 1 for additional information.

Kraft Pulp and Paper Reporting under the CDR Rule

The Kraft pulping cycle is a chemical recovery and reuse cycle that produces several different streams. Generally, the pulping cycle begins with the use of white liquor to break down the pulp to release lignin, allowing the resulting cellulose fibers (now lignin-free) to be used for paper production. This process results in the production of black liquor as a byproduct. The black liquor byproduct is used to manufacture green liquor. Calcium oxide is used to turn the green liquor into white liquor, resulting in the production of calcium carbonate as a byproduct. In a side process, the calcium carbonate is recycled to produce calcium oxide. Figure 1 provides a process flow diagram of the Kraft pulping cycle. Table 1 provides guidance on whether each stream is reportable or exempt from CDR rule reporting obligations:

Table 1: CDR Reporting Requirements for Select Examples of Kraft Pulp and Paper Activities^a

Stream Number	Chemical Substance	Generalized Process Description	CDR Reporting Requirement ¹
1	<i>Black liquor</i> (CASRN 66071-92-9)	<i>Sulfite liquors and Cooking liquors, spent</i> (CASRN 66071-92-9, referred to by industry as <i>black liquor</i>), is a byproduct resulting from the pulping process and is separated from the commercial product (i.e., cellulose) via a washing process. The resulting byproduct is concentrated and sent through the recovery furnace to generate <i>green liquor</i> .	Not Reportable for CDR purposes when this byproduct is recycled or otherwise used within a site-limited, enclosed system. ^b Reportable if this byproduct is not recycled or used to manufacture another chemical substance within an enclosed system at the same site. ^c
2	<i>Black liquor, oxidized</i> (CASRN 68514-09-0)	<i>Sulfite liquors and Cooking liquors, spent</i> (CASRN 66071-92-9, referred to by industry as <i>black liquor</i>) is oxidized at some sites to facilitate odor reduction during combustion in the recovery furnace, resulting in <i>Sulfite liquors and Cooking liquors, spent, oxidized</i> (CASRN 68514-09-0, referred to by industry as <i>black liquor, oxidized</i>). Other than odor reduction at the manufacturing site, the oxidation of the byproduct serves no commercial purpose separate from that of the <i>black liquor</i> .	Not Reportable for CDR purposes when this byproduct is recycled or otherwise used within a site-limited, enclosed system. ^b Reportable if this byproduct is not recycled or used to manufacture another chemical substance within an enclosed system at the same site. ^c

Table 1: CDR Reporting Requirements for Select Examples of Kraft Pulp and Paper Activities^a

Stream Number	Chemical Substance	Generalized Process Description	CDR Reporting Requirement ¹
3	Green liquor (CASRN 68131-30-6)	<p><i>Sulfite liquors and Cooking liquors, green</i> (CASRN 68131-30-6, referred to by industry as <i>green liquor</i>) is produced when <i>black liquor or black liquor, oxidized</i> is burned for energy recovery in the Kraft cycle and the liquefied inorganic chemicals drained from the bottom of the energy recovery furnace (also known as <i>energy recovery furnace smelt</i>) are dissolved in water.</p> <p><i>Green liquor</i> subsequently undergoes reaction with <i>calcium oxide</i> to form <i>white liquor</i>. <i>Green liquor</i> is transformed in whole or in part to intentionally manufacture another chemical substance. As used in the pulping cycle, this substance is an intermediate.</p>	<p>Not Reportable for CDR purposes when this intermediate is manufactured and used in a continuous process and in a manner that it is non-isolated.</p> <p>Reportable if it is not a non-isolated intermediate.</p> <p>NOTE: Isolation can occur when <i>green liquor</i> is diverted into flow-through storage tanks (e.g., to allow settling of solids) and held or stored for a period of time in excess of the time technically needed to successfully produce the green liquor. For example, holding or storing the green liquor for delayed or future use in the production of white liquor would be considered isolation.</p>
4	Lime or Calcium oxide (CASRN 1305-78-8)	<p><i>Calcium oxide</i> (CASRN 1305-78-8 referred to by industry as <i>lime</i>) is produced when the <i>calcium carbonate</i> byproduct is heated in the lime kiln to drive off carbon dioxide (CO₂).</p> <p><i>Calcium oxide</i> is then used as a reagent in a reaction with <i>green liquor</i> to form <i>white liquor</i>. <i>Calcium oxide</i> is transformed in whole or in part to intentionally manufacture another chemical substance. As used in the pulping cycle, this substance that is itself produced in the same overall Kraft process manufacturing equipment can be considered an intermediate for CDR purposes.</p>	<p>Not Reportable for CDR purposes if it is an intermediate and consumed in reaction with <i>green liquor</i> in a continuous process and in a manner that is not isolated.</p> <p>Reportable if it is not a non-isolated intermediate.</p>

Table 1: CDR Reporting Requirements for Select Examples of Kraft Pulp and Paper Activities^a

Stream Number	Chemical Substance	Generalized Process Description	CDR Reporting Requirement ¹
5	Calcium carbonate (CASRN 471-34-1)	Calcium carbonate, a byproduct of using <i>lime</i> to turn <i>green liquor</i> into <i>white liquor</i> using a causticizing reaction, is washed and sent to a lime kiln to regenerate <i>calcium oxide</i> for use in the causticizing reaction.	Not Reportable for CDR purposes when this byproduct is recycled or otherwise used within a site-limited, enclosed system. ^b Reportable if this byproduct is not recycled or used to manufacture another chemical substance within an enclosed system at the same site. ^c
6	White liquor (CASRN 68131-33-9)	<i>White liquor</i> is reacted with wood chips, through application of high temperature and pressure, to break down the pulp and release <i>lignin</i> (CASRN 9005-53-2), allowing the resulting cellulose fibers (now lignin-free) to be used for paper production. <i>Black liquor</i> is a byproduct of this reaction.	Reportable. <i>White liquor</i> is the product of a series of reactions, starting with <i>black liquor</i> and ending with <i>white liquor</i> .

^a Note that the guidance is generally applicable to most Kraft pulp and paper mills; however, each site will have to evaluate their process to ensure their process stream meets the CDR reporting and exemption requirements.

^b Byproduct substances listed in 40 CFR 711.10(d)(1)(i) are not subject to reporting under CDR when recycled or otherwise used within a site-limited, physically enclosed system that is part of the same overall manufacturing process from which the byproduct substance was generated, and when the site is reporting the byproduct or a different chemical substance that was manufactured from the recycled byproduct or manufactured in the same overall manufacturing process. (40 CFR 711.10(d)(1))

^c Your chemical production can be bifurcated between reportable and not reportable amounts. Report only the volume that meets the reportable requirements.

For further information:

To access copies of additional fact sheets and other CDR information, visit www.epa.gov/cdr. These documents might be of particular interest:

- For additional information about byproducts, see [Chemical Data Reporting Byproducts, Impurities, and Recycling Scenarios](#).
- For additional information about non-isolated intermediates, see [TSCA Chemical Data Reporting Fact Sheet: Non-Isolated Intermediates](#).

If you have questions about CDR, you can contact the TSCA Hotline by phone at 202-554-1404 or e-mail your question to eCDRweb@epa.gov.