

TSCA Chemical Data Reporting

Fact Sheet: Byproducts Reporting for the Printed Circuit Board Industry

This fact sheet provides information on existing Chemical Data Reporting (CDR) rule requirements related to byproducts reporting by persons who manufacture printed circuit boards and may be subject to CDR requirements. Persons who recycle or otherwise use the byproducts may also find this fact sheet useful.

The primary goal of this document is to help the regulated community comply with the requirements of the CDR rule. 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.

Printed Circuit Board Manufacturing and the CDR Rule

Reporting under CDR 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*.

Printed circuit board manufacturing typically results in the manufacturing of byproducts (which may be called spent solutions, produced excess solutions, or excess chemistry by manufacturers) that may contain valuable chemical substances with commercial recycling potential. Such byproduct manufacturing is potentially reportable under the CDR rule. Additionally, when the byproducts are used as feedstocks to manufacture other chemical substances, that step may itself be manufacturing subject to the CDR rule.

1. What is a byproduct?

Byproduct means a chemical substance produced without a separate commercial intent during the manufacture, processing, use, or disposal of another chemical substance(s) or mixture(s). (40 CFR 704.3)

2. What is a byproduct manufactured for commercial purposes, and who is the manufacturer?

Manufacturer means a person who manufactures a chemical substance. (40 CFR 711.3)

Manufacture means to manufacture, produce, or import, for commercial purposes. Manufacture includes the extraction, for commercial purposes, of a component chemical substance from a previously existing chemical substance or complex combination of chemical substances. A chemical substance is co-manufactured by the person who physically performs the manufacturing and the person contracting for such production when that chemical substance, manufactured other than by import, is:

- (1) produced exclusively for another person who contracts for such production, and
- (2) that other person dictates the specific chemical identity of the chemical substance and controls the total amount produced and the basic technology for the manufacturing process. (40 CFR 711.3)

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)

Byproducts in Printed Circuit Board Manufacturing

The use of certain solutions to manufacture printed circuit boards may result in the manufacture of one or more chemical substances as byproducts.

1. When is a byproduct reportable?

Like other chemical substances manufactured for commercial purposes, byproducts resulting from the manufacture of printed circuit boards are subject to CDR reporting unless an exemption applies.

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 manufacturer of a

byproduct is exempt from reporting the byproduct if it is not “used for commercial purposes.” (40 CFR 720.30(h)(2), referenced by § 711.10(c))¹

There are other circumstances where a byproduct may be exempt:

- The manufacturer of a byproduct is also exempt from reporting it 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)).
- 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)).

Consideration for applying “extract component chemical” exemption:

In general, byproducts from the printed circuit board industry are not likely to fall within this exemption. This is because component substances (e.g., copper chloride, copper tetramine dichloride (CTADC)) are, or need to be, converted into other copper compounds in the process of being separated from the rest of the byproduct. Consequently, it is unlikely that the byproduct or any identifiable component compounds would be exempt. As described in Table 1, you can either report the entire byproduct as a UVCB substance or report known compounds.

As of 2020, the listed manufacturing processes 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.

¹ 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.

- 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)).

Consider whether the “pollution control equipment” exemption could apply to byproducts produced during wastewater treatment, electrowinning, and neutralization of stripper solutions. See Table 1 for examples.

Table 1 identifies some of the materials that could be manufactured as byproducts of

various processes used for printed circuit board manufacture.

2. If I further process my byproduct to prepare it for use, what are my reporting obligations?

Note that further chemical processing of a byproduct to prepare it for a use may lead to the manufacture of other chemical substances, each of which may be subject to reporting under CDR. Depending upon your process, some of the manufactured chemical substances may be non-isolated intermediates, which are exempted from reporting under CDR. For more information, see the [Fact Sheet: Non-isolated Intermediates](#).

Suppose, for example, that tin nitrate is generated from the stripping of tin during the manufacture of printed circuit boards. You could calculate quantities of the tin compounds (in solutions or any other forms) removed from the process equipment if those represent the total quantity of all of the tin compounds that were generated in the process equipment. Used tin stripping solutions may contain tin nitrates and/or tin oxides. If more than 25,000 lbs of a specific tin compound is generated, you may have triggered reporting obligations. The tin nitrate is converted to tin hydroxide, which is then sold to a recycler who uses it to manufacture tin. In that case, both the tin nitrate and the tin hydroxide have commercial purposes and would be reportable by the printed circuit board company.

3. Who is responsible for reporting substances manufactured in further processing?

After the printed circuit board manufacturer manufactures byproducts, those byproducts may be further processed, resulting in the manufacture of other chemical substances. The entity that processes the byproducts to manufacture the other chemical substances is the entity responsible for reporting the other chemical substances. If the printed circuit board manufacturer sent those byproducts to a company that conducts the further processing (i.e., a recycler), this recycler would be responsible for reporting the chemical substances resulting from the further processing of the byproduct.

Continuing with the tin stripper example, a recycler uses the tin hydroxide to manufacture tin. The recycler would report the manufacture of tin.

A note about reporting downstream processing and use information. Although the printed circuit board manufacturer may have requirements to report information about the downstream processing and use of the chemical substances that it manufactured, it does not report that it is

the manufacturer of chemical substances actually manufactured by other downstream entities (e.g., chemical substances manufactured by a downstream recycler).

Reporting Byproducts under CDR

1. How is a byproduct characterized for identification purposes?

Based on information available to EPA, the Agency believes printed circuit board manufacturers often consider their byproducts to be mixtures of individual chemical substances. However, EPA recognizes that there are situations when a printed circuit board manufacturer may have a byproduct that is a complex reaction product and of unknown, uncertain or variable composition.

Generally, EPA considers each combination of substances resulting from a reaction to be either:

- (1) A mixture, composed of a definite number of two or more well-defined chemical substances to be named and listed separately; or
- (2) A reaction product (that is, a combination of chemicals resulting from a reaction) to be listed as a single chemical substance, using one name that collectively describes the products or, if that is not feasible, describes the reactants used to make the products. This type of byproduct is often identified as a single chemical substance using nomenclature for substances of Unknown or Variable composition, Complex reaction products and Biological materials (a "UVCB" substance) to represent what is often a chemical process stream if not a reaction product.

The manufacturing company should determine, based on the specific manufacturing scenario, whether the byproduct is more appropriately represented as a single well-defined chemical substance, a mixture of individual chemical substances, or a UVCB chemical substance.

It may be appropriate for CDR purposes to treat a complex byproduct as a mixture of well-defined chemical substances or even just a single well-defined chemical substance, even though there are uncharacterized components to the mixture. This would be instead of treating the byproduct as a single UVCB chemical substance. In addition, where a manufacturer reasonably concludes (after considering all the facts known to and reasonably ascertainable by the manufacturer) that the uncharacterized components of a byproduct will have no subsequent commercial purpose after they are manufactured, for CDR purposes, the manufacturer may treat the byproduct as a mixture of the remaining characterized components. The manufacturer would report each component as a separate substance. For each reported substance, the manufacturer would report the production volume associated only with that substance. The uncharacterized components that have no subsequent commercial purpose would not be reported to CDR.

Table 1 lists some of the potentially appropriate approaches for reporting some of the byproducts of printed circuit board manufacturing for the CDR rule.

2. How do I determine whether my byproduct meets the reporting threshold?

To determine whether a chemical substance meets the reporting threshold for CDR, compare the reporting volume threshold to the total amount of the chemical substance produced at the whole site (40 CFR 711.15). For example, if there are three processes on a site, and each process produces 10,000 lbs of byproduct Chemical X at the site in a single year, then the 25,000 lb reporting threshold is exceeded for Chemical X at the site.

When reporting based on the well-defined constituent(s) of the byproduct that have a subsequent commercial purpose, report the constituent(s) separately based on the production volume of each such constituent. When reporting a UVCB byproduct, report based on the entire production volume of the whole byproduct.

Table 1 gives examples of some of the processes used in the manufacture of printed circuit boards and byproducts which could be sent to a recycler for further processing.

Each company will need to determine if chemical substances recovered from the specific processes it uses in printed circuit board manufacture would be subject to CDR reporting.

Table 1: Possible Scenarios for Byproducts Used for a Commercial Purpose and Related to Printed Circuit Board Manufacturing

Process Resulting in Manufacture of Byproduct	Possible Byproduct Characterization and Reporting by Manufacturer <i>(see "When is a byproduct reportable?" on page 2)</i>
Etching copper clad boards with cupric chloride and hydrochloric acid, plus sodium chlorate, hydrogen peroxide or chlorine	<p>Report individual component chemicals that have a subsequent commercial purpose. For example, report as cupric chloride (CASRN 7447-39-4), if no other constituents have a subsequent commercial purpose¹; OR</p> <p>Characterize as a UVCB substance</p> <ul style="list-style-type: none"> • Exempt under §§ 711.10(c) and 720.30(g)(3) if characterized as a UVCB substance such that the recycler must treat extraction of cupric chloride as the recycler's manufacturing of cupric chloride and the remaining, non-extracted portions of the UVCB substance have no expected non-exempt commercial purpose. • Not exempt if the recycler uses the UVCB substance for some purpose other than the extraction of component chemical substances (e.g., cupric chloride). <p><i>If byproduct is not used for a commercial purpose, it is exempt from CDR under §§ 711.10(c) and 720.30(h)(2) and does not need to be reported.</i></p>
Etching copper clad boards with ammonium hydroxide, ammonium chloride and ammonium carbonate	<p>Report individual component chemicals that have a subsequent commercial purpose. For example, report as tetraamine copper dichloride (CASRN 10534-87-9), if no other constituents have a subsequent commercial purpose¹; OR</p> <p>Characterize as a UVCB substance</p> <ul style="list-style-type: none"> • Exempt under §§ 711.10(c) and 720.30(g)(3) if characterized as a UVCB substance such that the recycler must treat the extraction of tetraamine copper dichloride as the recycler's manufacturing of tetraamine copper dichloride and the remaining, non-extracted portions of the UVCB substance have no expected non-exempt commercial purpose.

	<ul style="list-style-type: none"> Not exempt if the recycler uses the UVCB substance for some purpose other than the extraction of component chemical substances (e.g., tetraamine copper dichloride). <p><i>If byproduct is not used for a commercial purpose, it is exempt from CDR under §§ 711.10(c) and 720.30(h)(2) and does not need to be reported.</i></p>
Plating copper using sulfuric acid bath	<p>Report individual component chemicals that have a subsequent commercial purpose. For example, report as copper sulfate (CASRN 7758-98-7), if no other constituents have a subsequent commercial purpose¹; OR</p> <p>Characterize as a UVCB substance</p> <ul style="list-style-type: none"> Exempt under §§ 711.10(c) and 720.30(g)(3) if characterized as a UVCB substance such that the recycler must treat extraction of copper sulfate as the recycler's manufacturing of copper sulfate and the remaining, non-extracted portions of the UVCB substance have no expected non-exempt commercial purpose. Not exempt if the recycler uses the UVCB substance for some purpose other than the extraction of component chemical substances (e.g., copper sulfate). <p><i>If byproduct is not used for a commercial purpose, it is exempt from CDR under §§ 711.10(c) and 720.30(h)(2) and does not need to be reported.</i></p>
Stripping to remove tin	<p>Report just the individual tin compounds that have a subsequent commercial purpose¹; OR</p> <p>Characterize as a UVCB substance</p> <ul style="list-style-type: none"> Exempt under §§ 711.10(c) and 720.30(g)(3) if characterized as a UVCB substance such that the recycler must treat the extraction of each individual tin compound with a commercial purpose as the recycler's manufacturing of those substances and the remaining, non-extracted portions of the UVCB substance have no expected non-exempt commercial purpose. Not exempt if the recycler uses the UVCB substance for some purpose other than the extraction of component chemical substances (e.g., tin compounds). <p><i>If byproduct is not used for a commercial purpose, it is exempt from CDR under §§ 711.10(c) and 720.30(h)(2) and does not need to be reported.</i></p>
Wastewater treatment using sodium hydroxide	<p>Exempt under § 711.10(d)(2) if the byproduct substance(s) are manufactured solely in pollution control equipment when that equipment is not integral to the chemical manufacturing processes of the site.</p>

	<p>If the equipment is integral to the chemical manufacturing processes of the site, then:</p> <ul style="list-style-type: none"> • Report as copper hydroxide (CASRN 20427-59-2), nickel hydroxide (CASRN 12054-48-7), and any other metal hydroxides or other substances having a subsequent commercial purpose¹; OR • Characterize as a UVCB substance: <ul style="list-style-type: none"> • Exempt under §§ 711.10(c) and 720.30(g)(3) if characterized as a UVCB substance such that the recycler must treat the extraction of hydroxides or other compounds as the recycler's manufacturing of those substances and the remaining, non-extracted portions of the UVCB substance have no expected or eventual non-exempt commercial purpose.² • Not exempt if the recycler uses the UVCB substance for some purpose other than the extraction of component chemical substances (e.g., copper hydroxide, nickel hydroxide, etc.). <p><i>If byproduct is not used for a commercial purpose, it is exempt from CDR under §§ 711.10(c) and 720.30(h)(2) and does not need to be reported.</i></p>
<p>¹ In the case where the printed circuit board manufacturer identifies the byproduct by its component constituents that have a subsequent commercial purpose, the recycler or other user of the byproduct reports only chemicals manufactured from the byproduct component. Any unreported portions of the byproduct would only be those that do not have a commercial purpose and would either be disposed of as a waste or become impurities in the subsequent product.</p> <p>² See discussion beginning on page 4 of this document, under "How is a byproduct characterized for identification purpose?"</p>	

Example -- Spent or Produced Excess Etchant

This example illustrates three approaches to characterizing a byproduct for reporting under the CDR rule from a printed circuit board manufacturing process which results in byproducts that may be reportable to CDR.

Background

TopNotch manufactures printed circuit boards using an etchant primarily comprised of cupric chloride and hydrochloric acid. Within the etchant bath, the cupric chloride reacts with the copper on the circuit boards to produce cuprous chloride. TopNotch adds hydrogen peroxide and additional hydrochloric acid to the bath to convert the cuprous chloride back into cupric chloride. This continues until the etchant bath no longer functions as desired, resulting in the production of spent cupric etchant containing cupric chloride, cuprous chloride, hydrochloric acid and various additives. The spent etchant is a complex combination of substances and it is not fully characterized as a mixture of well-defined chemical substances. TopNotch sends the spent cupric etchant to Recycler X.

Scenario 1: TopNotch characterizes the byproduct as a mixture of 99% cupric chloride, 0.50% cuprous chloride, 0.25% hydrochloric acid and 0.25% various other uncharacterized substances when it provides the byproduct to Recycler X. TopNotch reasonably concludes that Recycler X's only commercial purpose for the byproduct is to use the cupric chloride and cuprous chloride content of the byproduct (either to purify and sell the cupric chloride or to directly manufacture elemental copper from the cupric chloride or cuprous chloride). TopNotch reasonably expects that Recycler X will dispose of all of the other substances in the byproduct as wastes, after it has accomplished these objectives.

CDR reporting

TopNotch has manufactured what can be considered for CDR purposes a byproduct ~~product~~ mixture comprised of cupric chloride, cuprous chloride, hydrochloric acid, and various other uncharacterized chemical substances. TopNotch is able to identify that cupric chloride and cuprous chloride are the only components that will be used for a non-exempt commercial purpose, and therefore reports its manufacture of these two chemical substances. TopNotch does not report hydrochloric acid, which is a residual of starting ingredients and therefore is not manufactured by TopNotch, or the uncharacterized chemical substances in the mixture, because it can reasonably conclude that these other uncharacterized chemical substances will be disposed of as wastes.

Recycler X either purifies the cupric chloride and cuprous chloride from the mixture or, using electrolytic reduction, directly reduces these two substances to manufacture elemental copper. In neither case does it report that it is manufacturing cupric chloride or cuprous chloride. The manufacture of the two substances has already been reported by TopNotch. Recycler X still reports the elemental copper that it manufactures by electrolytic reduction of the cupric chloride and cuprous chloride.

Scenario 2: TopNotch characterizes the byproduct as a UVCB substance when it provides the byproduct to Recycler X. TopNotch reasonably expects that Recycler X will extract copper oxide (via a chemical reaction) from the UVCB substance and use it for further commercial purposes. TopNotch reasonably expects that Recycler X will dispose of the remainder of the UVCB byproduct as a waste.

CDR reporting:

TopNotch has manufactured a UVCB byproduct that is reportable under CDR. This is because Recycler X is extracting a chemical substance, copper oxide, that is not a component chemical substance. Recycler X must first react the component chemical substance, cupric chloride, to form the copper oxide before it a copper species is available for extraction..

Recycler X reports the manufacture of the copper oxide and any other chemical substances that it extracts from the UVCB.

Scenario 3: TopNotch characterizes the byproduct as a UVCB substance when it provides the byproduct to Recycler X. TopNotch reasonably expects that Recycler X will extract cupric chloride from the UVCB substance before using the cupric chloride for further commercial

purposes. TopNotch reasonably expects that Recycler X will dispose of the remainder of the UVCB byproduct as a waste.

CDR reporting:

TopNotch has manufactured a UVCB byproduct, but the manufacture of that UVCB byproduct is exempt from CDR reporting. This is because Recycler X has an exempt commercial purpose since it is only extracting the already present and well-characterized chemical substance, cupric chloride, from the UVCB substance as opposed to manufacturing a new substance, so therefore the byproduct is exempt.

Recycler X reports the manufacture of the cupric chloride and any other chemical substances that it extracts from the UVCB. Recycler X reports any elemental copper it manufactures by chemical processing of the cupric chloride it extracted.

Scenario 4: TopNotch characterizes the byproduct as a UVCB substance when it provides the byproduct to Recycler X. TopNotch reasonably expects that Recycler X will directly introduce the UVCB substance into an electrolytic manufacturing process for the production of copper metal, without first extracting any chemical substances from the UVCB substance.

CDR reporting:

Recycler X has a non-exempt commercial purpose for using the whole spent etchant: it is not simply extracting component chemical substances from the UVCB substance and disposing of the remainder as a waste.

TopNotch reports the manufacture of the UVCB. Recycler X reports the manufacture of copper metal.

For further information:

To access copies of additional fact sheets and other CDR information, log onto www.epa.gov/cdr.

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.