PUBLIC

ORIGINAL

UNITED STATES OF AMERICA
BEFORE THE FEDERAL TRADE COMMISSION
OFFICE OF ADMINISTRATIVE LAW JUDGES

In the Matter of Tronox Limited a corporation, National Industrialization Company (TASNEE) a corporation, National Titanium Dioxide Company Limited (Cristal) a corporation, And Cristal USA Inc. a corporation.	)	Docket No. 9377

RESPONDENTS' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

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PROPOSED FINDINGS OF FACT

I. THE PARTIES, THE TRANSACTION, AND THE PROCEEDING.

A. The Parties

a. Tronox

1. Tronox, Ltd. is a public company traded on the New York Stock Exchange (TRX). (Arndt, Tr. 1355[1]; PX0001-004). Tronox's global corporate headquarters are in Stamford, Connecticut. (Mei, Tr. 3143[2]; PX0001-004). Tronox is registered to do business under the laws of Australia. (PX0001-004).

2. Tronox is a global producer of titanium dioxide ("TiO2") pigment and titanium-bearing mineral sands. (RX1014; PX9053-010, -012). Tronox has global operations in North America, Europe, South Africa, and Australia, and serves customers around the world. (PX9053-012). Tronox's mines, feedstock facilities, and TiO2 pigment facilities are located in the United States, Australia, South Africa, and the Netherlands. (Mei, Tr. 3149-51). Tronox has a research and development facility in Oklahoma City, Oklahoma. (Engle, Tr. 2437).

3. Tronox was spun off of Kerr-McGee in 2005. (PX0001-004). Kerr McGee "is the predecessor to Tronox." (Dean, Tr. 2919-20). In 1988, Kerr-McGee had one plant in Hamilton, Mississippi, which was much smaller than it is today. (Romano, Tr. 2219-20). In 1992, Kerr-McGee and Minproc built the Kwinana plant in Australia as a joint venture. (Romano, Tr. 2219-

[1] Mr. Brennen Arndt is senior vice president of investor relations at Tronox. (Arndt, Tr. 1353). Mr. Arndt began working at Tronox in May 2012 as vice president of investor relations. (Arndt, Tr. 1353). Mr. Arndt has approximately 34 years of experience in the chemical industry. (Arndt, Tr. 1392).

[2] Ms. Rose Mei is director of sales and operation planning (S&OP) and global logistics at Tronox. (Mei, Tr. 3140-41). Ms. Mei has worked at Tronox for five years, and has led global planning and logistics at Tronox since 2016. (Mei, Tr. 3140). Ms. Mei's responsibilities include "manag[ing] the distribution network, all the warehouses around the globe, to deliver the products to our customer and to make sure we have inventory in the right place to support the requirements anytime." (Mei, Tr. 3141). Ms. Mei has over 20 years global supply chain and logistics experience. (Mei, Tr. 3147).

20). Around 1990, Kerr-McGee licensed its chloride technology to a company called Tiofine to convert their sulfate process facility at Botlek to a chloride process facility. (Dean, Tr. 2951-2952). Tiofine later sold the Botlek facility to Kemira in the 1990s. (Dean, Tr. 2951-52) In the early 2000s, Tronox acquired two facilities from Kemira: Botlek in the Netherlands and two other plants in Savannah, Georgia. (Romano, Tr. 2219-20; Dean, Tr. 2950).

4. Today, Tronox has three TiO2 facilities, three mines, two slag plants, and one synthetic rutile kiln. (PX9053-12). Tronox's TiO2 pigment plants are located in Hamilton, Mississippi; Botlek, The Netherlands; and Kwinana, West Australia. (Mei, Tr. 3151; Romano, Tr. 2231). Tronox employs about 3,200 people worldwide. (PX9053-12).

5. Tronox's total production capacity is approximately 465,000 metric tons of TiO2 pigment per year. (Quinn, Tr. 2317; Engle, Tr. 2492). In 2016, TZMI, an industry analyst, reported that Tronox's production capacity of TiO2 pigment was 236,000 tons per year for Hamilton (RX0105.0134); 152,000 tons per year for Kwinana (RX0105.0137); and 90,000 tons per year for Botlek (RX0105.0129). [redacted]

[redacted]

6. As of September 2017, Tronox reported that it operates its TiO2 pigment facilities at over 90% capacity utilization. (PX9053-012).

7. Tronox produces 91,000 metric tons of rutile and leucoxene, 220,000 metric tons of synthetic rutile, 410,000 metric tons of titanium slag, 200,00 metric tons of zircon, and 221,000 metric tons of pig iron annually. (PX9053-12). With its mines and pigment facilities, Tronox is the "[w]orld's largest fully vertically integrated titanium mining-to-titanium dioxide value chain with 3 mineral sands mines and 3 pigment production facilities." (PX9053-011).

8. Tronox went into Chapter 11 bankruptcy in January 2009 and emerged from bankruptcy in February 2011. (Romano, Tr. 2209-10). In June 2012, Tronox acquired the mineral sands division of Exxaro Resources. (Romano, Tr. 2254; Mancini, Tr. 2798). In 2017, Tronox reported annual revenue of $1.49 billion and EBITDA of $279 million. (PX9053-012).

b. Cristal

9. The National Titanium Dioxide Company Ltd. (hereinafter "Cristal"), is a privately held company registered under the laws of the Kingdom of Saudi Arabia. (RX0171.0035). [redacted] TASNEE is the parent company and [redacted] owner of Cristal. (Stoll, Tr. 2063; [redacted]. Cristal USA Inc. ("Cristal USA") is an indirectly owned subsidiary of Cristal. (JX0001). Cristal USA operates an administrative and technical center in Baltimore, Maryland, and two TiO2 manufacturing facilities in Ashtabula, Ohio. (JX0001).

10. Cristal subsidiaries operate TiO2 pigment manufacturing facilities on five continents: Ashtabula (Ohio), Ashtabula II (Ohio), Yanbu (Saudi Arabia), Stallingborough (United Kingdom), Bunbury (Australia), Bahia (Brazil), Fuzhou (China), and Thann (France). (JX0001). Cristal mines feedstock in Brazil and Australia. (PX9053-016). Cristal and it subsidiaries employ

approximately 4,100 people worldwide. (PX9053-014). Cristal does not produce enough feedstock to supply its own pigment plants, and therefore purchases feedsock on the market for its pigment production. (Stoll, Tr. 2111; Turgeon, Tr. 2604).

11. Cristal is the world's second largest TiO2 pigment producer. (PX9053-014). Cristal's annual nameplate capacity for TiO2 production is approximately 858,000 metric tons. (PX9053-014). [redacted] In 2015, Cristal extended its global footprint into China by acquiring Jiangxi Tikon Titanium Company. (Stoll, Tr. 2106).

B. The Transaction

a. Background & Terms

13. Tronox had been in conversation with Cristal regarding a potential deal since 2015. (Quinn, Tr. 2302; RX0236.0001). In October 2016, Tom Casey, then-CEO of Tronox, reported to the board of directors that Tronox and Cristal had reached a "preliminary framework for a deal." (Quinn, Tr. 2300).

14. On November 23, 2016, Tronox and Cristal agreed to non-binding deal construct, and due diligence between the parties commenced. (PX9053-18).

15. On February 21, 2017, Tronox announced a definitive agreement to acquire the titanium dioxide ("TiO2") business of Cristal. (PX0009-001; PX0001-005).

16. Tronox initially anticipated closing its acquisition of Cristal in the first quarter of 2018. (PX9053-18).

17. [redacted]

Shareholders approved the transaction on October 2, 2017. (PX9053-18).

18. To fund the cash portion of the purchase price for the acquisition of Cristal, Tronox sold its Alkali business to Genesis Energy LP in September 2017 for $1.325 billion. (Quinn, Tr. 2306-07; PX9053-010).

19. As part of the transaction, Tronox would receive Cristal's "pigment operations, global pigment operations around the world, plus [Cristal's] mineral sands operations in Australia and in Brazil." (Quinn, Tr. 2309-10; RX0236).

20. Tronox projected that after the transaction, its TiO2 pigment production would grow to 1.3 million tons annually with 11 production plants in 8 countries. (PX9053-15).

b. This Highly Synergistic Transaction Will Create a Lower-Cost, More Vertically Integrated, More Competitive Tronox.

21. "The overall strategic intent" of the Tronox-Cristal transaction is to lower Tronox's costs, improve Tronox's competitive position, and enable Tronox "to create a more viable,

sustainable company throughout" all of the cycle of the cyclical TiO2 industry. (Quinn, Tr. 2324; PX0010[3]).

22. The transaction is "a highly synergistic acquisition." (Quinn, Tr. 2329; PX0010[4]). The synergies result from the fact that Tronox and Cristal are "complementary in terms of the nature of the business." (Quinn, Tr. 2341; PX0010-218). Tronox is "long" on feedstock. This means Tronox has more feedstock than is necessary to supply its TiO2 pigment plants. (Turgeon, Tr. 2601-03).[5] Cristal, by contrast, is "short" on feedstock. (Turgeon, Tr. 2604). "[T]hat's where all the value of that deal come[s] into play." (Turgeon, Tr. 2654). "[T]he acquisition of Cristal provides a better balance between feedstock availability and feedstock requirements to make TiO2, because Cristal is feedstock short." (Stern, Tr. 3851).

23. The transaction will create "the world's most highly integrated titanium dioxide producer." (Quinn, Tr. 2344; PX0010-176). Currently, Tronox is the "sixth largest" TiO2 producer globally. (Quinn, Tr. 2345; PX0010-176). The largest producer, Chemours, is the "800 pound gorilla" in the TiO2 industry. (Quinn, Tr. 2344; PX0010-176). Chemours "has large-scale assets," "large-scale technology . . . that allows them to use a variety of feedstocks, including lower quality feedstocks," and, critically, a "low-cost position." (Quinn, Tr. 2344-45). The transaction

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[3] In PX0010, "Triangle" is the code name for Tronox and "Circle" is the code name for Cristal. "Hexagon" was the code name for the transaction itself. (Quinn, Tr. 2332-33).

[4] Mr. Jeffry N. Quinn is the chief executive officer (CEO) of Tronox Ltd. (Quinn, Tr. 2293). Mr. Quinn has been on the board of executives at Tronox since 2011 when the company exited bankruptcy. (Quinn, Tr. 2294). Mr. Quinn became the CEO in December 2017. (Quinn, Tr. 2294). Mr. Quinn has 14 years of experience in the chemical industry, and approximately 14 years before that in mining and refining industries. (Quinn, Tr. 2295).

[5] Mr. Jean-Francois Turgeon is the executive vice president of Tronox and chief operating officer (COO). (Turgeon, Tr. 2579). Mr. Turgeon was hired in January 2014 as the executive vice president of Tronox and president of the TiO2 business. (Turgeon, Tr. 2579). Mr. Turgeon is a chemical engineer with a master's degree in engineering. (Turgeon, Tr. 2579). For his master's degree, Mr. Turgeon "wrote a thesis on the digestion of slag in the sulfate process." (Turgeon, Tr. 2580). Mr. Turgeon worked for Rio Tinto, a mining company, for 24 years. (Turgeon, Tr. 2580).

will enable Tronox to compete with Chemours and Lomon Billions because it would lower Tronox's costs and would make Tronox "on par with Chemours in terms of size to be able to serve a growing . . . global customer base." (Quinn, Tr. 2345-46). The objective of the transaction is for Tronox "to be profitable throughout the cycle" of the TiO2 industry. (Romano, Tr. 2217).

24. Tronox's customers have been growing and "want[] Tronox to grow with them," and the Cristal transaction was an "obvious way for [Tronox] to meet [its] customer requirement" and grow along with its customers. (Turgeon, Tr. 2645). Tronox's customer base is "made up north of 50 percent global customers." (Romano, Tr. 2238[6]). Tronox's customers "are much bigger" than Tronox, especially true in the paint and coatings industry, where the paint companies are "multiple times" Tronox's size. (Quinn, Tr. 23454-46; PX10). Tronox's strategy on the commercial side "has been to grow with the customer[s] that are growing faster than the market." (Turgeon, Tr. 2659). "So in order for us to be successful, we also need to grow faster than the market." (Turgeon, Tr. 2659). In order to be able to supply these companies during their long-term growth, Tronox needs additional capacity. (Mancini, Tr. 2749-51). "Growing in size and substance allows" Tronox to improve its cost position overall and compete better. (Quinn, Tr. 2345-46; PX0010).

25. The transaction will enable Tronox to better compete with growing Chinese companies, which benefit from "low labor costs," "low capital costs," and "assistance from . . . the Government" with respect to "developing a global business." (Quinn, Tr. 2347). The largest of

[6] Mr. John Romano is senior vice president and chief commercial office (CCO) at Tronox. (Romano, Tr. 2214). Mr. Romano has been senior vice president and CCO for three years. (Romano, Tr. 2214-15). In total, Mr. Romano has been employed at Tronox for nearly 30 years. (Romano, Tr. 2214). Previously, Mr. Romano served as senior vice president of sales and marketing, senior vice president and president of the pigment division, head of marketing for the pigment division, and head of sales. (Romano, Tr. 2215). Based on Mr. Romano's background and experience at Tronox and in the TiO2 industry generally, Mr. Romano is knowledgeable to testify to Tronox's business around the world, Chinese competition in the industry, TiO2 pricing, and the market for both chloride-process and sulfate-process TiO2. (Romano, Tr. 2218-19).

the Chinese producers, Lomon Billions, is bigger than Tronox. (Turgeon, Tr. 2659-60; Romano, Tr. 2243-44; Engle, Tr. 2492-93). Lomon Billions has "grown rapidly" in recent years and has publicly stated that its goal is to "dominate [the TiO2] industry within the next few years." (Quinn, Tr. 2347; PX0010). Today, Tronox faces "significant competition from China in all world regions" (Quinn, Tr. 2348), and Chinese competition in the future is going to get "more intense." (Quinn, Tr. 2348-49). Tronox "had to do something" to respond to Chinese competition. (Quinn, Tr. 2347). To deal with the competition, Tronox "chose to grow" to become "a vertically integrated producer of TiO2 pigment." (Quinn, Tr. 2347-48; PX0010).

26. The transaction will not only "increase the size" of Tronox, but also "reduce the diversity of Tronox's business." (Quinn, Tr. 2328-29; PX0010). Combined with the elimination of the alkali business,[7] the transaction will complete leadership's plan to create a "real pure, plain titanium dioxide producer." (Quinn, Tr. 2328-29; PX0010). New Tronox's singular focus on TiO2 will "enhance shareholder value" and "increase the growth rates for earnings and EBITDA." (Quinn, Tr. 2329; PX0010).

27. The transaction will also generate efficiencies, which would allow Tronox to become more efficient, by spreading costs over a greater number of assets. (Mancini, Tr. 2749-51). The synergies Tronox expects to achieve in the Tronox-Cristal transaction generally fall within the following four major categories: (1) feedstock related synergies; (2) selling, general, and administrative ("SG&A"); (3) operating synergies; and (4) procurement, supply chain, and logistics. (Mancini, Tr. 2768-69; Quinn, Tr. 2336-37; PX0010).

[7] "Cristal's business had better . . . earnings, better EBITDA, and better cash flow generation potential than the alkali business that (Tronox) were giving up." (Quinn, Tr. 2319; RX0236). Thus, Tronox sold its alkali business "to fund the cash portion of the purchase price of the Cristal transaction." (Quinn, Tr. 2307; RX0236). The alkali business was sold for approximately "1.3 billion in cash." (Quinn, Tr. 2306).

28. The transaction will allow Tronox to "grow and increase [its] footprint" and thereby be able to better compete in "a very competitive industry." (Quinn, Tr. 2318-19; RX0236). By increasing Tronox's "footprint in the pigment plants," the acquisition of Cristal would allow Tronox to run its mineral sands operations and smelters "all out," or at "full capacity."[8] (Quinn, Tr. 2317-18). Tronox will be able to run assets full out by consuming the produced feedstock itself without having to attempt to sell it "into the merchant market, which may or may not be attractive at any given time." (Quinn, Tr. 2317-18). This would allow Tronox to produce more high-grade feedstock with the same facilities. (Quinn, Tr. 2317-18; RX0236). The advantage to Tronox of running its plants full out is that "it reduces" costs. (Quinn, Tr. 2321). "It takes the same fixed costs and spreads that out over a broader production volume," resulting in lower costs. (Quinn, Tr. 2321).

29. The transaction will also create "significant shareholder value" for Tronox's investors. (Quinn, Tr. 2333; PX0010). The transaction is "significantly accretive from an earnings-per-share basis," will "create a stronger balance sheet and better free cash flow generation," and will "have a deleveraging effect on the company because of the synergies and the EBITDA growth."[9] (Quinn, Tr. 2328). Tronox's standalone TiO2 business's average EBITDA from 2011 through 2016 is $428 million. After adding the average EBITDA for Cristal from 2011 through 2016 and the $237 million of synergies annualized to $428 million, it results in a pro-

[8] To run a plant "full out" means running at or above nameplate capacity, subject to good maintenance practices. In other words, "[r]unning as much volume through those plants" as possible. (Quinn, Tr. 2321).

[9] As explained by Mr. Quinn, "[l]everage . . . can kill a company. In a cyclical business . . . during downturns in the industry, if [a company is] highly leveraged, that's a . . . problem. It also restricts [a company's] . . . ability to invest in the business and . . . is a significant operating issue." (Quinn, Tr. 2335-36; PX0010-174). "Tronox had just come from a period of time where it had that issue [of leverage] . . . so it was—the opportunity and the possibility of (deleveraging) relativity quickly was viewed by the board as being a very important component of the transaction." (Quinn, Tr. 2335-36; PX0010-174).

forma number of EBITDA for New Tronox—just "over a billion dollars." (Quinn, Tr. 2331-32; PX0010-173).

30. Tronox's experience in the 2015 economic down cycle was another factor in its decision to seek to acquire Cristal. (Mancini, Tr. 2752). Tronox's experience in the 2015 down cycle caused it to realize it needed to establish a stronger base of profitability, and that it needed to lower the ratio of debt to EBITDA. (Mancini, Tr. 2752-55)

31. If the transaction is not allowed to move forward, Tronox risks becoming "irrelevant" in the global TiO2 market, in large part because of "very aggressive," low-cost Chinese competitors. (Turgeon, Tr. 2733-34). "That's the reason why we're doing that deal with Cristal." (Turgeon, Tr. 2733-34).

C. Pre-Hearing Background & Proceeding

32. Tronox has fully cooperated with the FTC since announcing the proposed acquisition of Cristal on February 21, 2017. (PX0009; PX0001-005).

33. On March 14, 2017, Tronox and Cristal filed a Premerger Notification and Report Form with the FTC and the Department of Justice pursuant to the Hart-Scott Rodino Act ("HSR Act") 15 U.S.C. § 18a. The filing informed the FTC of the transaction's "drop-dead" expiration date of May 21, 2018, which was more than a year away at that time. (PX0009).

34. The FTC issued a request for additional information and documentary material to assist its review of the merger on April 13, 2017. (PX0002).

35. Tronox substantially complied with the formal request for information on September 6, 2017. (PX0002).

36. Cristal substantially complied with the FTC's request for additional information on September 13, 2017, providing requested information on September 6, 2017 and a log of

documents withheld for privilege on September 20, 2017. (PX2003). The parties provided over 1.3 million documents comprised of 4.2 million pages, as well as narrative answers and comprehensive analysis to the Commission. (*See* PX0002, PX0003).

37. Tronox and Cristal then granted the FTC additional time past their original deadline of October 23, 2017, to review the requested information, and by this agreement, the HSR waiting period expired on December 1, 2017. (PX9087). The FTC allowed the extended deadline to pass without acting and without announcement. (PX9086-005).

38. On December 5, 2017, the two remaining commissioners at the FTC authorized Complaint Counsel to file a complaint against Tronox and Cristal and to seek a temporary restraining order and preliminary injunction in federal district court to block the Tronox-Cristal transaction. (RX1399).

39. The Commission set a trial date for this matter of May 18, 2018. (Administrative Complaint, Docket No. 9377, December 5, 2017; Order Regarding Scheduling, Docket No. 9377, January 24, 2018).[10] At a pretrial hearing before the FTC on this action, Complaint Counsel claimed that the FTC did not want to seek a preliminary injunction in federal court because Tronox had not yet received European regulatory approval to close. (Dec. 20, 2017, Pretrial Conf. Tr. 17).

40. On March 1, 2018, Tronox announced that it had extended its agreement with Cristal to December 31, 2018, with an automatic 3-month extension to March 31, 2019, if needed. (PX9102-03). The re-negotiated deal came at a cost: if (1) at any point between January 1, 2019 and March 31, 2019, Tronox decides not to proceed with the transaction due to regulatory

[10] The Commission initially set a trial date for this matter of May 8, 2018. (RX1399; Order Regarding Scheduling, Docket No. 9377, December 20, 2017). The Commission then postponed that trial date to May 18, 2018, due to a temporary government shutdown. (Order Regarding Scheduling, Docket No. 9377, January 24, 2018).

uncertainty, *or* (2) if the deal expires on March 31, 2019, Tronox will be required to pay Cristal a $60 million break-fee. (PX9102-003).

41. On May 17, 2018, the Court held a final prehearing conference between the parties. The hearing commenced in this case on May 18, 2018, when the Court heard opening statements from both sides and began hearing witness testimony. Testimony continued over the course of the next month, with trial proceedings on the following dates: May 18, 23-25, and 30-31 and June 1, 6-8, 13-15, and 20-22. Over the course of trial, exhibits were received into evidence from the Respondents as set forth in the exhibit index in **Exhibit A**, and live testimony was received into the hearing record fromTronox and Cristal fact and expert witnesses as set forth in the witness index in **Exhibit B**.[11]

II. BACKGROUND ON THE TIO2 INDUSTRY

A. Titanium Dioxide ("TiO2")

42. TiO2 is "an industrial chemical primarily used as a pigment." (RX0171.0006; JX0001-02; *see also* Malichky, Tr. 275). TiO2 is "the standard white inorganic pigment used in a wide range of products for its exceptional durability and its ability to impart whiteness, brightness and opacity." (RX0171.0017; JX0001-02; Young, Tr. 641-42; Pschaidt, Tr. 965).

43. TiO2 is used in "paints, plastics, paper, fibers, inks, food and cosmetics. It shows up in everything from toothpaste to coffee cups to whitewall tires, primarily whitening paint, plastics, paper and rubber." (RX0171.0017-0018).

[11] At trial, Complaint Counsel notably presented testimony from only five customer witnesses despite having initially disclosed that as many as 39 customers were likely to possess information relevant to these proceedings. (Complaint Counsel's Mandatory Initial Disclosures Pursuant to 16 C.F.R. 3.31(b), Docket No. 9377, December 18, 2017, pp. 1, Appendix A) These 39 non-parties were TiO2 customers spanning every major industry that uses TiO2: paint, coatings, paper, plastics, inks, and pharmaceuticals. (Complaint Counsel's Mandatory Initial Disclosures Pursuant to 16 C.F.R. 3.31(b), Docket No. 377, December 18, 2017, pp. 1, Appendix A). At trial, Complaint Counsel called only five customer witnesses: four from the paint and coatings industry (representing PPG, Sherwin-Williams, Masco, and True Value) and one from the plastics industry (representing Deceuninck).

44. In coatings, TiO2 "provides functional characteristics such as opacity, whiteness, brightness, hiding power, and durability." (RX0171.0018; Malichky, Tr. 273). In plastics, TiO2 "is used to aid in the consistency of color quality." (RX0171.0018; RX1503). TiO2 "is also used in various paper applications as a filler to add brightness, opacity, and printing consistency." (RX0171.0018; RX1503).

45. TiO2 end use breaks down approximately as 60% coatings, 25% plastics, 10% paper, and 5% others specialty uses such as inks and pharmaceuticals. (Mouland, Tr. 1211). In a gallon of flat, latex, indoor paint, "between 20 and 40 percent of that could be titanium dioxide as raw material." (Vanderpool, Tr. 162). Darker colors have the least amount of TiO2 in them because other colorants in the paint replace it. (Vanderpool, Tr. 163). Due to the different properties of different grades of TiO2 provided by suface treatments, more TiO2 in paint does not necessarily indicate higher quality—some surface treatments allow customers to use as much as 20 percent less in TiO2 with the same effect. (Engle, Tr. 2453-54). [redacted] Producers also frequently make small improvements to the same grade without changing its number or price, and customers are able to continue purchasing the same grade for use in the same manner. (Engle, Tr. 2438-39).

a. TiO2 Manufacturing Process

47. TiO2 can be manufactured through either the chloride process or the sulfate process. (Turgeon, Tr. 2605-06; RX0171.0020).

48. The chloride process is a continuous process that uses chlorine gas. The reaction takes place in a high-temperature fluid bed. The feedstock is fluidized by chlorine, which creates a gas. The gas is then cooled, which creates a titanium tetrachloride molecule ("TiCl4"). The molecule is then oxidized with pure oxygen at a high temperature, which alters the molecule to create TiO2. (Turgeon, Tr. 2613-17).

49. In the sulfate process, feedstock is combined in batches with sulfuric acid. The sulfuric acid solubilizes the material into a "black liquor." The oxide in the material is chemically changed to become a sulfate. The TiO2 is then precipitated out of the "liquor" so that there is a waste acid and a solid titanium hydroxide. The titanium hydroxide is then "washed" and "calcined," which creates a TiO2 molecule. (Turgeon, Tr. 2613, 2617).

50. The chloride process is a continuous process, and the sulfate process is a batch process. (Turgeon, Tr. 2617-18). The sulfate process is more labor-intensive than the chloride process. These differences cause the chloride process to generally be more economically efficient than the sulfate process. (Turgeon, Tr. 2617-18).

51. Although there can be differences among both chloride-process and sulfate-process grades of TiO2, a molecule of TiO2 has the same chemical formula and molecular structure whether it's created through a sulfate process or a chloride process. (Turgeon, Tr. 2615, 2673; Malichky, Tr. 338-40).

52. Once a TiO2 molecule is obtained, producers differentiate their product by "finishing" the molecule into different "grades." Grades can be distinguished by differences in

attributes such as surface chemistry, solubility, and durability. Various grades are used to make plastics, paints, paper, etc. (Turgeon, Tr. 2620-22). Regardless of whether TiO2 is obtained through the chloride or sulfate process, it goes through the same "finishing" process in the "white end" of a TiO2 plant. (Turgeon, Tr. 2614).

53. The finishing process is more important to achieve the final product because the TiO2 that exists before finishing is the same material, regardless of whether it is obtained by the chloride or sulfate process. (Turgeon, Tr. 2621, 2623). The finishing process determines whether TiO2 is high quality or low grade, and not the the production process (i.e. chloride or sulfate production). (Engle, Tr. 2433).

54. As a result, a properly executed sulfate process produces TiO2 with the same whiteness and hue as a properly executed chloride process. (Turgeon, Tr. 2614-15). Western producers and "tier one" Chinese producers produce TiO2 through the sulfate process that is indistinguishable from TiO2 produced through the chloride process. (Turgeon, Tr. 2614-15).

b. TiO2 Feedstock

55. TiO2 "feedstock" refers to the raw material that gets transformed into TiO2 pigment. (Turgeon, Tr. 2580-81) [redacted]

56. The first step in developing TiO2 pigment starts at the mining stage. (Turgeon, Tr. 2585-86). Unlike many materials, titanium is mined near the surface of the Earth, typically as deep as 20-60 meters. The beginning material can either start as ilmenite, leucoxene, or as natural rutile. (Turgeon, Tr. 2585-88).

57. Tronox owns three mines: one on the west coast of Australia near Perth (Cooljarloo), one on the east coast of South Africa (KZN Sands), and one on the west coast of South Africa (Namakwa Sands). (Turgeon, Tr. 2590). Although other TiO2 producers also own mining facilities,[12] Tronox is the most vertically integrated of the world's TiO2 producers. (Turgeon, Tr. 2593-94).

58. TiO2 is mined, essentially, from sand, and the heavy minerals are then separated out. (Turgeon, Tr. 2586-87). Tronox's mines are essentially "old beach[es] . . . from when the sea was a bit further in." (Turgeon, Tr. 2586-87). The heavy minerals—ilmenite, natural rutile, and zircon—are concentrated in these sand dunes and are separated from the sands using gravity. (Turgeon, Tr. 2585-87). These heavy minerals are mined "on the surface," not underground. (Turgeon, Tr. 2587).

59. Ilmenite is titanium oxide and iron oxide combined together. (Turgeon, Tr. 2589-90). It is a mineral that is lower in TiO2 than natural rutile. (Turgeon, Tr. 2589-90). Ilmenite contains about 35%-65% TiO2, while natural rutile is about 92%-96% TiO2. (Turgeon, Tr. 2589-90). Occasionally a mine could also contain leucoxene, which is approximately 65%-90% TiO2. (Turgeon, Tr. 2589-90). Some ilmenite can be directly converted into TiO2 pigment. Other ilmenite must go through an intermediate step called an "upgraded process." (Turgeon, Tr. 2596-97).

60. This intermediate step creates a TiO2 pigment plant feedstock. (Turgeon, Tr. 2596). Upgrading ilmenite to feedstock is generally more efficient and less wasteful overall than

[12] For example, Lomon Billions owns mines in China, Chemours owns a mine in northern Florida, and Kronos owns a mine in Norway. (Turgeon, Tr. 2593-94). Cristal owns mining operations in western Austrialia (Wonnerup Mine) and in eastern Australia (Ginkgo and Snapper Mines). Cristal's mines are much smaller and produce far less feedstock than Tronox's mines. (Turgeon, Tr. 2593).

attempting to convert ilmenite directly into TiO2. (Turgeon, Tr. 2595-96). Natural rutile is a high-value feedstock that can be directly converted into TiO2 pigment. (Turgeon, Tr. 2595).

61. One way to convert ilmenite into feedstock is through "smelting." (Turgeon, Tr. 2596-97). Smelting is a process where ilmenite is melted at high-temperatures in a furnace with anthracite, and the iron in the material is separated from the titanium. (Turgeon, Tr. 2596). The titanium product that results from smelting is called "slag." (Turgeon, Tr. 2596-97). Slag is a feedstock that can be used in a TiO2 pigment plant. (Turgeon, Tr. 2596-97). By smelting ilmenite into slag, the TiO2 content rises from approximately 55% pure to 88% pure. (Turgeon, Tr. 2596-97).

62. After the iron is separated from the TiO2 at a smelting facility, Tronox uses the TiO2 slag in its pigment plants and sells resultant iron that is left over. (Turgeon, Tr. 2597-98).

63. Ilmenite can also be converted into "high-grade feedstock" called "synthetic rutile." (Turgeon, Tr. 2598-99). Synthetic rutile is made in a kiln by rusting away the iron from the mineral sands. Synthetic rutile is approximately 92% TiO2. Some mineral sands are easier to convert to feedstock in a slag process, while other work better in a synthetic rutile kiln. (Turgeon, Tr. 2598-99).

B. TiO2 Industry

64. The TiO2 industry "is a global business." (Turgeon, Tr. 2660).

65. The TiO2 industry is part of the broader "chemical industry." (RX01711.0014[13]). The chemical industry "produces over 70,000 different products, ranging from the chemicals first

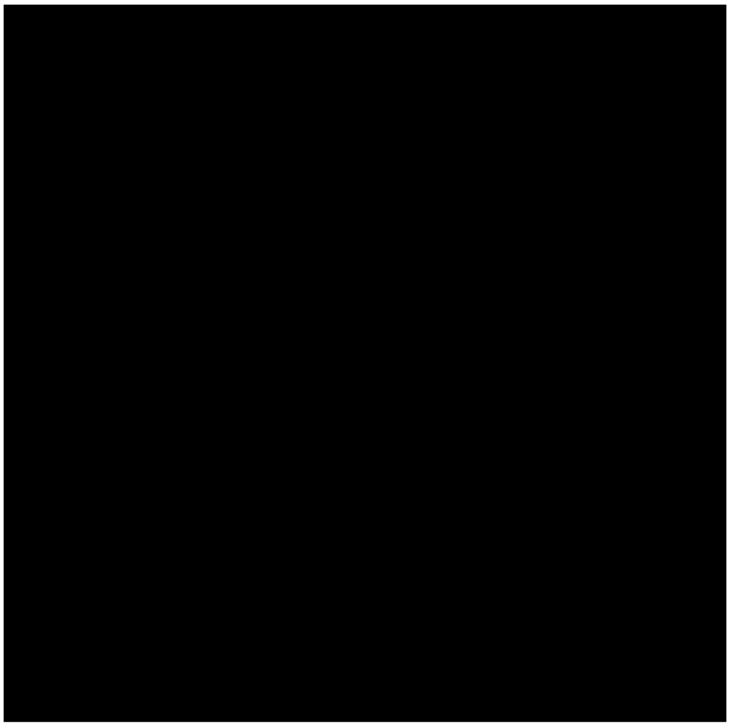
[13] Mr. Kenneth M. Stern is a chemical industry expert. (RX0171.0005). Mr. Stern is senior managing director at FTI, with responsibility for FTI's petroleum and chemicals practice. (Stern, Tr. 3694). Mr. Stern has a bachelor's degree in chemical engineering and an MBA. (Stern, Tr. 3694). Mr. Stern has experience consulting in the TiO2 industry. (Stern, Tr. 3697). Mr. Stern has testified regarding competitive effects of proposed transactions in the petroleum and chemicals industries, as an expert in those industries. (Stern, Tr. 3697). Mr. Stern has published regarding both the petroleum and chemicals industries. (Stern, Tr. 3697).

derived from the initial processing of organic or inorganic raw materials to finished consumer products." (RX0171.0014). The production of basic industrial chemicals "falls into two broad categories, organic and inorganic chemicals." (RX0171.0014). TiO2 is an "inorganic chemical." (RX0171.0014).

[redacted]

68. Furthermore, since 2005, "there has been tremendous growth in Chinese TiO2 capacity, including one new global player, Lomon Billions." (RX0171.0026). "The majority of the remaining capacity is held by other Chinese producers." (RX0171.0026).

69. As shown in Stern Figure 7 (RX0171.0027), global TiO2 capacity in 2017 was split as follows: Chemours (15%); Cristal (11%); Venator (11%); Lomon Billions (8%); Kronos (8%); Tronox (7%); Others (40%).



70. The six largest producers (Chemours, Cristal, Venator, Lomon Billions, Kronos, Tronox) are commonly referred to as the "global producers." (RX0171.0027). Each of the global producers has "proprietary chloride technology: some producers have only chloride plants while others have a mix of chloride and sulfate plants." (RX0171.0027).

71. The TiO2 industry "is part of a value chain that starts with the mining of the ore used to produce TiO2 pigment and continues through the product end user." (Stern, Tr. 3705-06; *see also* Quinn, Tr. 2310). A "value chain" is "a set of operations or processes that follow each other sequentially in order to transform a raw material—… a feedstock—into a building block[,] which then gets transformed into a chemical intermediate and finally into an end product." (Stern, Tr. 3706). This also happens in the TiO2 business. (Stern, Tr. 3706). In the TiO2 industry, "raw materials (ores) are transformed into TiO2 pigment, which is purchased by companies producing end-products such as paint or PVC piping." (RX0171.0015). The demand for end products "is what drives demand for the chemical product TiO2." (Stern, Tr. 3708).

72. In the TiO2 industry, "[v]ertical integration is one of the key methods of achieving and maintaining competitive advantage in the chemical industry." (RX0171.0016). "Vertical integration" refers to "[t]he integrated nature of . . . upstream, midstream, and downstream activities." (Stern, Tr. 3708). [redacted]

C. TiO2 Pricing & Price Cycles

73. Tronox establishes prices for TiO2 by negotiating every price individually with every customer around the globe. (Romano, Tr. 2227; Mouland, Tr. 1247). [redacted]

74. Tronox's negotiations with its customers are affected by a number of factors, including "the supply-demand relationship" with the individual customer, "price," Tronox's "value proposition," the "service" provided by Tronox, "consignment," "vendor-managed inventory," "who we're competing" against, and "the market segment that we're in" for a particular region or market segment, such as "whether it's coatings or plastics." (Romano, Tr. 2227) [redacted]

[redacted]

75. Tronox distinguishes itself as a company through its "Total Value Proposition." Tronox's "Total Value Proposition" relies upon the consistency of the product and the quality of the product. It also includes pricing, terms, and technical collaboration with customers—whether a customer needs help formulating products in their portfolio regarding TiO2. (Mouland, Tr. 1204-05). Tronox's value proposition includes providing services related to research and development, technical sales, and longer-term opportunities. (Romano, Tr. 2228-29).

76. Public price increase announcements or letters to individual customers announcing a price increase are just "the starting point of any price negotiation." (Romano, Tr. 2230). Price change announcements do not provide accurate information, as producers do not know their competitors' real as opposed to listed prices. (Mouland, Tr. 1166) [redacted]

78. Tronox does not set prices for TiO2 by region, rather by individual customer. (Romano, Tr. 2227; 2236-37). [redacted]

[redacted]

79. Dr. Hill admitted that "there is no uniform North American price for TiO2" because "prices vary by producer and by customer." (Hill, Tr. 1932).[14]

80. Pricing for TiO2 customers may differ by region due in part because "[e]very customer is different," and because supply and demand can "fluctuate" over time as a result of "a variety of variables," including the geographic region or country. (Romano, Tr. 2234). [redacted]

82. Moreover, TiO2 customers in North America typically have supply contracts, while TiO2 customers outside of North America normally do not have supply contracts, unless they are

[14] Dr. Hill is Complaint Counsel's economist. Dr. Hill has "never submitted an expert report in any case before this case." (Hill, Tr. 1967). Dr. Hill has never testified before — as an expert or otherwise. (Hill, Tr. 1967). Dr. Hill claims that he was previously "retained as a potential testifying expert" in three cases, but Dr. Hill did not submit an expert report, was not deposed, and did not testify in any of those cases. (Hill, Tr. 1659-60, 1967). For most of his professional life, Dr. Hill has worked on behalf of federal antitrust agencies. Prior to joining Bates White in July 2017, Dr. Hill worked for over a decade for federal antitrust agencies. (PX5000-123). Almost immediately after leaving government service, Dr. Hill was retained by the Federal Trade Commission around August 2017. (Hill, Tr. 1661).

global offtakers. (Stern, Tr. 3728; Malichky, Tr. 372-73). Indeed, many customers in North America have price protections written into their contracts, whereby an announced price increase won't affect price levels in North America for a longer period of time. (Stern, Tr. 3729; [redacted] If a customer has price protection in its contract, that customer will not be affected by increases announced by TiO2 producers for a specified period of time—normally for at least, 90 days. (Stern, Tr. 3728-29; [redacted] As a result of price protection, prices in North America tend to be "stickier" than the rest of the world, because of the nature of the contracts of much of the North American market; price protection clauses in North America cause a delay in upward changes in price. (Stern, Tr. 3732).

83. [redacted]

84. [redacted]

85. [redacted]

[15] In order to implement TiO2 price changes on an organizational level, buyers at PPG, for example, program the current price into the order system that people at their plants enter orders into. (Malichky, Tr. 625-26.)

[redacted]

86. The TiO2 industry is a "notoriously cyclical business," similar to the broader chemical industry. (Stern, Tr. 3735; Romano, Tr. 2217; Christian, Tr. 881). The TiO2 business "cycles up and down based on supply and demand patterns." (Romano, Tr. 2224). TiO2 "price cycles" are part of this cyclicality. (Romano, Tr. 2224). "[I]n a cyclical business, it necessarily follows that prices will be cyclical, following the performance of the business." (Stern, Tr. 3735-36) As a result of these price cycles, the TiO2 business experiences "ups and downs" in sales. (Turgeon, Tr. 2636).

87. TiO2 price cycles are driven by "supply-demand, capacity utilization and inventory," with "supply-demand being the most significant." (Romano, Tr. 2224-25). "The balance between supply and demand is one of the key reasons why the chemical industry in general and the TiO2 business in particular exhibit cyclical performance." (Stern, Tr. 3735-36). The primary "element of cyclicality" is that TiO2 pricing fluctuates. (Christian, Tr. 881-82). TiO2 prices fluctuate as a result of "supply-demand" and "negotiation[s]" with customers. (Christian, Tr. 885). As to negotiations, one "element" as to why the TiO2 industry is cyclical is "because the customers have . . . significant strength." (Christian, Tr. 881).

88. The TiO2 "price cycle tends to move globally." (Romano, Tr. 2224-25). In other words, "there is no point in time where you'll have pricing in one region moving up and in another region moving down." (Romano, Tr. 2225). Rather, TiO2 prices globally "tend to lead and lag

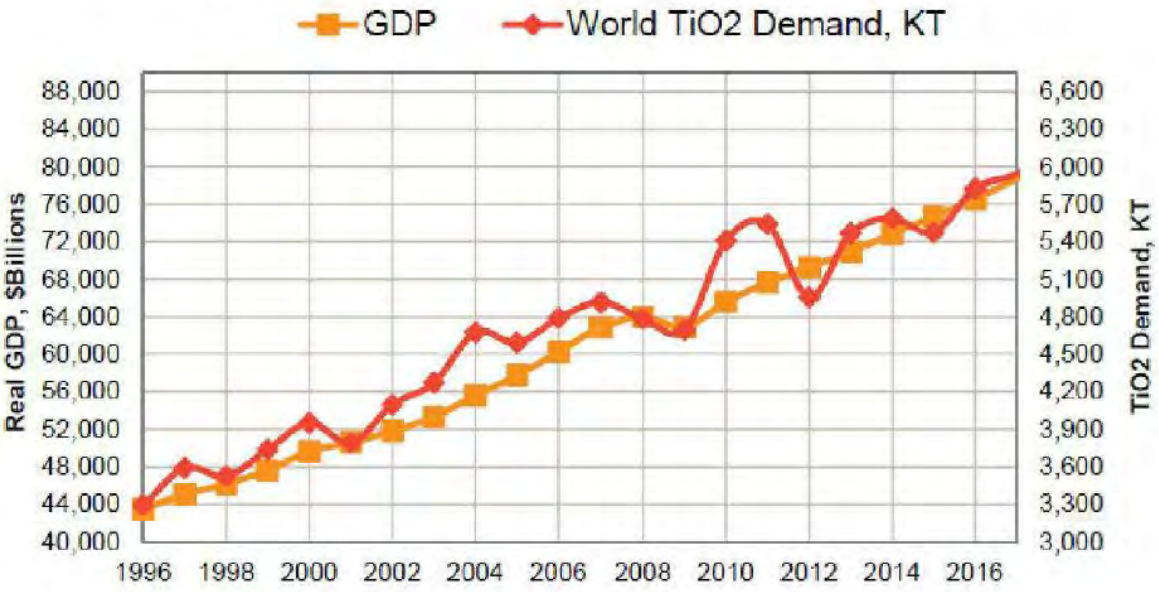
each other in some instances, depends on what market we're in." (Romano, Tr. 2225). As a result, "[s]ometime pricing is higher in one region" than another, on average. (Romano, Tr. 2236). For example, "[s]ince August of 2017, the price in North America has been the lowest in the world. At this particular stage, it's almost $400 lower than it is on a U.S. dollar basis in Europe." (Romano, Tr. 2236).

89. In the chemical industry, demand curves are typically easy to predict—they often follow GDP and slope upwards from left to right. (Stern, Tr. 3736-37). However, supply curves are different. They are "step functions," such that they rise in "large gulps." (Stern, Tr. 3736-37). This is because when someone builds a new plant, it is typically a large, world-scale plant, resulting in a significant increase in supply. (Stern, Tr. 3736-37). Because demand curves in the chemical industry are typically curved, and supply curves move in these "step functions," there are times when supply is typically much higher than demand, which correspond with troughs in the industry. When demand catches up to supply, this typically corresponds with peaks in the business. (Stern, Tr. 3736-37).

90. The driver of demand for TiO2 is the "demand in end products." (Stern, Tr. 3708) Factors such as price, level of competition, and number of players influence the demand for TiO2 pigment. (Stern, Tr. 3709). TiO2 is often referred to as a "lifestyle product," because "its demand and demand growth rate are closely tied to GDP growth rates." (Stern, Tr. 3709) Stern Figure 23 (RX0171.0063) shows the relationship between global GDP growth and TiO2 demand growth on a global basis for the last 20 years.

Figure 23[190]

Global GDP v. TiO2 Pigment Demand



91. As shown in Stern Figure 23, "over a long period of time, TiO2 demand tends to follow GDP." (RX0171.0063-64). These curves track well over time, although there are a few periods where there are dislocations. One such example: following the great recession of 2008, 2009, there was a significant increase in world TiO2 demand. (Stern, Tr. 3710; RX0171.0063).

92. Plant operating rates fell globally in 2012 because, after the great recession of 2008, demand for TiO2 increased substantially in 2010 and 2011, which caused prices for the product to rise; however, there was simultaneously a significant feedstock shortage, which reduced producers' ability to produce sufficient TiO2. As a result, large consumers "lived off inventory," a concept referred to as "destocking." (Stern, Tr. 3714-15).

93. Operating rates are an indication of global supply/demand balances because when demand for a product is strong, necessarily plant operating rates will be high—and the reverse is true as well. (Stern, Tr. 3712).

94. TiO2 prices and price cycles are influenced by numerous factors. Regional supply-demand balances affect TiO2 prices. (Stern, Tr. 3717). Global exchange rates can also be the biggest factor that causes fluctuating gaps between prices by region, in large part because this is a "globally traded material." (Stern, Tr. 3718-19). Indeed, "the exchange rate has more impact on the price than the price itself." (Turgeon, Tr. 2672-73). "[T]he fluctuation in currency has a huge impact on our business." (Turgeon, Tr. 2672-73).

95. [redacted] Tronox's customers have successfully used pricing in one region to negotiate better pricing in another region. (Duvekot, Tr. 1341).

96. Although "there's no specific timeline on how long [price cycles] last," they typically last for "three to five years," and "[s]ometimes it could be as long as six [years]." (Romano, Tr. 2224-25). The last TiO2 price cycle began after the Great Recession of 2008-2009. (Stern, Tr. 3742). During the last TiO2 price cycle, there was an effort to satisfy rapidly growing demand for TiO2 following the Great Recession. That required reopening mines that satisfied the TiO2 producers' desires to get feedstock in order to make TiO2 product. (Stern, Tr. 3742).

97. A lengthy down-cycle in the TiO2 industry lasted from approximately 2011 through the beginning of 2016. (Turgeon, Tr. 2637). The TiO2 price cycle peak in the first quarter of 2012 was caused by a fall in TiO2 demand; feedstock prices were also escalating at a rapid rate. (Stern, Tr. 3744-45) TiO2 customers responded to these price increases by curtailing purchases of TiO2, and living off of their accumulated inventories. (Stern, Tr. 3745). Because of the reduction in

demand in 2012, destocking took over, and that lead to a deep reduction in TiO2 prices through 2016. (Stern, Tr. 3745-46).

98. The price cycle reached its bottom (or "trough") at the end of 2015, first quarter of 2016. (Stern, Tr. 3746). During the trough at the end of 2015, and into the first quarter of 2016, TiO2 producers struggled to cover cash costs at soft price levels. Several of the producers had their financial status downgraded. (Stern, Tr. 3746). The market situation in 2015 was particularly poor. In 2015, market prices for TiO2 were at their lowest point in at least the preceding 28 years. (Turgeon, Tr. 2638). At the time, Tronox was running its plants "at cost"; there was an "oversupply of material"; global demand had "collapsed"; and Tronox's inventory levels were "very high." (Turgeon, Tr. 2637).

99. The continuing decline in TiO2 prices between 2012 and 2016 demonstrates that, in the face of output reduction by suppliers, TiO2 supply still "outstripped demand, leading to a weak pricing environment and producers who were struggling to reduce supply by trying to reduce inventory." (Stern, Tr. 3771).

III. THE TRONOX-CRISTAL ACQUISITION WILL GENERATE SIGNIFICANT OUTPUT-ENHANCING AND COST-SAVING SYNERGIES.

100. "[T]he proposed transaction will lead to significant output-enhancing efficiencies" at both the pigment level (i.e., production of TiO2) and at the feedstock level, as well as "significant cost reductions." (Shehadeh, Tr. 3441-42; Quinn, Tr. 2363-64).

101. The transaction's output-enhancing efficiencies will create an increase of TiO2 in the global market. (Shehadeh, Tr. 3443). This will occur at both the TiO2 pigment and feedstock levels:

a. At the TiO2 pigment level, increasing TiO2 production at the Yanbu plant and "application of best practices across the combined" company post-merger "will lead

to output-expanding efficiencies in pigment." (Shehadeh, Tr. 3442). The increase in global supply of TiO2 will have a "direct effect" in terms of "customer[] benefit." (Shehadeh, Tr. 3442-43).

b. At the TiO2 feedstock level, output-expanding efficiencies will both "enhance the incentives of the postmerger Tronox to expand output of pigment" as well as "free up" additional sources of feedstock supply "for other competitors," thereby increasing total pigment production and total feedstock supply in the market. (Shehadeh, Tr. 3444). The resulting increased output of TiO2 pigment in the global market will also have a "direct effect" in terms of "customer[] benefit." (Shehadeh, Tr. 3443).

102. The significant cost-saving efficiencies from the transaction will further "increase[] the incentives of the postmerger firm to expand output and, as a result," cause an "incentive to supply more to its customers, to the benefit of those customers." (Shehadeh, Tr. 3444-45).

103. "The expected transaction synergies will increase Tronox's production capacity and lower its costs, increase Tronox's ability to compete, including against growing Chinese competition." (Stern, Tr. 3704-05).

104. One of the "primary drivers" of the transaction is to permit Tronox to increase production and output of TiO2. (Romano, Tr. 2216-17). The purpose of the transaction is to "get additional volume" from the post-merger firm's TiO2 plants by applying "operational excellence" principles across the post-merger pigment plants. (Romano, Tr. 2216-17).

105. The transaction will also allow Tronox "to be able to service our customers better." (Romano, Tr. 2216). Tronox "need[s] to get bigger" in order to "be able to continue to support the growth of those very large customers that continue to consolidate." (Romano, Tr. 2216-17).

By increasing Tronox's size and production volume, Tronox will increase its "ability to serve globally." (Romano, Tr. 2216-17).

106. Total synergies from the transaction are conservatively estimated to be between $200 and $250 million of annualized value. (Quinn, Tr. 2329; PX0010; Mancini, Tr. 2816). Tronox publicly communicated to the market a realization of $100 million of EBITDA synergies by the end of year 1, and $200 million by the end of year 3. (Mancini, Tr. 2800). The synergy estimates are "valuable" and are "conservative estimate"; "[t]he natural tendency is to be conservative . . . because you want to make sure that the deal makes financial sense." (Quinn, Tr. 2329, 2341-42). It was "conveyed to the board that" the synergies were a "conservative estimate" and "risk-adjusted" such that "there might be more upside than" the value estimated.[16] (Quinn, Tr. 2329; PX0010). By delivering on the synergies, Tronox will create value for shareholders that is "very significant." (Quinn, Tr. 2331-32; PX0010-0173).

107. The fact that the synergy estimates are conservative has been borne out by confirmatory, post-signing due diligence. Tronox has continued to do confirmatory due diligence after the announcement of the transaction. (Mancini, Tr. 2762). "As the parties engaged in more detailed discussion post-signing . . . the synergy numbers . . . moved up." (Quinn, Tr. 2341-42; PX0010). [redacted]

[16] As described by Mr. Quinn, "Tronox is . . . a public company, and when you announce a deal like this, one of the things it's really great to do is meet expectations and raise them and meet expectations." "It's prudent to be conservative in initial estimates." (Quinn, Tr. 2330; PX0010). It is important to be sure that Tronox can attain the synergies because, "there's lots of consequences if you don't, especially on . . . the financing side and delivering those to the satisfaction of your banks." (Quinn, Tr. 2342-43; PX0010). It is also important to be sure that Tronox can attain the synergies so that management remains credible before the board and investors. (Quinn, Tr. 2342-43; PX0010).

[redacted]

108. Tronox has "a very high level of confidence" in its ability to achieve the announced synergies. (Mancini, Tr. 2805-06). In particular, Tronox "has an extraordinarily high level of confidence in [its] ability to deliver and exceed the specific synergies with respect to Yanbu and Jazan." (Mancini, Tr. 2795).

109. Tronox's "combination of the skill-set and the experience to operate Yanbu and the skill-set to operate [the] Jazan smelter are both . . . unique, [and] to have both of those houses in the same company is . . . one of a kind." (Quinn, Tr. 2357-59).

110. Tronox conducted extensive due diligence visits to a number of Cristal plants, including Tikon, Bunbury, Yanbu, Thann, Stallingborough, Ashtabula I and Ashtabula II, as well as the Paraiba mine and the Bahia plant in Brazil. (Mancini, Tr. 2763-64).

111. Tronox performed due diligence work for the Tronox-Cristal transaction in stages. (Mancini, Tr. 2756).

A. The Transaction Will Generate Substantial Efficiencies from Enhancing Tronox's Vertical Integration.

112. Tronox's business model is based on vertical integration. (Van Niekerk,[17] Tr. 3901-02). Vertical integration is Tronox's "competitive advantage" and gives Tronox "competitive strength." (Turgeon, Tr. 2601-02).

[17] Dr. Van Niekerk has extensive experience in the field of pyrometallurgy, with 15-20 years of hand-on experience and later transitioning to the management side. (Van Niekerk, Tr. 3903-06). Pyrometallurgy is "the chemistry or the metallurgy that takes place at elevated temperatures." (Van Niekerk, Tr. 3903). Dr. Van Niekerk

113. "Tronox currently is fully vertically integrated." (Van Niekerk, Tr. 3901-02). Tronox is "long" on feedstock. This means Tronox has more feedstock than is necessary to supply its TiO2 pigment plants. (Turgeon, Tr. 2601-03). Tronox has "too much feedstock for [its] own consumption." (Van Niekerk, Tr. 3901-02). Tronox attempts to sell its excess feedstock. (Turgeon, Tr. 2601-02). However, because purchasers of TiO2 feedstock are all direct competitors to Tronox in the TiO2 pigment industry, Tronox often has difficulty selling its TiO2 feedstock. If Tronox cannot sell its excess feedstock, it simply gets stockpiled at a facility. (Turgeon, Tr. 2601-03). Tronox is currently "about 200,000 tons of feedstock long." (Van Niekerk, Tr. 3901-02).

114. Cristal, by contrast, is currently "feedstock short." (Turgeon, Tr. 2604). Because "Cristal is short on feedstock . . . they don't have enough to supply" their pigment plants. (Stoll, Tr. 2111; Turgeon, Tr. 2604). This is why Tronox wants to complete the transaction with Cristal. (Turgeon, Tr. 2603-04). "[T]he acquisition of Cristal provides a better balance between feedstock availability and feedstock requirements to make TiO2, because Cristal is feedstock short." (Stern, Tr. 3851). "Tronox has excess feedstock capacity that can be used by the Cristal plants. (Stoll, Tr. 2111).

115. After the transaction, Tronox will be able to use all of its excess feedstock to supply the current Cristal TiO2 pigment plants. (Turgeon, Tr. 2604). The combined entity will still be somewhat short on feedstock and will still need to purchase some feedstock on the market. (Turgeon, Tr. 2604). This is a more "ideal situation" because Tronox "won't have to compete with feedstock producer to try to sell ilmenite or to sell slag because we will use all that we could produce for ourselves." (Turgeon, Tr. 2604). Instead, it will be a customer of feedstock producers

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also received a degree in commerce at the University of South Africa and attended The Management College in the U.K. which is now called Brunel University. (Van Niekerk, Tr. 3902-03).

"when the market is really good and the demand's good," but "when the market goes down and the demand is not as good, we will still be able to run those feedstock assets at full rates." (Quinn, Tr. 2361-62).

116. Because post-merger Tronox "will be able to use that excess feedstock that we have to feed those pigment plant[s]," the combination between Tronox and Cristal is a "perfect fit." (Turgeon, Tr. 2604).

117. Vertical integration eliminates one or two levels of margins from the production costs of TiO2 pigment—the feedstock producer's margin, and if the feedstock producer did not have its own source of ilmenite (a key raw material), the margin from the mine owner. (Shehadeh, Tr. 3420-21).

118. The goal of vertical integration and the transaction is to "reduce [Tronox's] cost to the lowest possible level." (Quinn, Tr. 2364). The transaction will enhance Tronox's vertical integration and enable the company to "increase output . . . because of the additional pigment plants." (Quinn, Tr. 2363-64; PX0010).

119. Vertical integration is a "critical" component of the company's strategy in pursuing the Cristal transaction. (Quinn, Tr. 2363). It is "the way that [Tronox] is going to be able to compete in [a] . . . dynamic, global, competitive business." Vertical integration is "sort of our secret sauce." (Quinn, Tr. 2363-64; PX0010).

120. As a result, there are "[s]ignificant" cost advantages to vertical integration of feedstock supply to be achieved by the Tronox-Cristal acquisition. (Stoll, Tr. 2111-12).

B. The Transaction Will Result in Significant Expansion of TiO2 Pigment and Feedstock Output, Benefiting Consumers.

121. The Tronox-Cristal transaction will generate substantial increase in the production of TiO2 pigment and feedstock by the post-merger company. (Stern, Tr. 3852). Indeed, increasing

output is a critical component of Tronox's plans after the merger to be competitive in the dynamic, global market place. (Quinn, Tr. 2363-64). As described by Tronox, "one of the primary drivers" of the Cristal acquisition "is to be able to get more out of the existing assets" and increase volume of TiO2 production in the post-merger firm's plants. (Romano, Tr. 2216-17).

122. From the very beginning, Tronox has planned to run its TiO2 and feedstock facilities "all out," or at full capacity, after the Cristal transaction. (RX0236.0001; Quinn, Tr. 2316-17; Turgeon, Tr. 2652, 2655).

123. In announcing the "preliminary framework" of the deal to the board of directors, then-CEO Tom Casey reported that "[t]his combination would increase our pigment production to approximately 1.25 million tons and our high grade feedstock SR and slag production to approximately 1.1 million tons (not including rutile)." (RX0236.0001; Quinn, Tr. 2316-17). Mr. Casey further reported to the board of directors: "Therefore, assuming we produce pigment at approximately capacity levels, we could run our slag and SR production facilities 'all out,' which would maximize the efficiency of both our pigment and feedstock production and enhance our margins significantly." (RX0236.0001).

124. "Tronox on a stand-alone basis has about 465,000 tons . . . and Cristal has [approximately] . . . 700,000 or 650" of TiO2 pigment production, and together "that would be 1.25 million." (Quinn, Tr. 2317). The planned increase in TiO2 pigment production "would be a significant increase [in TiO2 pigment production]." (Quinn, Tr. 2317). Cristal has a high-grade feedstock capacity, so the total capacity on the feedstock side would be 1.1 million tons. (Quinn, Tr. 2316-17). Thus, achieving more overall production after the transaction would provide competitive benefits to the merged firm. (Turgeon Tr. 2642). Greater overall TiO2 output will "distribute fixed costs over more pounds going out of the plant facility, and in so doing, [] reduce[]

the fixed cost" of production and give the company "a better position on the cost curve globally." (Stern, Tr. 3852).

125. Currently, Cristal's plants are running well below nameplate capacity. (Mancini, Tr. 2783, 2792-94). By contrast, Tronox has been "improving the utilization of" its plants since 2016. (Quinn, Tr. 2349-50, PX0010). Tronox operates its "plants at or near nameplate capacity, and it's sometimes above nameplate capacity." (Quinn, Tr. 2349-50; PX0010). Since Cristal has not been able to run its plants at or near nameplate capacity, "there is significant . . . output enhancement to be had by getting the Cristal plants up to the same level of utilization as the Tronox plants." (Quinn, Tr. 2349-50; PX0010). By acquiring Cristal's assets, which have been running "far from their nameplate capacity," this will "create a huge opportunity for [Tronox] to increase [its] capacity and meet [its] customer requirement[s]." (Turgeon, Tr. 2659).

126. Tronox will have an incentive to increase its output after the transaction, especially at Hamilton and Ashtabula, because those plants represent the lowest cost structure for both Tronox and Cristal presently. (Stern, Tr. 3852; Turgeon, Tr. 2642 (describing how having the lowest cost structure earns producers "the right to grow")).

127. Tronox also has the unique ability to bring Cristal's plants up to nameplate capacity. (Mancini, Tr. 2779). Tronox refers to this process as "unlocking the hidden factory." (Turgeon, Tr. 2655-56). Tronox plans to "unlock the hidden factory" within Cristal plants in order to raise output and lower its cost-position in the TiO2 industry. (Turgeon, Tr. 2655-56). The planned enhanced output of TiO2 production post-transaction at Cristal's Yanbu facility is a merger-specific synergy that will benefit customers by increasing TiO2 pigment available in the market. (Mancini, Tr. 2782-85).

128. Tronox has experience increasing output at newly acquired plants. (Dean, Tr. 2950). For example, when Tronox acquired Botlek, it produced 45-48,000 tons per year, and currently it produces 90,000 tons per year. (Dean, Tr. 2950).

129. The transaction will also create a larger "combined network" of TiO2 production and distribution across the globe. (Mei, Tr. 3166-67). By acquiring Cristal's global TiO2 assets, the post-merger Tronox will have "more coverage" and a larger global "footprint" in terms of "where we can produce, optimize pigment, and what kind of grade can produce in what plants." (Mei, Tr. 3167). Indeed, Tronox is currently developing a global "enterprise optimization model" to improve the efficiency of the global network and operations post-transaction, similar to network optimization tools used by Amazon and Apple. (Mei, Tr. 3164-66). Tronox's customers will benefit from a larger global footprint because Tronox "will be closer to the customers in terms of where the products can be produced, on average basis." (Mei, Tr. 3167). The improved global network will also give Tronox a "more reliable supply and stable quality" of TiO2 feedstock, which will increase TiO2 pigment output. (Mei, Tr. 3167).

130. Increase in the global supply and availability of TiO2 resulting from the Tronox-Cristal acquisition will benefit customers. (Shehadeh, Tr. 3443; Mei, Tr. 3167; [redacted] Mr. Greg Arrowood of Deceuninck North America testified that if "more titanium dioxide were available on the market" "that would be good for Deceuninck." (Arrowood, Tr. 1130) [redacted]

[redacted]

C. Tronox Is Uniquely Qualified to Maximize TiO2 Production at the Underperforming Pigment Facility in Yanbu, Saudi Arabia.

131. The Tronox-Cristal transaction presents a unique opportunity to enhance TiO2 output by improving Cristal's pigment plant in Yanbu, Saudi Arabia. (Dean, Tr. 2917, 3027-29).

132. The Yanbu pigment plant has experienced low production rates for years. (Dean, Tr. 2979; Stern, Tr. 3851-52).

133. Tronox has described increasing TiO2 production at Yanbu to its nameplate capacity as a "key goal" of the proposed transaction. (Dean, Tr. 2917).[18] Indeed, Tronox "ha[s] an extraordinarily high level of confidence in our ability to deliver and exceed the specific synergies with respect to . . . Yanbu." (Mancini, Tr. 2795).

a. Yanbu Has Suffered from Low Operating Rates.

134. In recent years, the Yanbu TiO2 facility's performance has been "[e]xtremely subpar." (Dean, Tr. 2979).

135. The nameplate capacity of Yanbu is 210,000 tons per year. (Dean, Tr. 2979-80).[19] But under Cristal management, Yanbu has "not ever been able to produce" its nameplate capacity.

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[18] Post-closing, Mr. Dean will "be responsible for operating the Yanbu facility in Saudi Arabia." (Dean, Tr. 2917).

[19] The Yanbu facility is capable of producing 210,000 tons per year because "if you look at the chlorinator size, you look at the condensation size, the six oxidizers . . . and the configuration of the finishing plant, the capacity of that facility really becomes bottlenecked at chlorination at around 212 to 215,000 tons." (Dean, Tr. 2980). "The inherent capability of six oxidizers . . . is 238,000 tons." The oxidation work that Dean has done "on the chlorination side, with only having two condensation trains . . . is at around 210,000, 215,000 tons of titanium dioxide equivalent." (Dean, Tr. 2980).

(Quinn, Tr. 2350-51) [redacted] Last year, Cristal produced "approximately 130,000 tons, so some 80,000 tons short of capability of the facility." (Dean, Tr. 2979-80). After Cristal added "three more lines, three more chlorinators [at Yanbu] . . . from 2001 to 2011 . . . they didn't achieve any kind of ratio of production like they had with their other three lines." (Dean, Tr. 2982-83).[20]

136. [redacted]

137. [redacted]

138. Although Cristal previously had a contract with Kerr-McGee to help run the Yanbu facility, today Cristal does not "have the inherent low-pressure technology fundamentals in the

[20] [redacted]

[21] The difference between high-pressure and low-pressure technology is, "the mode of force that drives the process [with low pressure technology] is gravity. We have tanks at the beginning of the oxidation process where we have the titanium tetrachloride is actually elevated up in the air, and as it's fed into the vaporization process, that height determines the maximum pressure that's going to be generated in the process. Other manufacturers actually pump the titanium tetrachloride in, and that can take it up to a much higher pressure." (Dean, Tr. 2929-30).

organization today. They lost that after they lost the support" from Kerr-McGee. (Dean, Tr. 2984-85).[22]

139. After Cristal and Kerr-McGee "went separate ways," "Cristal started expanding the plant, but they did it without any sort of ongoing technical support, and they had had no operational support as well, product development support." (Dean, Tr. 2980-81). Yanbu "has gone through multiple expansions since around the 2000, 2001 time frame, and that was coincident with the time when Cristal separate from Kerr-McGee, who was a 25 or 30 percent owner in Yanbu at that time." (Dean, Tr. 2980-81).

140. [redacted]

141. [redacted] Cristal has "brought in people that have retired or left Tronox or Tronox-related operations to . . . try and bring in that expertise, but there's never been any sustainable" efforts implemented at Yanbu. (Dean, Tr. 2984-85). The former Tronox employees "left the business for a reason, either for retirement or other reasons personal to them, and their state of knowledge ended at that point in time, whereas the improvements in the technology are a continuous evolution. (Dean, Tr. 2984-85).

142. Cristal has also had "numerous" SWAT team initiatives, where "they tried to get technical and operational personnel that could come in and help the local team operate the plant better and get production rates up." (Dean, Tr. 2980-81). Yanbu will not be fixed with a "SWAT"

[22] Although "Cristal acquired new facilities . . . through the acquisition of Millennium," "Millennium had no know-how or technology that's related to the Tronox technology." (Dean, Tr. 2984-85).

team. (Dean, Tr. 3073). "Every example of [Cristal] bringing in these groups to [fix Yanbu] . . . whether it be some old Tronox employees or . . . Cristal people from around the world . . . [did] not build a sustainable work process." (Dean, Tr. 3131-32).

143. Cristal has also made a "series of errors" at Yanbu. Cristal did not develop "the people correctly" and did not have a good handle on the technology, which "caused them many operational problems." (Dean, Tr. 2980-81).

144. Mr. Graham Hewson is the current vice president of integration operations at Cristal, and was previously the vice president of manufacturing at Cristal, beginning in 2013. (Hewson, Tr. 1600; 1604). Mr. Hewson was also the director of Cristal's operational excellence program for one year in 2012. (Hewson, Tr. 1604).

145. [redacted]

b. Tronox Has Proprietary Know-How and Expertise in Yanbu's Low-Pressure Chloride Technology.

146. Kerr-McGee, the predecessor company to Tronox, helped Cristal build Yanbu. (Dean, Tr. 2930, 2979; Hewson, Tr. 1608). Yanbu was built using Kerr-McGee's proprietary low-pressure chloride TiO2 production technology. (Dean, Tr. 2930, 2979; Hewson, Tr. 1609).

147. [redacted]

148. [redacted]

[redacted]

149. The Kerr-McGee technology used for the chloride process at Yanbu is "owned by Tronox." (Stoll, Tr. 2110). In fact, Cristal's Yanbu plant "is built on the same technology as . . . Tronox's Hamilton, Mississippi plant. It was built with the old Kerr-McGee technology" that Tronox is the successor to. (Quinn, Tr. 2350 - 51).

150. Tronox, the legacy company of Kerr-McGee, is "the master in the titanium dioxide industry at low-pressure technology." (Dean, Tr. 2929-30). Tronox has "inherent intellectual property that exists in that low-pressure technology." (Dean, Tr. 2930-31). "[I]f you look back at the history of the industry, Tronox or its predecessor, Kerr McGee, continued a long period of research and development and development of the low-pressure technology." (Dean, Tr. 2930-31). "Tronox was the only company that ever . . . mastered that particular technology." (Dean, Tr. 2930-31). "[W]e've refined [low-pressure] technology. We've become very good at it. We're recognized as one of the top producers of good quality pigment." (Dean, Tr. 2930-31). The low-pressure chloride technology in place at Yanbu is Tronox's "bread and butter. It's what we do in Mississippi and in Australia." (Quinn, Tr. 2355).

151. [redacted]

152. [redacted] Tronox has had 20 years of experience with Kerr-McGee/Tronox technology to which Cristal has not had access. (Turgeon, Tr. 2657-59).

153. As a result, Tronox has a "unique skill-set to be able to bring to [Yanbu] that no other company in the world possesses." (Quinn, Tr. 2355-56). Tronox is "uniquely qualified to assist the Yanbu plant." (Mancini, Tr. 2790-91). It is "pretty obvious that Tronox would have a significant impact on improving the operating rate and efficiency and consequently the cost posture of that plant." (Stern, Tr. 3851).

154. The Yanbu plant is nearly identical in every material way to Tronox's TiO2 plants, including Tronox's Botlek, Kwinana, and Hamilton facilities. (Dean, Tr. 2979).

155. For instance, Yanbu's oxidizers are "virtually a copy of what [Tronox] has in [its] plants." (Dean, Tr. 2977). Yanbu's "oxidizer physical design from the outside looks to be nearly identical to the oxidizers [Tronox] run[s] in Botlek, Kwinana, and Hamilton." (Dean, Tr. 2977). This is because Yanbu was built "around 1990 or 1991," approximately the same time Tronox's TiO2 plants at Botlek and Kwinana were built with similar technology. (Dean, Tr. 2979).

156. Of the plants that use "Kerr-McGee/Tronox low-pressure technology" Hamilton performs the best. (Dean, Tr. 2979). Hamilton performs well because it has a "very stable, very well-trained and disciplined workforce, and they understand the technology very, very well." (Dean, Tr. 2979).

157. As Cristal acknowledges, there are two ways that Tronox' expertise can assist in the operation at Yanbu:

a.

b. [redacted] Cristal cannot provide the same experience to its workers that Tronox can provide because "they don't operate a plant that resembles [Yanbu's] technology, and the plants they operate, operate significantly differently." (Dean, Tr. 2990).

158. The "Yanbu plant was visited by a team" during pre-signing due diligence. (Dean, Tr. 2970). Mr. Dean has been to the "Yanbu plant several times" and has evaluated the plant to "ascertain its capabilities" as part of his "due diligence responsibilities." (Dean, Tr. 2975-76).

159. Mr. Dean, a vice president in Tronox's manufacturing operations who has previously served as plant manager at Hamilton and has been the plant manager at seven other plants, will have primary responsibility for coordinating all the Tronox resources invested in the Yanbu Transformation Plan. (Mancini, Tr. 2796-97; Dean, Tr. 2995-96). Only "ten" other people at most in the world have experience similar to Mr. Dean's in regards to "turning around TiO2 pigment plants." (Dean, Tr. 2996).

160. The Yanbu Transformation Plan reflects "the series of things that [Mr. Dean] believe[s] are critical" for Tronox to do "to start the process of Yanbu turning around to become a productive facility and . . . getting back to the capabilities [Yanbu] exhibited in the late nineties." (Dean, Tr. 2994-95). This primarily includes applying the "Tronox Way" to Yanbu. (Dean, Tr. 2995, 3003, 3055). [redacted]

[redacted]

161. Mr. Dean's primary goal for the Yanbu Transformation is "to get the plant to its nameplate capacity of 210,000 tons of titanium dioxide equivalent and to deliver the synergies that have been identified in the early phases of due diligence in the project." (Dean, Tr. 2917). As a part of implementing the Tronox Way at Yanbu, Dean will work "with the leadership team to look at how [Tronox is] going to redesign the organization so that it will fit [Tronox's] Tronox Way templates." (Dean, Tr. 2995).

162. [redacted]

163. [redacted]

164. Under Mr. Dean's approach, "developing [the] workforce is going to be . . . first and foremost [a part of Mr. Dean's] approach to turning [Yanbu] around. (Dean, Tr. 2985-86). Tronox will not "try to force knowledge" but will "develop [the] knowledge" instead. (Dean, Tr.

2985-86). "[T]he Saudi workforce . . . is very easy to learn. . . [T]he huge benefit that [Tronox] bring[s]" is the fact that Tronox has "three plants that are operating" the same technology at Yanbu "extremely successfully." (Dean, Tr. 2986-88).

165. [redacted]

166. [redacted]

167. [redacted]. Yanbu's chlorinators are similar to those at Hamilton, Kwinana, and Botlek. "They have four 12-foot and two 14-foot chlorinators in that arrangement." (Dean, Tr. 2976-77).

168. [redacted]

169. [redacted] Tronox's expected production rates are also based on the fact that Tronox's other plants use virtually the same equipment to create the same product. (Dean, Tr. 2979).

c. The FTC Does Not Have Expertise to Challenge the Substantial Yanbu Synergies.

170. [redacted]

171. [redacted]

172. [redacted]

D. The Post-Merger Tronox Will Realize Efficiencies from Shared Best Practices from Both Cristal and Tronox Pigment Plants.

173. The transaction will also generate efficiencies in TiO2 pigment production from the sharing of best practices across the merged firm. (Turgeon, Tr. 2657-58). The post-merger Tronox "will take the best out of Cristal and the best out of Tronox, and combining it together, our practice will become even more solid." (Turgeon, Tr. 2657-58).

174. First, Tronox will apply the "Tronox Way" to facilities Tronox acquires at Cristal. (Turgeon, Tr. 2657-58). Second, Tronox will apply best practices from Cristal "using their knowledge, theirs being Cristal, to try to use some of their best practices to get additional volume from our own plants." (Romano, Tr. 2216-17).

175. The best practices from both Tronox and Crisal will be employed "globally" across all of the post-merger TiO2 plants post-merger. (Turgeon, Tr. 2657-58). As a result, "the combination of the know-how of Cristal and the know-how of Tronox will allow [Tronox] to refine those standards that we have developed in Tronox" on a global basis across a larger footprint of TiO2 pigment plants after the transaction. (Turgeon, Tr. 2657-59).

176. Indeed, Tronox has described combining Tronox and Cristal's best practices as "the best way" to "continue to improve our practice and improve our technology." (Turgeon, Tr. 2666-67).

E. Only Tronox Has the Incentive and Ability to Restore and Bring Online Cristal's Inoperative Feedstock Smelter in Jazan, Saudi Arabia.

177. The Jazan slagger is an ilmenite smelting facility located in Jazan, Saudi Arabia. (Van Niekerk, 3946-47).

178. The Jazan slagger is owned by AMIC. AMIC is a subsidiary of 50 percent Cristal, 50 percent TASNEE. TASNEE is also the owner of Cristal, so the Jazan Slagger is ultimately owned by TASNEE. (Van Niekerk, Tr. 3899-3900).

179. The Jazan slagger is not operational today. (Van Niekerk, Tr. 3900). Cristal started the process of commissioning the slagger in 2015, but that ultimately failed. (Van Niekerk, Tr. 3900). "In trying to do that, they had some fairly catastrophic failures, including . . . explosions." (Quinn, Tr. 2310-11).

180. The Jazan slagger is "a facility that Cristal had spent hundreds of millions of dollars on and had not been able to get . . . running properly. (Quinn, Tr. 2310-11). [redacted]

181. Tronox "ha[s] an extraordinarily high level of confidence in our ability to deliver and exceed the specific synergies with respect to . . . Jazan." (Mancini, Tr. 2795). Tronox has "done the due diligence" and "we are very confident that we will get the slagger up and running." (Van Niekerk, Tr. 3901-02).

182. Tronox also has strong incentive to get Jazan up and running. (Van Niekerk, Tr. 3901-02). Tronox "needs this output from the Jazan slagger" to feed the newly acquired pigment plants because after the transaction, Tronox will be short of high-grade feedstock. (Van Niekerk, Tr. 3901-02, 3945-46).

183. Tronox already has raw material to use in the smelter, including a large pile of ilmenite and currently untapped mines. Tronox currently has an unused stockpile of "about three and a half million tons" of ilmenite at a facility in South Africa. (Van Niekerk, Tr. 3941-42). Once the Jazan smelter is operational, Tronox plans to use that existing stockpile of ilmenite to feed the Jazan slagger. (Van Niekerk, Tr. 3953-55). Tronox also has mines that are scheduled to come online in the future that it can bring online quicker to use in the Jazan slagger. (Van Niekerk, Tr. 3953-55). If needed, Tronox can also purchase ilmenite on the open market to feed the Jazan slagger. (Van Niekerk, Tr. 3953-55).

184. There are many synergies that Tronox can realize at Jazan: the first involve the feedstock synergies, which have been publicly announced; second, there are additional synergies that stem from the combined entity's ability to produce slag at a lower cost per ton, finally, the combined entity will enjoy a nonfinancial synergy stemming from the reliability of feedstock production. (Mancini, Tr. 2792-94).

a. Cristal Has Failed to Successfully Bring the Jazan Slagger Online by Itself.

185. [redacted]

186. Cristal encountered significant problems with the furnaces when they attempted to commission the Jazan slagger in 2015—those issues have continued through today and the Jazan slagger is still not operational. (Van Niekerk, Tr. 3900).

187. [redacted]

188. Both of Jazan's furnaces "are still down" since their failure to operate. Cristal has tried to address Jazan's flaws. (Stoll, Tr. 2113). Cristal "attempted . . . but the furnaces are still down." (Stoll, Tr. 2113).

189. [redacted]

190. [redacted]

[redacted]

b. Tronox Has World-Class Expertise and Highly Skilled Operators for Jazan.

193. Tronox has a "unique" skill-set for operating the Jazan slagger. (Quinn, Tr. 2357-59). Tronox has "a number" of "really highly skilled operating people" as it relates to Jazan. (Quinn, Tr. 2357-59) [redacted]

194. Tronox's highly skilled operators for Jazan who will be assisting with the Jazan plant include two of the world's "foremost experts" in the area of feedstock and smelting: Dr. Willem Van Niekerk and Jean-Francois Turgeon. (Quinn, Tr. 2357-58; Mancini, Tr. 2798-99).

a. Dr. Van Niekerk, Tronox's Senior Vice President of Strategy, has a Ph.D. in pyrometallurgy. (Van Niekerk, Tr. 3899, 3903). Dr. Van Niekerk was "in charge of the team that designed the smelter at KZN." (Van Niekerk, Tr. 3926-27).

b. Mr. Turgeon, Tronox's Chief Operating Officer, is the holder of a patent for smelting titanium dioxide. (Mancini, Tr. 2796-98; Turgeon, Tr. 2584-85). Mr. Turgeon is the inventor of the UGS high-grade feedstock at Rio Tinto and designed and developed the furnaces that Rio Tinto currently operates in Quebec. (Mancini, Tr. 2798-99).

c. Mr. Neels Oosterhuis will manage Jazan on a day-to-day basis. (Van Niekerk, Tr. 3951-52). Mr. Oosterhuis "has a long history of ilmenite smelting." (Van Niekerk, Tr. 3952). He "was previously the manager of [Tronox's] Namakwa smelter" and "was also the manager at [Tronox's] KZN smelter." (Van Niekerk, Tr. 3952). Mr. Oosterhuis is "probably the only guy in the world who has run two different ilmenite smelters." (Van Niekerk, Tr. 3952).

195. Tronox has extensive experience running slaggers. (Quinn, Tr. 2357-59; Stoll, Tr. 2113-14). Tronox's two smelters in South Africa (Namakwa and KZN) have several key similarities to the furnaces at Jazan, including:

a. "they use electricity to put heat into the furnaces";

b. "they charge through the roof into the furnace";

c. they both "have slag and metal tapholes";

d. they "operate at the same temperatures"; and

e. they all have "the same thermodynamic and chemical processes that happen inside the furnace."

(Van Niekerk, Tr. 3950).

196. Tronox operates "four furnaces in South Africa in two different locations, so [Cristal] is very confident [Tronox] ha[s] the people and the capability to assist (Cristal)." (Stoll, Tr. 2114).

197. Ilmenite smelters like the Jazan slagger require "unique" expertise to operate and maintain effectively. (Van Niekerk, Tr. 3931-33, 3957). The "fundamentals of ilmenite smelting" are "totally different than any other smelting process." (Van Niekerk, Tr. 3931-33). The process is "virtually on a knife's edge the whole time" which requires second-by-second monitoring of "power, ilmenite and anthracite." (Van Niekerk, Tr. 3931-33). In most other smelting processes, the metal is the final product and the "slag is there to assist you, to act as an insulating layer, to act as a sink for impurities and to take out things that you don't want in a metal." (Van Niekerk, Tr. 3931-33). In ilmenite smelting, "the slag has a total[ly] different role than [in] any other pyrometallurgical process," because in ilmenite smelting, the slag is the "main product." (Van Niekerk, Tr. 3931-33).

198. Ilmenite smelters are heated using an electrical conductive arc between two electrodes which is "sort of [like a] lightning strike or lightning that's continuously there." (Van Niekerk, Tr. 3928-30). This electric arc generates heat up to 7,000 degrees Celsius. (Van Niekerk, Tr. 3928-30). This intense heat smelts "the ilmenite to produce titanium slag and liquid iron." (Van Niekerk, Tr. 3928-30). Smelting is not the same as melting — smelting includes both melting and "chemical work." (Van Niekerk, Tr. 3928-30). In the smelters, Tronox "transform(s) the ilmenite from mineral into titania slag, as well as . . . heat it up and melt it." (Van Niekerk, Tr. 3928-30). As Dr. Van Niekerk described: "You can think of this furnace as a little volcano" "Mother Nature took millions and millions of years" to make ilmenite, and Tronox is "reversing that in minutes to make (it into) titanium and iron again." (Van Niekerk, Tr. 3928-30).

199. Inside the smelter, the "slag is a little bit lighter than the iron, so it floats on top of the iron." (Van Niekerk, Tr. 3933-35). Material is removed from the furnace through a hole in the furnace called a "taphole" which is a hole in the side of the furnace. (Van Niekerk, Tr. 3933-35; RXD-0036). Taphole operators will open those holes and "will then manage that whole process to get the liquid out, either into slag pots or into the metal ladle." (Van Niekerk, Tr. 3933-35). At Namakwa and KZN, when the titania slag comes out of the smelter, it is places into bell-shaped pots, cooled, removed from the pots, crushed, and ultimately shipped around to Tronox's pigment plants around the world. (Van Niekerk, Tr. 3937-39). After the iron is removed from the furnace through its taphole, it is tapped into a ladle, treated, cast into small blocks called "pigs," and sold around the world to be used in end-uses such as engine blocks. (Van Niekerk, Tr. 3939-40).

c. Tronox Conducted Extensive Technical Due Diligence for Jazan.

200. Tronox has conducted "extensive technical diligence" related to the Jazan slagger. (Van Niekerk, Tr. 3943). This includes Tronox's "significant field visits" to Jazan. (Quinn, Tr. 2357-58).

201. Dr. Van Niekerk and others from Tronox first visited the slagger in "late 2016" and "spent a few days at the slagger." (Van Niekerk, Tr. 3944-45). Tronox "requested a number of reports" related to the Jazan slagger and "[a]ll of those reports were posted" in the data room. (Van Niekerk, Tr. 3944-45). Tronox's due diligence related to the Jazan slagger also included a week-long workshop with the designers of the furnace, Outotec. (Van Niekerk, Tr. 3944-45). In total, Dr. Van Niekerk and a team from Tronox visited the Jazan site three times to conduct further due diligence. (Van Niekerk, Tr. 3944-45).

202. Dr. Van Niekerk also oversaw Tronox's participation in workshops "to identify all the areas where Jazan need[ed] Tronox to get the slagger commissioned." (Van Niekerk, Tr. 3951).

d. The Transaction Includes an Option Agreement for Tronox's Acquisition of the Jazan Slagger.

203. The Jazan slagger has been a part of the overall deal with Cristal from the beginning. (Quinn, Tr. 2316). Tronox "always considered" the Jazan slagger to be "part of the transaction." (Quinn, Tr. 2316; RX0236). The first time Tronox CEO Tom Casey told the Tronox Board of Directors about the potential Cristal transaction, he mentioned the Jazan slagger and Tronox's plan to enter into an option agreement. (Quinn, Tr. 2310-11; RX0236).

204. Tronox ultimately entered into two agreements with AMIC related to the Jazan slagger: an option agreement and a technical services agreement ("TSA"). (Van Niekerk, Tr. 3900-01). In the agreement that sets up the overall transaction, Tronox and Cristal agreed to negotiate and ultimately enter into an option agreement related to the Jazan slagger. (Van Niekerk, Tr. 3900-01, 3945-46). While Tronox and Cristal were still negotiating the specifics of the Jazan

slagger option agreement, Tronox entered into a TSA to help Cristal commission the slagger. (Van Niekerk, Tr. 3901).

205. [redacted] Under the option agreement, Tronox has a five-year option to acquire. (Van Niekerk, Tr. 3901).

206. [redacted]

207. The option agreement is connected to and dependent on the larger Tronox-Cristal transaction. (Quinn, Tr. 2376). At the time the parties "signed the original merger agreement, the terms of the merger required that the parties would negotiate in good faith to later complete and execute this option agreement." (Quinn, Tr. 2376). Indeed, Tronox "would have never entered into this agreement if the big merger agreement didn't exist." (Quinn, Tr. 2378).

208. An option agreement rather than an outright purchase of the Jazan slagger was proposed because: the slagger "hadn't worked," but would be "really valuable" if it did work. (Quinn, Tr. 2311-12). Tronox proposed entering the option agreement because "we had to give our board comfort that we would not buy something that was not operational." (Van Niekerk, Tr. 3945-46).

209. Furthermore, Tronox did "not have enough cash to do an all-cash deal which includes the slagger." (Van Niekerk, Tr. 3945-46).

210. It is "not uncommon at all for there to be ancillary documents as part of . . . a big merger that get done after the fact." (Quinn, Tr. 2312-13). "Usually they're technical services agreements or transition services . . . I've seen situations with creative ways of bridging value that, you know, have been incorporated into the deal, and I think this is just an example of that." (Quinn, Tr. 2312-13).

211. Tronox entered into the TSA to make sure Tronox "actually acquire[s] a working, operational slagger." (Van Niekerk, Tr. 3951). For Tronox, "it was critical" to enter into a "technical services agreement in order to assist Cristal to get the Jazan slagger recommissioned because [Tronox] want[s] to buy it." (Van Niekerk, Tr. 3951). Tronox was concerned that since Cristal personnel "previously were not successful to start up the slagger" that if Cristal tried to start the furnace with Tronox's help, Cristal "might again run into difficulties." (Van Niekerk, Tr. 3951). Tronox "would never have helped Jazan if it wasn't for the transaction." (Van Niekerk, Tr. 3961).

212. Under the TSA, Tronox has begun investing substantial financial resources in addition to its technical knowledge. Furthermore, "almost immediately after [the TSA] agreement was signed, [Tronox] began training personnel;" maintaining onsite presence; consulting with Cristal on Jazan's design issues; and "[m]a[king] several significant contributions and suggestions for doing things differently" (Quinn, Tr. 2426).

213. As part of the TSA, Tronox has been providing practical, on-the-job training for the operators of the Jazan slagger. (Van Niekerk, Tr. 3955). This practical, on-the-job training is "a very important part of the TSA" because "one of the deficiencies" Tronox found at Jazan was that "they've never operated smelters before." (Van Niekerk, Tr. 3955). Tronox has already started the practical, on-the-job training. (Van Niekerk, Tr. 3955-56).

214. Tronox has been providing Cristal tap room operators "the exact same training" that Tronox provides its own tap floor operators. (Van Niekerk, Tr. 3956-57). The training has been happening in South Africa on location at Tronox's two smelters at Namakwa and KZN. (Van Niekerk, Tr. 3956). Tronox has a four-week training for tap floor operators that "involves a little bit of theoretical training, lots of safety training, and then physical, on-the-job training." (Van Niekerk, Tr. 3956-57). The "first group of tap floor operators have already been trained, declared competent and went back to the Kingdom." (Van Niekerk, Tr. 3956-57). Tronox also trained the metallurgists and the plant managers for two weeks in South Africa. (Van Niekerk, Tr. 3956-58). Tronox is providing "thorough theoretical and practical on-the-job training" for control room operators who are "in charge of that furnace 24/7." (Van Niekerk, Tr. 3957-58). Tronox is also providing training for the Jazan maintenance people because the "maintenance requirements on an ilmenite smelter (are) unique." (Van Niekerk, Tr. 3957-58). Tronox is providing metal treatment training on how to properly treat the iron because "[i]f you have problems at your metal treatment station station, it can prevent the furnace from running at full capacity." (Van Niekerk, Tr. 3957-58).

215. In the future, Tronox plans "to rotate Saudi people into South Africa, South Africa people into the Jazan slagger, and in that way . . . keep everybody competent." (Van Niekerk, Tr. 3959-60).

216. Stand-alone Cristal cannot give similar training to their people because they do not currently run an ilmenite smelter and "bought this Jazan slagger as a turnkey project from Outotec." (Van Niekerk, Tr. 3958-59).

217. If the Tronox-Cristal transaction does not go forward, "both the technical services agreement and the option agreement will lapse immediately because they are part and parcel of the bigger Cristal-Tronox deal." (Van Niekerk, Tr. 3960).

F. The Transaction Will Generate Substantial Cost-Saving Efficiencies.

218. "[T]he proposed transaction will lead to . . . significant cost reductions." (Shehadeh, Tr. 3441-42).

219. The transaction will allow Tronox to move "towards the lower cost end of the curve" which will "enable the merged entity to more effectively compete against Chemours and other low-cost producers like the Chinese." (Stern, Tr. 3790). Today, the "lowest-cost players" in the "industry globally are Chemours and Lomon Billions." (Arndt, Tr. 1406). The transaction will enhance Tronox's vertical integration and allow them to better compete against low-cost rivals. (Stern, Tr. 3790).

220. The cost-saving efficiencies would also "increase[] the incentives of the postmerger firm to expand output and, as a result," cause an "incentive to supply more to its customers, to the benefit of those customers." (Shehadeh, Tr. 3444-45). The cost savings will partly result from increasing the output of TiO2, which by itself moves Tronox toward the lower end of the cost curve. (Stern, Tr. 3790-91).

221. Tronox publicly communicated to the market a realization of $100 million of EBITDA synergies by the end of year 1, and $200 million by the end of year 3. (Mancini, Tr. 2800).

222. The estimated SG&A cost savings primarily result from the reduction in personnel and so-called "third party spend," i.e., contracts for third parties to provide needed services to the combined company. (Mancini, Tr. 2773-75). SG&A savings come from two primary areas: the

first is the reduction of personnel that you don't need, which includes the reduction of both salary as well as benefits for those employees; the second is third party spend. (Mancini, Tr. 2773-75). Tronox and Cristal both have separate HR, Finance, and executive teams that overlap and eliminating that overlap with save costs for the combined entity. (Mancini, Tr. 2773-75). Because the combination of two global organizations with corporate staffs causes "an enormous amount of overlap," the companies can eliminate much of that overlap and generate significant savings. (Mancini, Tr. 2773-74).

223. Tronox will also realize SG&A savings from reducing third-party spend. (Mancini, Tr. 2773-75). Both Cristal and Tronox spend money hiring third parties for insurance, and communications and accounting firms. (Mancini, Tr. 2773-75). The combined entity will save costs on these services. (Mancini, Tr. 2773-75).

224. The transaction will also generate supply chain savings. (Mancini, Tr. 2775-76). The supply chain benefits will allow Tronox to reduce the price it pays because of the scale of purchases it will be making, which will allow the combined Tronox-Cristal to get a greater volume purchase discount than either company currently enjoys. (Mancini, Tr. 2775-76). For example, both Tronox and Cristal buy pet coke, and there are indications that having a global supply agreement for the volume from both companies would significantly reduce the cost per ton of pet coke. (Mancini, Tr. 2775-76).

225. The transaction will improve the debt-to-income ratio for the combined company and save financing costs because it will pair the new, increased revenue base of the combined company with the current debt of both. (Quinn, Tr. 2334-2336). "The estimated leverage for Tronox on a stand-alone basis was 4.4 million, 4.4 times EBITDA, and immediately with the deal, because [Tronox would purchase] with EBITDA and . . . stock," leverage would immediately

decrease. (Quinn, Tr. 2335-36; PX0010-175). Because of deleveraging, "[i]mmediately, when the transaction was done, that estimate [for earnings per share] on a pro forma basis would [increase by $0.82] a share . . . a very positive improvement." (Quinn, Tr. 2334-35).

226. [redacted]

G. The FTC's Efficiencies Analysis Does Not Refute the Substantial Synergies to Be Realized from the Transaction.

a. Dr. Zmijewski Has No Expertise to Evaluate the Output-Enhancing Synergies.

227. Dr. Zmijewski is not an expert in the TiO2 industry or TiO2 manufacturing process. (Zmijewski, Tr. 1492-93). Dr. Zmijewski admitted that "[t]he extent of [his] knowledge regarding the operations in the TiO2 industry . . . is limited to documents [he] reviewed in this case." (Zmijewski, Tr. 1496).

228. Dr. Zmijewski has "no expertise or expert knowledge regarding the titanium dioxide manufacturing process." (Zmijewski, Tr. 1493). Dr. Zmijewski is admittedly not an expert in the operations of the TiO2 industry (Zmijewski, Tr. 1492), the technical operations at Tronox's or Cristal's pigment plants (Zmijewski, Tr. 1493), or the operation of any continuous process chemical manufacturing plants such as TiO2 plants. (Zmijewski, Tr. 1493.) [redacted] Dr. Zmijewki is "not qualified to evaluate the similarities or differences between Tronox's Hamilton plant and Cristal's

Yanbu plant" from a technical or operational perspective. (Zmijewski, Tr. 1493-94).[23]

229. Dr. Zmijewski also admittedly has no expertise or background in "chemical engineering or chemistry or metallurgy or mining." (Zmijewski, Tr. 1493). Dr. Zmijewski has no "technical or operational knowledge of how the Jazan facility works." (Zmijewski, Tr. 1494).

230. Dr. Zmijewski is only holding himself out as an expert in "accounting, economics, and finance, as they relate to financial analysis and valuation." (Zmijewski, Tr. 1492).

b. Dr. Zmijewski Does Not Offer the Opinion that the Transaction Synergies Will Not Occur.

231. Dr. Zmijewksi, the FTC's expert in finance and accounting, does not offer the opinion that the synergies will not occur. (Zmijewski, Tr. 1519). Specifically:

a. Dr. Zmijewski is not offering the opinion that there would be no increase in the output of TiO2 from the post-merger firm (Zmijewski, Tr. 1519);

b. Dr. Zmijewski is not offering the opinion that Tronox would not be able to expand its feedstock supply (Zmijewski, Tr. 1519); and

c. Dr. Zmijewski is not offering the opinion that there would be no cost-saving efficiencies (Zmijewski, Tr. 1519).

232. Dr. Zmijewski also does not "have an opinion one way or the other regarding whether KPMG's findings in its due diligence assessment [of the transaction synergies] are correct." (Zmijewski, Tr. 1552). Dr. Zmijewski "ha[sn't] evaluated whether or not [KPMG's] statements are correct." (Zmijewski, Tr. 1552).

233. When Dr. Zmijewski says a particular efficiency is "not verified," he is ***not*** saying "that the efficiency will never come to pass." (Zmijewski, Tr. 1505-06). [redacted]

234. All Dr. Zmijewski means when he says a particular synergy is not "verifiable" is that in all the information he reviewed, including the expert reports, he "ha[sn't] seen enough substantiation or a suitable methodology in the records available to [him] to say that the efficiency is verified according to [his] standards." (Zmijewski, Tr. 1505-06). Dr. Zmijewski "do[esn't] say the efficiencies are correct or incorrect. I think I said, hopefully clearly on my direct testimony, I don't see a number as accurate or inaccurate. The verification process, that's not the purpose. The purpose is can you identify information that is foundational for a particular assumption so that the Government has some level of confidence, whatever is required, that that assumption is reasonable based on what the Court determines in this particular case." (Zmijewski, Tr. 1521-22).

235. As Dr. Zmijewski succinctly put it: "I don't say the efficiencies are correct or incorrect." (Zmijewski, Tr. 1521-22).

c. Dr. Zmijewski Does Not Offer Any Alternative Estimate or Calculation of the Synergies.

236. Dr. Zmijewski is not offering "any alternative calculation of efficiencies beyond what the Respondents have put forward." (Zmijewski, Tr. 1519). [redacted] Dr. Zmijewski also did not offer a "haircut" to the synergies. (Zmijewski, Tr. 1520). [redacted] Dr. Zmijewski has "never calculated [his] own efficiencies." (Zmijewski, Tr. 1519-20).

237. Dr. Zmijewski did not even review every document that he listed as having been reviewed in his expert report. (Zmijewski, Tr. 1502).

H. The Parties' Estimates of the Transaction Synergies Were Subject to Extensive Third-Party and Company Review and Verification.

238. Not only are the synergy estimates for the transaction based on extensive due diligence by both Tronox and Cristal, but they have also been subject to extensive third-party review and due diligence by KPMG, a third-party consultant. (Mancini, Tr. 2801).

a. KPMG, a Third-Party Consultant, Pressure-Tested the Company's Synergies Estimates.

239. KPMG was hired by Tronox as a third-party consultant in this case to evaluate the transaction and the synergies to be realized. (Mancini, Tr. 2801; Zmijewski, Tr. 1528). [redacted]

240. As the FTC acknowledged, companies often hire third-party accountants, consultants, and financial advisors like KPMG to assist in the due diligence process. (Zmijewski, Tr. 1521). KPMG is a "very reputable firm." (Quinn, Tr. 2339).

241. "The company hired KPMG to . . . perform a detailed review of this assessment and to pressure-check and challenge the assumptions." (Quinn, Tr. 2338-39). It "was a very important part of (the synergy analysis), to get that third-party, independent verification." (Quinn, Tr. 2339). Tronox "brought in . . . real expertise from outside to make sure that" the synergy analysis is "done correctly." (Quinn, Tr. 2339). KPMG's synergy assessment was relied upon and presented to banks in order to obtain financing for the transaction. (Quinn, Tr. 2338).

242. KPMG "assess[ed]" and "pressure-test[ed]" the synergies. (Mancini, Tr. 2801-02).

243. KPMG validated the synergies that Tronox had publicly communicated. (Mancini, Tr. 2804).

244. KPMG's due diligence analysis was conducted by synergy and assessment and validation team to look at Tronox's estimates. (Mancini, Tr. 2802). The KPMG team included both operating and financial personnel. (Mancini, Tr. 2802). [redacted]

245. [redacted]

246. The KPMG team was clean-team certified, and were given access to the entire data room, including even data that company personnel at Tronox and Cristal could not access. (Mancini, Tr. 2802-04). [redacted] The KPMG team was "able to access all the information that was made available to Tronox and more." (Mancini, Tr. 2802-04). KPMG

had information available to them that was not available to both parties, i.e., Cristal and Tronox. (Mancini, Tr. 2802-04).

247. [redacted]

248. KPMG "put their stamp of approval" on Tronox's synergies. (Mancini, Tr. 2801-2). KPMG "had a strong level of confidence that . . . Tronox could deliver these estimated synergies." (Mancini, Tr. 2801-02). KPMG's report, which "demonstrated they had assessed and validated the synergies that we had publicly communicated" was "provide[d] to the lenders." (Mancini, Tr. 2804).

b. Tronox Has Conducted Extensive Due Diligence to Support Its Synergies Estimates.

249. In addition to third-party due diligence review by KPMG, Tronox and Cristal worked cooperatively to develop a "detailed synergy analysis" for the transaction synergies. (Quinn, Tr. 2337; PX0010-175).

250. The synergy analysis was "on-the-ground work that happened with a team consisting of Tronox people and Cristal people to go out and really" take a look at the synergies. "[T]here were boots on the ground . . . by experienced operating people, to take a look at what" the synergies were. (Quinn, Tr. 2337-38). The synergies analysis wasn't "done by a bunch of investment bankers sitting around in their offices in New York." (Quinn, Tr. 2337-38).

251. Tronox "formed a significant . . . project management office . . . and has a very formal process for identifying each of these synergies, assigning accountability for it, tracking it . . . and measuring it." (Quinn, Tr. 2339). "The Tronox diligence team visited each of the Cristal facilities around the world." (Quinn, Tr. 2354-55).

252. [redacted]

253. [redacted]

254. [redacted]

c. The Extensive Company and Third-Party Due Diligence on the Transaction Synergies Satisfies the Standard for Verification Under the Merger Guidelines.

255. Dr. Zmijewski admitted that the Merger Guidelines and existing case law "do not prescribe specific standards, methods, or tests that should be used to verify efficiency claims." (Zmijewski, Tr. 1489).

256. Dr. Zmijewski agreed that under the Merger Guidelines, federal agencies evaluating mergers and acquisitions in the antitrust context "give careful consideration to the views

of individuals whose responsibilities, expertise, and experience relating to the issues in question provide particular indicia of reliability." (Zmijewski, Tr. 1492).

257. [redacted]

258. Dr. Zmijewski acknowledged that the Respondents "clearly have more information than I do and more data than even is available to the Court" regarding the calculation of transaction synergies. (Zmijewski, Tr. 1519-20).

259. Dr. Zmijewski agreed that under the Merger Guidelines, "business records about output and level of activity are appropriate factual bases for determining the verifiability of synergies." (Zmijewski, Tr. 1491). Dr. Zmijewski also agreed that "business records about capacity utilization, labor efficiency, and utilization rates are appropriate factual bases for determining verifiability of synergies." (Zmijewski, Tr. 1491-92).

260. Dr. Zmijewski has not found and does not offer the opinion that any of the transaction efficiencies arise from "anticompetitive reductions in output or service." (Zmijewski, Tr. 1488).

I. Tronox Has Successfully Achieved—and Exceeded Its Estimates for—Synergies from Prior Acquisitions Involving Vertical Integration.

261. Tronox has experience achieving many of the same types of synergies as are expected from the Cristal transaction (supply chain and logistics, value in use of feedstock, and SG&A), and has successfully done so in the past. (Mancini, Tr. 2746-47).

262. [redacted]

[redacted]

263. [redacted] Tronox not only successfully realized the anticipated synergies in the Exxaro transaction, but it "overdelivered on the synergy estimates." (Mancini, Tr. 2747-48).

264. Indeed, not only did Tronox overdeliver on the synergies, it did so on an earlier timeline than anticipated. (Mancini, Tr. 2747-48). Tronox estimated approximately $30 million in synergies "by the end of year two," but "already realized 32 million of synergies by the end of year one." (Mancini, Tr. 2747-48). And "by the end of year two, we were at 40 million of synergies." (Mancini, Tr. 2747-48).

265. Tronox has more synergies to achieve from the Cristal transaction compared to the Exxaro transaction "because the Cristal business is so similar to the Tronox business that there is a lot more overlap." (Mancini, Tr. 2748-49).

266. [redacted]

267. [redacted]

IV. THE RELEVANT GEOGRAPHIC MARKET IS BROADER THAN NORTH AMERICA, AND IS GLOBAL.

268. "[T]he relevant market in which to evaluate the likely competitive effects of the proposed transaction . . . is global." (Shehadeh, Tr. 3202).[25]

269. Dr. Shehadeh conducted an economic analysis to determine the proper geographic market for this case. (Shehadeh, Tr. 3203-04). Dr. Shehadeh's approach for defining the geographic market in this case is the hypothetical monopolist test as described in the Horizontal Merger Guidelines, "starting with the candidate market that had been proposed by Dr. Hill," i.e., "sales to customers in North America." (Shehadeh, Tr. 3203-04).

270. The "economic evidence" confirms "that the market is broader than North America." (Shehadeh, Tr. 3204-05). "[T]he global trade" data and "the relationship between prices globally . . . all demonstrate that the market is global in scope." (Shehadeh, Tr. 3207). The specific "sources of economic evidence" demonstrating that the market for TiO2 is global include "global trade patterns," in particular "the magnitude of global trade of titanium dioxide relative to both production and consumption, the movement over time, the elasticity of global trade that is evident in the variation of trade over time and across countries, including the sources of trade into North America and the variation in trade into North America." (Shehadeh, Tr. 3204-05). This economic evidence also includes "the comovement of prices globally, including applying accepted economic techniques [used by FTC economists] to evaluate that comovement of prices

[25] Dr. Ramsey Shehadeh is an expert in economics, industrial organization ("IO," or "the study of how companies and customers interact in marketplaces"), and econometrics ("the application of statistics to economic data"). (Shehadeh, Tr. 3196). Dr. Shehadeh is a managing director and partner at National Economic Research Associates ("NERA"), and he is formerly the chair of NERA's global antitrust practice. (Shehadeh, Tr. 3197). Dr. Shehadeh has a master's and Ph.D. in economics from Cornell University, and a bachelor of science in mathematical economics from the University of Wisconsin at Madison. (Shehadeh, Tr. 3195-96). Dr. Shehadeh's "exclusive" work over the past 25 years at NERA has been IO and econometrics, and the "vast majority" of that work has been "evaluating the competitive effects of mergers, acquisitions, joint ventures, and other business combinations." (Shehadeh, Tr. 3197). Dr. Shehadeh has evaluated the competitive effects of "hundreds" of mergers and acquisitions, including in the chemical industry. (Shehadeh, Tr. 3197-99). Dr. Shehadeh has also evaluated the competitive effects of global acquisitions, including global mergers and acquisitions in the chemical industry. (Shehadeh, Tr. 3199).

statistically." (Shehadeh, Tr. 3204-05). "The fabric of that economic evidence points to a conclusion that across the board that the relevant market is global." (Shehadeh, Tr. 3282-83).

A. Significant International Trade Flows Demonstrate the Global Nature of the TiO2 Market.

271. Global trade flow data show "significant trade flows around the globe," including "trade both into and out of North America in very significant volumes." (Shehadeh, Tr. 3212).

272. Overall, "69% of consumption of TiO2" in the world crosses international borders. (Romano, Tr. 2233). This TiO2 "comes from trade flows, meaning that it's sold in a country that it's not produced." (Romano, Tr. 2233).[26]

273. All told, "[t]he magnitude of global trade flows overall, the magnitude relative to production, and the magnitude relative to consumption, and . . . the variability and flexibility over time, including increases to meet demand in North America, are inconsistent with a market limited to North America and, in fact, reflect the global nature of demand and supply" in the TiO2 market. (Shehadeh, Tr. 3223).

a. All Major TiO2 Producers Produce and Sell TiO2 in a Global Network.

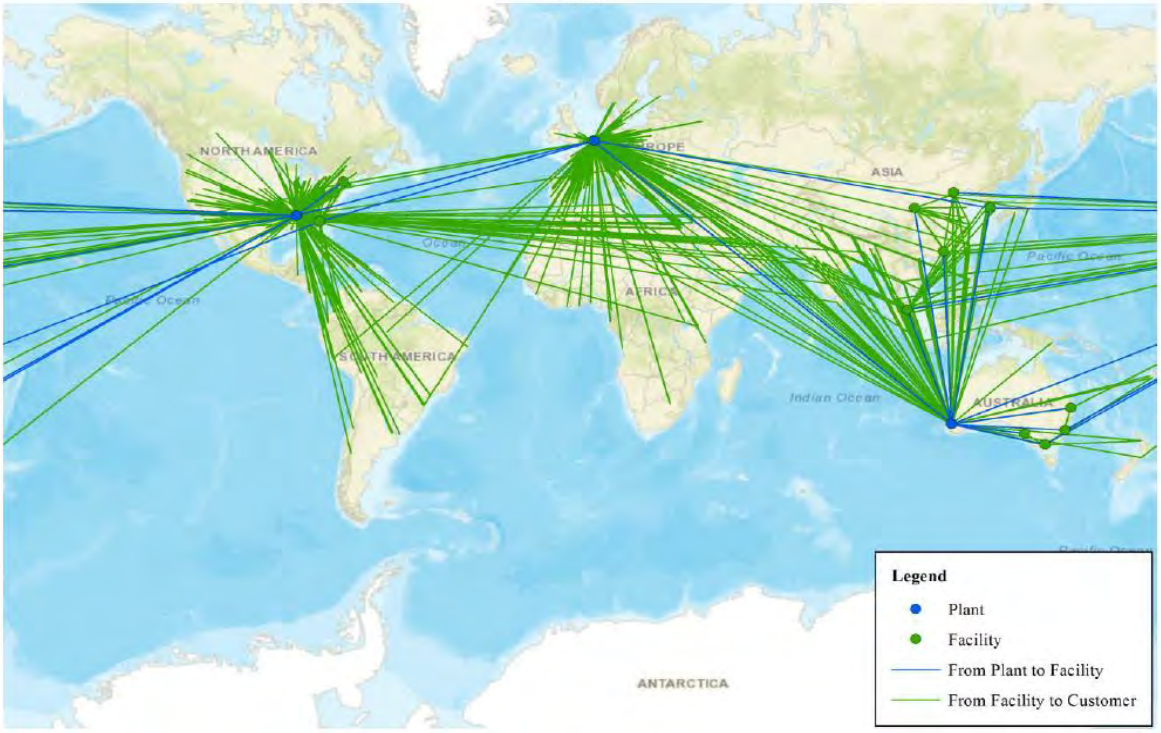
274. The global TiO2 producers (Chemours, Cristal, Venator, Lomon Billions, Kronos, Tronox) produce, sell, and ship product all over the world. (RX0171.0027; Shehadeh, Tr. 3210-11).

275. For example, as shown in Shehadeh Figure 1 (RX0170.0011), TiO2 product shipped from manufacturing plants to facilities and warehouses demonstrate that TiO2 "is moving

[26] It is also typical for large coatings companies to have centralized, worldwide raw materials buying functions. (Malichky Tr. 625). [redacted]

around the globe from plants around the globe." (Shehadeh, Tr. 32111; *see also* Mei, Tr. 2150-55 (describing Tronox's global inventory movements)).

Figure 1
TiO2 Flows from Tronox Plants to Facilities and Customers
2016



276. Shehadeh Figure 1 (RX0170.0011) shows "the scope of trade and logistical movements out of [Tronox's] facilities." (Shehadeh, Tr. 3210).

277. Tronox has a global network to produce TiO2, including mines, feedstock facilities, pigment plants, and warehouses all over the world. (Mei, Tr. 3149-50).

a. Tronox's mines and feedstock facilities are located in South Africa and Australia. (Mei, Tr. 3150-3151). Tronox's feedstock "need[s] to cross ocean to reach our pigment plants" in Europe and the United States. (Mei, Tr. 3151).

b. Tronox's pigment plants are located in Hamilton, Mississippi; Botlek, The Netherlands; and Kwinana, West Australia. (Mei, Tr. 3151; Romano, Tr. 2231).

c. Tronox has 10 warehouses globally that it uses as distribution centers: in Rotterdam, The Netherlands; South Africa; South Korea; Malaysia; Dubai; two in China; and four in Australia. (Mei, Tr. 3154). Tronox also ships TiO2 directly to customers all over the world. (Mei, Tr. 3153). Tronox ships its TiO2 pigment globally using "ocean bulk and ocean container." (Mei, Tr. 3152-53). On land, Tronox ships pigment by rail or truck. (Mei, Tr. 3155).

278. Tronox "export[s] TiO2 all over the world." (Romano, Tr. 2237).

279. Tronox manages its TiO2 and feedstock inventory "globally." (Mei, Tr. 3164). As a result, "if any region is short, we will move products either from other plant or from other warehouses." (Mei, Tr. 3164). These cross-regional transfers are a "very common practice." (Mei, Tr. 3164).

280. Tronox's customer service group is located around the world and services a global customer base. (Romano, Tr. 2228). Tronox has a customer service group in Australia that's responsible for customers in Asia; a customer service group in The Netherlands that's responsible for customers in Europe, Africa, and the Middle East; and a customer service group in North America that's responsible for North America, which includes Canada and Mexico, and also Latin America. (Romano, Tr. 2228).

281. Tronox ships TiO2 to more than 1,200 locations worldwide and sells its TiO2 product "globally in over 90 countries." (Mei, Tr. 3155; Romano, Tr. 2231). Each year, Tronox exports approximately 25% of the production at its Hamilton, Mississippi plant to foreign nations (Mei, Tr. 3161; Shehadeh, Tr. 3210). Tronox exports more than 90% of the production at its Kwinana plant outside Australia. (Mei, Tr. 3161). As Figure 1 shows, "the product is moving around the globe from plants around the globe." (Shehadeh, Tr. 3211).

282. Cristal produces TiO2 at facilities in Ashtabula, Ohio; Yanbu, Saudi Arabia; Stallingborough in the U.K; Thann, in France; Bunbury, Australia; and Tikon, in Fuzhou, China. (PX0002-11-12). These facilities produce TiO2 for customers all over the world. (*See* PX0013).

283. TiO2 is traded internationally in significant quantities because TiO2 has no expiration date, a virtually infinite shelf life, and no safety issues involved with transporting TiO2. (Mei, Tr. 3157-58). TiO2 is easily transported by truck, rail, or sea. (Mei, Tr. 3154-57). There are "no special requirement in terms of handling or transportation" of TiO2. (Mei, Tr. 3156).

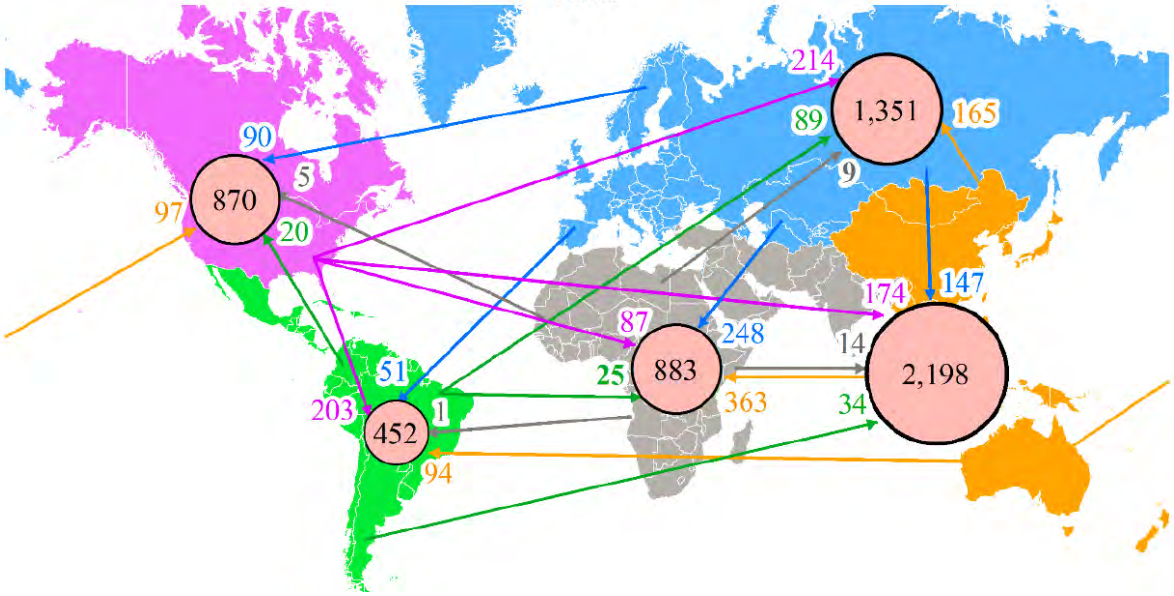
284. TiO2 is also relatively inexpensive to ship across the globe. TiO2 costs about 3% of the total price to move it into and out of the United States. (Mei, Tr. 3158). Indeed, shipping TiO2 internationally is so economical that total shipping costs, including tariffs and taxes, can be lower for TiO2 shipped internationally than TiO2 shipped domestically. (Mei, Tr. 3159-60). For instance, it costs less to ship TiO2 from Australia to Los Angeles than it does to ship it from Hamilton, Mississippi to Los Angeles. (Mei, Tr. 3159).

b. Substantial Imports into and Exports from North America Confirm There Is No Narrow, North America-Only TiO2 Market.

285. "North America is not an island." (Shehadeh, Tr. 3229). In 2010 and 2016, total trade volume of TiO2 in North America was "over 100 percent," which is "quite significant" and indicates substantial openness to trade in North America. (Shehadeh, Tr. 3228-29).

286. As depicted by Shehadeh Figure 2 (RX0170.0012), there are "significant trade flows around the globe, and we see trade both into and out of North America in very significant volumes." (Shehadeh, Tr. 3212).

Figure 2
Global Trade Flows Between Regions
2016

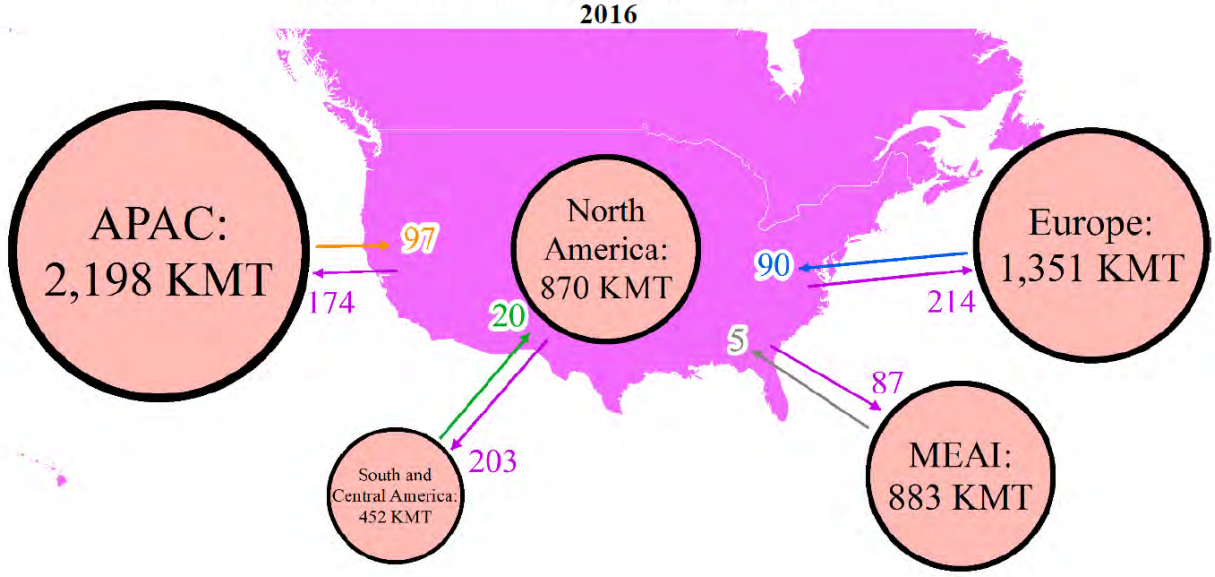


287. Shehadeh Figure 2 (RX0170.0012) shows each geographic region's "apparent consumption" of TiO2 (production plus imports minus exports) in 2016. (Shehadeh, Tr. 3212; RX0170.0012). The unit is thousands of metric tons per annum ("ktpa"). (Shehadeh, Tr. 3213). The other numbers are "the imports and/or deliveries into those destination countries, with the lines showing the origination." (Shehadeh, Tr. 3212-13). For instance, apparent consumption for the United States and Canada[27] in 2016 was 870 ktpa. (Shehadeh, Tr. 3213).

288. Shehadeh Figure 3 (RX0170.0013) shows "this parallel trade in both directions" specifically for North America. (Shehadeh, Tr. 3215).

[27] Shehadeh Figure 2 depicts "North America" as the United States and Canada minus Mexico because Dr. Shehadeh's analysis of geographic market "start[ed] with the candidate market that Dr. Hill has proposed," which excludes Mexico from North America. (Shehadeh, Tr. 3215-16; RX0170.0013).

Figure 3
Imports into and Exports out of North America
2016



289. As shown in Shehadeh Figure 3 (RX0170.0013), imports to the United States and Canada in 2016 were 90 ktpa from Europe; 5 ktpa from the Middle East/Africa; 20 ktpa from South and Central America; and 97 ktpa from Asia Pacific/China. (RX0170.0013). Exports from the United States and Canada in 2016 were 214 ktpa to Europe; 174 ktpa to Asia; 87 ktpa to Africa; and 203 ktpa to Latin America. (Shehadeh, Tr. 3213-14; RX0170.0013).

290. These global trade flows into and out of North America show "the linkage of demand in North America to supply around the world." (Shehadeh, Tr. 3229).

291. Total imports of TiO2 into North America are "around 150 to 200,000 kilotons per year," and total exports of TiO2 from North America are "around 600 to 700,000 kilotons per year." (Shehadeh, Tr. 3214).

292. From 2002 to 2016, annual imports of rutile TiO2 into North America varied from 75,000 metric tons per year to 200,000 metric tons per year. (Hill, Tr. 1901; PX5000-035, Fig. 13; Shehadeh, Tr. 3217-18).

293. In 2016, roughly 15 percent of the rutile titanium dioxide consumed in North America was imported. (Hill, Tr. 1901).

294. Even though the North American market currently has more production capacity than is required by customers, hundreds of thousands of tons of TiO2 are imported by customers yearly. (Turgeon, Tr. 2670-71).

295. Imports of TiO2 into North America show significant "elasticity of import supply over time," which is "reflected in the variation of imports to respond to demand in North America." (Shehadeh, Tr. 3217-18).

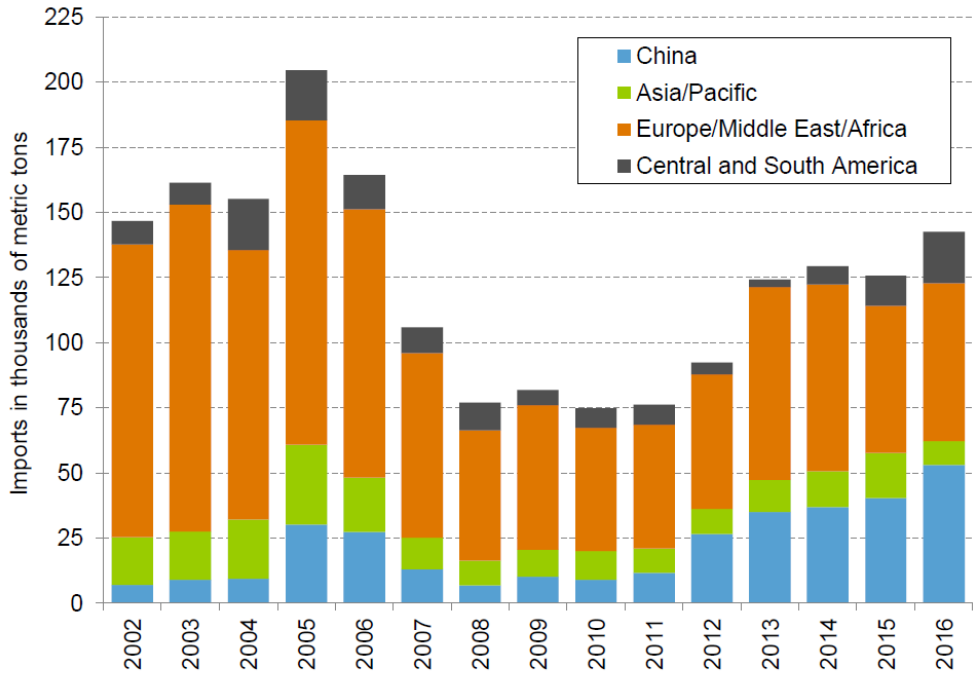
296. From 2002 to 2016, imports of TiO2 into North America "var[ied] from a high in excess of 200,000 tons per year to a low of approximately 75,000 tons per year." (Shehadeh, Tr. 3217-18).

297. The significant magnitude and variation in imports of TiO2 into North America is "striking" and "reflects the flexibility of import supply to respond to changes in demand, including demand that would arise in response to a SSNIP [small but significant nontransitory increase in price] in the hypothetical monopolist test, the ability to respond to that in North America." (Shehadeh, Tr. 3217-18; PX5000-033, Figure 12).

298. Imports of TiO2 into North America also show a "variation of the origin countries," including, more recently, increases from China. (Shehadeh, Tr. 3220-21). UN Comtrade data reflecting imports of TiO2 into North America by "country of origin" is depicted in Hill Figure 13 (PX5000-035).[28] (Shehadeh, Tr. 3220-21).

[28] Dr. Shehadeh testified that he "agree[s] with" the underlying UN Comtrade data reflected in Figure 13 from the expert report of Dr. Hill, the FTC's economist, even though he "do[es] not agree with [Dr. Hill's] conclusion" from this data. (Shehadeh, Tr. 3221-22).

Figure 13. North America imports by region of origin



Source: UN Comtrade data.

299. As Hill Figure 13 (PX5000-035) shows, "when the peak imports over [the period 2002-2016] were achieved in 2005 . . . the origins were largely Europe. More recently, as we have seen imports increase, you will see that the origin was much more China, and that's consistent with what we've learned about—everything about the rise of China as a global supplier of titanium dioxide." (Shehadeh, Tr. 3220-21). This data shows "flexibility depicted in the variation of the origin countries." (Shehadeh, Tr. 3220-21).

300. From 2010 to 2016, Chinese imports of TiO2 into North American increased by "approximately five times." (Shehadeh, Tr. 3220-21). Chinese imports of TiO2 into North America are still "a relatively small portion of total exports from China." (Shehadeh, Tr. 3224-26). This means there is greater "potential that's out there for that substitution by North American customers to alternative sources of supply." (Shehadeh, Tr. 3224-26). These alternative sources

of supply for TiO2 are relevant for North American customers who would be seeking "other sources in response to [a] SSNIP" in North America. (Shehadeh, Tr. 3224-26).

301. The "significant volume of imports and the flexibility and elasticity in imports" observed at the global level can also be observed at the "individual company level." (Shehadeh, Tr. 3226-27).

[redacted]

303. In terms of exports, North America is a net exporter of rutile TiO2 and chloride-process TiO2. (Hill, Tr. 1901-02). Indeed, "a significant amount of chloride titanium dioxide produced in North America is exported." (Hill, Tr. 1901).

304. Between 2002 and 2016, North American exports of chloride-process TiO2 ranged from just over 400,000 metric tons per year to almost 700,000 metric tons per year. (Hill, Tr. 1902; PX5000-038, Fig. 15). In 2016, over 600,000 metric tons of chloride titanium dioxide—46 percent of all chloride titanium dioxide produced in North America—was exported out of North America. (Hill, Tr. 1902; PX5000-037 ¶ 84). Chemours alone exports roughly 400,000 tons of chloride TiO2 from North America each year. (Hill, Tr. 1902; 1935).

305. "The significant trade flows lead to the linkage of demand in North America to supply around the world and reflect the ability of customers in North America to turn to international supply, including in response to a small but significant nontransitory increase in price in the candidate market, North America." (Shehadeh, Tr. 3229). For geographic market definition and the hypothetical monopolist test, this means "that the market related to North America would be drawn too narrowly and needs to be expanded to be global." (Shehadeh, Tr. 3229).

B. TiO2 Prices Rise and Fall Together Across Geographic Regions, Demonstrating that the Market for TiO2 Is Global.

306. The "statistically and economically significant" "co-movement" of TiO2 prices across geographic regions is a well-established economic method that "demonstrate[s] that the relevant market is broader than North America" and, in fact, is global. (Shehadeh, Tr. 3230). Co-movement means TiO2 prices across different regions "mov[e] together over time." (Shehadeh, Tr. 3230). Specifically, "when price goes up, it goes up everywhere in the world, and when price goes down, it goes down everywhere in the world." (Turgeon, Tr. 2672).

307. The co-movement of prices involves "look[ing] at the closeness of relationships between geographies, whether or not there is a long-term relationship." (Shehadeh, Tr. 3230). The statistical analysis of this co-movement of prices "account[s] for other factors" in determining the co-movement of prices beside being in the same geographic market. (Shehadeh, Tr. 3229-30).

308. The statistically and economically significant global co-movement of TiO2 prices "inform[s] the scope of the relevant market, and particularly, here, demonstrate[s] that the relevant market is broader than North America." (Shehadeh, Tr. 3229-30).

309. The methods used by Dr. Shehadeh to evaluate the co-movement of TiO2 prices, both economically and statistically, are "generally accepted economic methods" in the field. (Shehadeh, Tr. 3229-30). Indeed, these methods for evaluating co-movement of prices for determining relevant markets have "been used by economists" and "published in academic journals, including publications by economists at the Federal Trade Commission." (Shehadeh, Tr. 3229-30). The economic literature Dr. Shehadeh relies upon is "peer-reviewed." (Shehadeh, Tr. 3231-32).

310. To evaluate the statistical and economic co-movement of TiO2 prices across geographic regions, Dr. Shehadeh "looked at pricing data from companies produced in this

litigation, as well as pricing data from industry analysts, TZMI." (Shehadeh, Tr. 3230-31). Based on this data, the evidence shows that "prices over time, across geographies," "establish the relationship between North America and the rest of the world." (Shehadeh, Tr. 3232). This shows that "[t]he geographic market is global." (Shehadeh, Tr. 3233).

311. [redacted]

312. [redacted]

313. [redacted]

"[A]nytime . . . the TiO2 pricing moves outside of that band, it [tends] to migrate back into the band over time." (Romano, Tr. 2233). [redacted] If one region were to fall outside of that trend, it would open up arbitrage opportunities. (Stern, Tr. 3719). [redacted] The same factors influence prices across the globe, so in that sense prices for TiO2 are "interdependent" of one another in different parts of the world. (Romano, Tr. 2237).

314. [redacted]

315. [redacted]

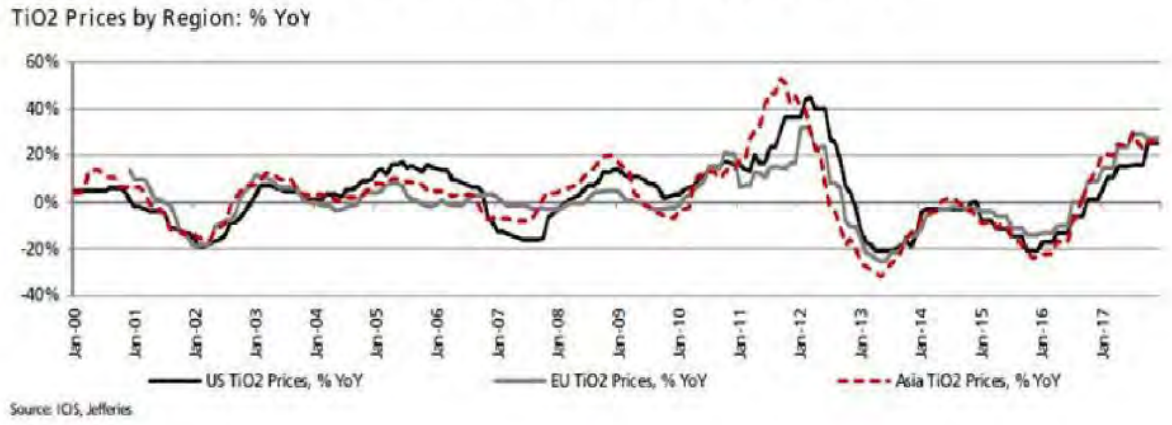
316.

317. The data on TiO2 pricing across geographic regions "consistently show[s] that the co-movement in prices is statistically and economically significant across a variety of statistical tools, including correlations and cointegration." (Shehadeh, Tr. 3231). FTC economists describe the methods used by Dr. Shehadeh for evaluating co-movement in TiO2 prices across regions and

product types as "among the broadly applied techniques" for defining antitrust markets; this is true for both geographic and product markets. (Shehadeh, Tr. 3233-38). Indeed, the data on co-movement of TiO2 prices globally "fits squarely into the fabric of economic evidence that is called for in the Merger Guidelines when describing the hypothetical monopolist test and consistent with the economics literature."[29] (Shehadeh, Tr. 3243-44).

318. Stern Figure 26 (RX0171.0072) shows "the extent to which there have been price changes for TiO2 for various regions," including the United States, Europe, and Asia between 2000 and 2017. (Stern, Tr. 3720).

Figure 26[226]
Year-over-Year TiO2 Price Changes (%)



319. Stern Figure 26 (RX0171.0072) shows that prices changes "year by year have tracked each other quite well." (Stern, Tr. 3720). "The shape of the curves is nearly identical." (Stern, Tr. 3720).

[29] At trial, Complaint Counsel objected to Dr. Shehadeh, an economist, testifying about the DOJ/FTC Merger Guidelines in a merger case. (Shehadeh, Tr. 3245-46).

320. [redacted].

321. The Pori fire in Europe is an example of a regional event affecting global supply-demand balance. (Stern, Tr. 3717-18). [redacted] Supplies from other regions needed to pour in to replace the lost supply. (Stern, Tr. 3717-3718). In fact, after the Pori fire, Europe, which "used to be one of the lowest area price[s] in the world suddenly switched to become the highest price," and producers responded by "start[ing] to move their production to feed that market." (Turgeon, Tr. 2668).

322. Even though the Pori plant is located in Finland and makes TiO2 using only the sulfate process—it does not use the chloride method—the fire affected TiO2 prices worldwide, including in North America. (Stern, Tr. 3718; [redacted] In the short-term, TiO2 prices globally went up. (Stern, Tr. 3718).

[30] [redacted]

323. [redacted]

[redacted]

324. [redacted]

[redacted]

325. The global co-movement of TiO2 prices, as informed by well-accepted, peer-reviewed economic literature by FTC economists, "demonstrate[s] the interrelationship of titanium

dioxide globally" and, in particular, "that a market limited to North America is drawn too narrowly and that, in contrast, the properly defined relevant market is global." (Shehadeh, Tr. 3231).

C. TiO2 Producers and Customers Can and Do Engage in Arbitrage.

326. Both suppliers and customers of TiO2 "engage[] in arbitrage." (Romano, Tr. 2237-38). In particular, customers of TiO2 "have the capability to" move TiO2 "all over the world." (Romano, Tr. 2237). Customers have the ability to engage in arbitrage of TiO2, so if price reaches levels "where it's significantly higher for a significant period of time, customers will move product around." (Romano, Tr. 2237-38). This is arbitrage. (Romano, Tr. 2237). For the most part, "those are global customers." (Romano, Tr. 2237-38).

327.

328.

[31] PPG Industries is one of the largest paint and coatings companies in the world. (Malichky, Tr. 267-69, 343). In the United States, PPG sells architectural paint under the brand names Glidden, Pittsburgh Paint, Manor Hall, Liquid Nails, and others. (Malichky, Tr. 269). PPG also sells paint for industrial applications, like bridges, cars, and airplanes. (Malichky, Tr. 269-70).

[redacted]

329. Although customers will engage in arbitrage when opportunities exist, in practice there are few opportunities for arbitrage because prices "all follow the same sort of trend globally." (Stern, Tr. 3719; [redacted]. As a result, "[y]ou won't find one region seriously out of whack with another region. That would open up arbitrage opportunities." (Stern, Tr. 3719).

D. Dr. Hill Narrowly and Artificially Draws His Geographic Market to "North America," Which He Defines as the United States and Canada, Minus Mexico.

a. Dr. Hill Deliberately Limited His Analysis to "North America," Despite Acknowledging This Is a "Worldwide Merger."

330. Dr. Hill admits that the transaction at issue "is a worldwide merger." (Hill, Tr. 1903; Hill, Tr. 1782). But Dr. Hill admitted that "when it comes to a potential global TiO2 market," he has "not done any of the analysis that [he] as an economist typically would do when analyzing a market." (Hill, Tr. 1944).

331. For example, Dr. Hill only ran one of his models using worldwide market shares for rutile TiO2,[32] and this model run predicted that the merger would not be profitable. (Shehadeh, Tr. 3203, 3392, 3399-3400; Hill, Tr. 1781-82). Dr. Hill did not run any other model simulations over a global geography. (Shehadeh, Tr. 3203, 3392). Instead, Dr. Hill ran the rest of his models using a North America-only and chloride-process-only market. (Shehadeh, Tr. 3203, 3392-93).

[32] This was a Cournot model run for a global rutile titanium dioxide market. (Shehadeh, Tr. 3203, 3392). This model run is discussed *infra* Proposed Findings of Fact ("FOF") at ¶¶ 693-95.

332. Chief Judge Chappell pressed Dr. Hill about why he did not run his economic model for a worldwide market even though he admitted that the transaction was global in nature. (Judge Chappell, Tr. 1783). Dr. Hill's basis for running his models over a North America-only market was his "assumption" that the geographic market is North American only. (Hill, Tr. 1784-85). As Dr. Hill testified:

> JUDGE CHAPPELL: Just so I'm clear, the variables you plugged into your model were based on the assumption that the geographic model in this—the geographic market in this case is North America, excluding Mexico, and the product market is chloride process titanium dioxide?
>
> THE WITNESS: That is correct, Your Honor. In both of my models, that's correct.

(Hill, Tr. 1784-85).

333. Dr. Hill's Cournot model could have been fully applied worldwide, but Dr. Hill chose not to "analyz[e] the incentives worldwide." (Hill, Tr. 1782-83). Instead, Dr. Hill only analyzed "the profitability or incentives in the North American market." (Hill, Tr. 1782-83). Indeed, Dr. Hill confirmed that in both of his models [the capacity closure model and Cournot model], "the variables [he] plugged into [his] model were based on the assumption that the . . . geographic market in this case is North America, excluding Mexico, and the product market is chloride process titanium dioxide." (Hill, Tr. 1784-85).

334. Dr. Hill admitted that "a good way to start looking for a candidate market is to look for areas of overlap between the merging firms"—but that is not what he did. (Hill, Tr. 1668-69; Hill, Tr. 1903). Ultimately, Dr. Hill ended his market definition inquiry right where he started—concluding that the "most relevant market" is "the sale of chloride titanium dioxide in the U.S. and Canada." (Hill, Tr. 1670).

335. Chief Judge Chappell observed that Dr. Hill's model was "front-running" because Dr. Hill applied it only to his preferred market, and not to other possible markets. (Judge Chappell, Tr. 1783).

336. As another example, Dr. Hill did not conduct "a hypothetical monopolist test or a capacity closure model based on [a] worldwide market." (Hill, Tr. 1944). Dr. Hill also did "not analyze[] the likelihood of anticompetitive coordinated effects in any markets other than for sales of chloride TiO2 in North America and sales of rutile TiO2 in North America." (Hill, Tr. 1945).

337. In short, Dr. Hill did not conduct any analysis of a worldwide market for TiO2. (Hill, Tr. 1943).

b. Dr. Hill Narrowly Defines the Geographic Market in This Case as "North America," Thereby Artificially Increasing Market Concentration.

338. Dr. Hill's definition of the geographic market (i.e., sales to customers in North America) is "too narrow." (Shehadeh, Tr. 3205). This is true for Dr. Hill's hypothetical monopolist test,[33] which relied exclusively on his critical loss analysis. (Shehadeh, Tr. 3206). The effect of Dr. Hill's drawing the geographic market too narrowly is "to calculate shares that are too high because they are limited to that market." (Shehadeh, Tr. 3206). Specifically, it "increases the HHI." (Shehadeh, Tr. 3206).

339. Furthermore, and "more importantly, in the context of his merger simulation models," the effect of Dr. Hill's drawing the geographic market too narrowly is that it "constrains the effect of the scope of competition that is, in fact, being observed in the real world, and that effect drives through his models." (Shehadeh, Tr. 3206).

[33] To define his relevant product market, Dr. Hill purportedly used used the hypothetical monopolist test under the Merger Guidelines. (Hill, Tr. 1905). This test is designed to consider whether a hypothetical company that controlled all sales within North America could implement a small, but significant, non-transitory increase in price ("SSNIP"). (Shehadeh, Tr. 3258).

340. Dr. Hill's analysis of geographic market is "unreliable" because it "isn't consistent with the real world." (Shehadeh, Tr. 3202-03). Dr. Hill's geographic market analysis does not properly take into account "the response of global trade to changes in relative prices in North America." (Shehadeh, Tr. 3205-06). "[T]he global trade, the relationship between prices globally, all demonstrate that the market is global in scope." (Shehadeh, Tr. 3206). Dr. Hill's geographic market definition does not comport with "the economic evidence." (Shehadeh, Tr. 3206).

341. [redacted]

342. Dr. Hill's inappropriately narrow application of the hypothetical monopolist test is partly "how he could end up with the result of excluding Mexico from his definition" of North America. (Shehadeh, Tr. 3261).

343. Dr. Hill's geographic market is drawn too narrowly because in his hypothetical monopolist test, Dr. Hill "constrain[s] the ability of customers to turn to alternative sources of supply outside of North America." (Shehadeh, Tr. 3205-06). Specifically, "Dr. Hill imposes on his hypothetical monopolist test that the hypothetical monopolist controls not just current and

future supply in his candidate market, but current, future, and all potential supply in the candidate market and, therefore, inappropriately restricts the alternatives to which customers could return—could turn in response to a SSNIP." (Shehadeh, Tr. 3257-58). This "has the effect of causing the [geographic] market to be drawn too narrowly." (Shehadeh, Tr. 3205-06).

344. In his hypothetical monopolist test, Dr. Hill assumed that the only way to defeat a SSNIP imposed by a hypothetical monopolist is substitution away from the product or by "arbitrage." (Hill, Tr. 1905). As a result, Dr. Hill's hypothetical monopolist test is overly restrictive because "he restricts the scope of substitution and the scope of . . . arbitrage relative to what is properly considered in the Merger Guidelines." (Shehadeh, Tr. 3260).

345. Dr. Hill further defined arbitrage in an overly restrictive way, i.e., as "a customer buying product in one region and transporting that product by itself to another region." (Hill, Tr. 1905). In other words, Dr. Hill defined "traveling" in its "most literal sense," such that in order for a customer to substitute to Chinese supply of TiO2, Dr. Hill "requires that the customer travel to China, take delivery in China, and bring that product back to North America." (Shehadeh, Tr. 3260).

346. Under Dr. Hill's definition of "arbitrage," if a customer in North America reached out to Lomon Billions to get TiO2, if that customer handled shipping it would count as "arbitrage," but if Lomon Billions handled shipping and the customer picked up the product at the port of Los Angeles that would not count as "arbitrage" according to Dr. Hill. (Hill, Tr. 1905-06).

347. Dr. Hill's analysis ignores evidence that customers in North America can and do turn to international suppliers for TiO2, and the supply of international production to North American customers has increased in recent years, including from China. (Shehadeh, Tr. 3225; *see also* RX0170.0010;).

348. [redacted]

349. Dr. Hill's analysis of the relationship between prices in North America and imports into North America also "has the effect of causing the market to be drawn too narrowly." (Shehadeh, Tr. 3205-06). This is because Dr. Hill's analysis of prices and imports "understate[s]" the relationship between prices in North America and imports; this also "has the effect of causing the market to be drawn too narrowly." (Shehadeh, Tr. 3205-06).

350. "[W]hen Dr. Hill goes on to analyze the relationship between prices in North America and imports, he uses methods that understate that relationship and, as a result, does not provide reliable information on the responses of global trade to changes in relative prices in North America." (Shehadeh, Tr. 3205-06).

351. Dr. Hill's analysis of prices and imports leads to statistical predictions that are "in conflict with the real world." (Shehadeh, Tr. 3267-68).

352. In the real world, a customer "making a decision about whether or not to purchase from a supplier in North America or seek supply from another source around the world . . . isn't going to just look at the prices in North America. That customer will also look at the alternatives, in Europe, in China." (Shehadeh, Tr. 3273-74).

353. Dr. Hill's calculation of the statistical relationship between imports and prices (his "import regression") implies that "the variation in global trade flows, including the variation in North America, has nothing to do with price from anywhere in the world except for China, and even for China, according to his regression, it's small. And that's simply not consistent with what the economic evidence shows in terms of the volume of trade and in terms of the relationship in prices across geographies that results." (Shehadeh, Tr. 3276).

354. Dr. Hill's import regression further "understates the responsiveness of imports to relative price changes" in North America because it ignores prices from suppliers outside North America. (Shehadeh, Tr. 3274).

355. As a result of these errors in Dr. Hill's import regression, his "statistical world" is "strikingly different" from "what's happening in the real world." (Shehadeh, Tr. 3267-68). Specifically, Dr. Hill's analysis of prices and imports for geographic market definition is "inconsistent" with the economic evidence of global trade flows and co-movement of TiO2 prices across regions. (Shehadeh, Tr. 3276).

356. The effect of Dr. Hill's drawing the geographic market too narrowly doesn't just affect his geographic market; it also affects his calculation of market shares and his analysis of competitive effects of the transaction. (Shehadeh, Tr. 3206).

357. Dr. Hill's calculation of predicted loss for geographic market definition is unreliable because his regression analysis for imports to North America "understates the variation in price," and "as a result, that would lead to drawing the market too narrowly." (Shehadeh, Tr. 3269-70).

358. Dr. Hill's regression analysis is unreliable because it implies "that the imports that we observe from the rest of the world and the variation over time of the imports we observe from

the rest of the world has nothing to do with price." (Shehadeh, Tr. 3267). To say that the significant variation in imports to North America from the rest of the world "has nothing to do with price as an indicator of demand in North America just to my eye doesn't pass the test." (Shehadeh, Tr. 3268).

359. Dr. Hill's regression analysis is further unreliable because he uses a producer price index ("PPI") as the price for his candidate market. (Shehadeh, Tr. 3268-69). The PPI "reflects the prices earned by producers in the United States." (Shehadeh, Tr. 3269). This is a flaw in Dr. Hill's analysis because his "candidate market is ***sales*** to customers in North America," not producers in North America. (Shehadeh, Tr. 3269 (emphasis added)). As a result, Dr. Hill's price index for his regression analysis "[is not]… the price in the candidate market." (Shehadeh, Tr. 3269). Because the PPI "includes the prices earned on exports," which are outside Dr. Hill's candidate market, and because "it excludes the prices earned by suppliers from outside of North America into the candidate market," Dr. Hill's use of a PPI "leads to understating that relationship." (Shehadeh, Tr. 3269).

360. Because Dr. Hill's regression analysis understates the variation in price, "it leads to an understatement in the identified relationship statistically," which, as a result, "would lead to drawing the [geographic] market too narrowly." (Shehadeh, Tr. 3270).

361. Dr. Hill's regression analysis is further unreliable because his example of imports from the rest of the world "doesn't account for" prices outside of North America (e.g. in China or in Europe). (Shehadeh, Tr. 3273-74). This is flawed because a customer "making a decision about whether or not to purchase from a supplier in North America or seek supply from another source around the world . . . isn't going to just look at the prices in North America. That customer will also look at the alternatives, in Europe, in China." (Shehadeh, Tr. 3273). "And likewise, a supplier

in China or in Europe will not be just looking at the price in North America. They'll be looking at the price in North America, in their home country, so, for example, China, and in the other countries to which they could supply." (Shehadeh, Tr. 3274). It is key to include all of these global prices in a regression analysis because "as we saw from that extent of global trade, [customers] have numerous options." (Shehadeh, Tr. 3274). For example, "when price goes up to $4,000," Dr. Hill's regression "doesn't consider that the price outside of North America also went up, and so by doing so, it understates the responsiveness of imports to relative price changes." (Shehadeh, Tr. 3274).

362. The effect of Dr. Hill's failure to consider prices outside of North America in his regression analysis "understates the responsiveness" and therefore his calculation "indicate[s] that the market is narrower than it in fact is from an economic perspective." (Shehadeh, Tr. 3276).

363. All of the economic evidence, including "prices, the magnitude of imports, the elasticity of imports and the evidence from the economics literature" together "points to a conclusion that across the board that the relevant market is global." (Shehadeh, Tr. 3282-83).

364. Furthermore, for product market, Dr. Hill assumed that the geographic market was North America when testing whether chloride TiO2 was a relevant product. (Hill, Tr. 1903).

365. For competitive effects analysis, "more importantly, in the context of his merger simulation models," drawing the geographic market too narrowly "constrains the effect of the scope of competition that is, in fact, being observed in the real world." (Shehadeh, Tr. 3206).

V. THE RELEVANT PRODUCT MARKET INCLUDES ALL RUTILE TIO2, WHETHER FROM THE SULFATE PROCESS OR CHLORIDE PROCESS.

366. The "relevant product market in which to evaluate the likely competitive effects of the proposed acquisition of Cristal by Tronox includes both sulfate-produced and chloride-produced rutile titanium dioxide." (Shehadeh, Tr. 3283).[34]

367. The economic evidence supporting a product market of both sulfate-produced and chloride-produced rutile TiO2 includes "the comovement in prices," the variation in imports of sulfate-process and chloride-process TiO2 into North America, "commercial data" from suppliers, "industry studies," and "the testimony of customers and producers." (Shehadeh, Tr. 3284-85).[35][36]

368. The purpose of defining a relevant product market "is to understand the scope of products among which customers do and can switch in response to relative price changes." (Shehadeh, Tr. 3283). It "include[s] not only historical evidence of customers switching at *current prices* but also evidence about the switching that customers could undertake and would undertake

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[34] Notably, Complaint Counsel's claim here regarding the product market for TiO2 cannot be reconciled with the FTC's own past positions. When reviewing TiO2 producer DuPont's proposed acquisition of the TiO2 division of Imperial Chemical Industries ("ICI") in 1998, the FTC found direct competition between chloride- and sulfate-process TiO2. In the merger review, the Commission found a single TiO2 market that included both sulfate- and chloride-process TiO2 and acknowledged the significant global trade in TiO2. (*See* RX1598).

[35] Comovement is apparent even during market extremes - notably, when chloride-produced TiO2 was nearly $4,000 per MT (FOF ¶361), sulfate-produced TiO2 was also almost $4.000 per MT. (*See*, *for example*, RX0170-30 and 31, figure 13 and 14 (showing sulfate-produced TiO2 at the same price or higher than chloride-produced TiO2 when buying from Venator and Kronos at the market's peak).

[36] The FTC has not proposed a titanium dioxide slurry market in this case. (Hill, Tr. 1948-49) ("Q. Doctor, I just want to make sure that we're clear on the record for the court. You've not defined a chloride TiO2 slurry market in North America, right? A. That is correct. Q. And you're not presenting an opinion that North American slurry is a relevant market; correct? A. Correct, I am not presenting that opinion."). Slurry is simple to make from dry titanium dioxide (which is easily shipped overseas). Many titanium dioxide customers already make their own slurry. [redacted] Engle, Tr. 2452 (explaining that there is no "technical reason why you would be unable to make slurry out of TiO2 made from the slurry process")).

in response to a SSNIP."[37] (Shehadeh, Tr. 3284 (emphases added)). Because today "we observe customers already switching at current prevailing prices," this means that "substitution will be hastened and extended by a change in relative prices that makes sulfate relatively more favorable given its lower price because the SSNIP is only applied to chloride." (Shehadeh, Tr. 3321-22).

A. Chloride- and Sulfate-Process TiO2 Are Interchangeable for the Vast Majority of End-Use Applications.

369. About 80% of TiO2 end products can be made with either the sulfate or chloride processes. (Turgeon, Tr. 2622-23; Stern, Tr. 3835-39). Indeed, a TiO2 industry study states that "80 percent of end applications are indifferent towards chloride and sulfate, provided quality is the same." (Shehadeh, Tr. 3319; RX1503.0014). "[T]here's universal agreement with that assumption among the experts" that the vast majority of end-use applications are indifferent to chloride process and sulfate process, provided quality is the same. (Shehadeh, Tr. 3673-74; RX1503.0014).[38] About 10% of products are more compatible with the sulfate process, and about 10% of products are more compatible with the chloride process. (Turgeon, Tr. 2622-23). So while "[t]here is some specific product that are easier to make from the sulfate process pigment, and there is some specific product that are easier to make from the chloride pigment," for "the vast majority of the application, like 80 percent, you could be one or the other." (Turgeon, Tr. 2622-23). "[I]t doesn't matter for the end result, the end product." (Turgeon, Tr. 2623; Stern, Tr. 3836, 3838; PX9020-

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[37] For example, according to Dr. Hill, "if 15 percent of volume switched in response to a SSNIP of 10 percent, then that would be sufficient to expand the market beyond" chloride-process only TiO2. (Shehadeh, Tr. 3322). If the SSNIP were 5 percent, the number would change to 7.5 percent of customers needing to switch. (Shehadeh, Tr. 3322).

[38] Customer testimony elicited by complaint counsel at trial about the differences between chloride and sulfate product was provided by non-expert, non-chemists, who primarily focus on purchasing and product testing or formulation at their companies. (Malichky, Tr. 275 ("I would not say that I'm a chemist… but I have enough that I can survive most conversations.").

007; RX1503.0013). Tronox sold both chloride and sulfate-process TiO2 until it closed its Savannah plant when it had financial difficulties. (Engle, Tr. 2445-46 (explaining Tronox personnel's expertise in sulfate-process TiO2); Romano, Tr. 2249; Dean, Tr. 2947 (discussing the closing of the Savannah plant)).

370. "[Y]ou could make a very good paint with a sulfate TiO2 and you could make a very good paint with a chloride TiO2." (Turgeon, Tr. 2622). "[I]f you control your sulfate process properly, the quality of the sulfate pigment is as good and even better than the quality of the chloride pigment in some case." (Turgeon, Tr. 2622).[39]

371. [redacted]

372. Paints and coatings produced with chloride-process and sulfate-process TiO2 can look "exactly the same." (Engle, Tr. 2466-67) (referring to RXD-0016, which shows samples of CR-828 and CR-826, Tronox's chloride product, compared with TR92, a sulfate-made Venator product); Engle, Tr. 2464-65).

[39] Although impurities in raw TiO2 can be affected by the production process, impurities in the finished product are impacted more by the feedstock used for production. (Turgeon, Tr. 2584; Engle, Tr. 2441 (testing impurities in feedstock); Engle, Tr. 2439 (purification that occurs *after* the chlorination process)).

[40] Mr. Jeffrey Engle is the vice president of marketing and product development at Tronox. (Engle, Tr. 2433). Mr. Engle leads Tronox's research and development laboratory in Oklahoma City. (Engle, Tr. 2437). Mr. Engle has a degree in chemical engineering from Oklahoma State University and an MBA from Auburn University in 2006. (Engle, Tr. 2433-34). Mr. Engle began working as a technical service engineer for Tronox in 2006. (Engle, Tr. 2434).

373. Sulfate-process TiO2 can also be "comparable" to chloride-process TiO2 with respect to relative tint strength versus relative hiding power. (Engle, Tr. 2463-65; Pschaidt, Tr. 1022-23) [redacted]

374. For durability of TiO2 pigment, "95 percent of that technology is in surface treating," rather than the manufacturing process. (Engle, Tr. 2477). To improve a TiO2 pigment's durability, the process that Tronox would focus on "would be 100 percent finishing and treatment," rather than the manufacturing process. (Engle, Tr. 2480).[41]

375. Other TiO2 producers have also testified that chloride-process TiO2 can be used interchangeably with sulfate-process TiO2 in the vast majority of end-use applications. (Christian, Tr. 893-96). For instance, Kronos agreed that both chloride-process and sulfate-process TiO2 are "suitable" for use in the vast majority of end-use applications, including:

- "architectural coatings";
- "house paints";
- "decorative coatings";
- "industrial coatings";
- "plastic for packaging" (e.g., polyolefins);
- "plastics for the construction sector"; and
- "laminate paper."[42] (Christian, Tr. 893-96).

[41] [redacted]

376. In short, "most end-use applications can use pigments produced by either process." (Christian, Tr. 896).

377. [redacted]

B. The Chloride and Sulfate Processes Are Conceptually Similar, and the Resulting Pigment Is Chemically Identical.

378. "[I]f you use the chloride process or if you use the sulfate process, you end up with the same TiO2 molecule at the end." (Turgeon, Tr. 2673). Since TiO2 is TiO2, "at the end, you can make paint with the TiO2 molecule the same way if it came from chloride or if it came from sulfate." (Turgeon, Tr. 2673-74).

379. Although there are some differences between the two, the chloride process is similar in key respects to the sulfate process. (Engle, Tr. 2444). "[T]hey're basically both ways of extracting whatever iron is left in the feedstock, extracting that out." (Engle, Tr. 2444). One process uses chloride to "reduce the TiO2" and "take out the iron" (chloride process) and another process "us[es] sulfuric acid to do it." (Engle, Tr. 2444). "So the concept is really the same." (Engle, Tr. 2444).

380. After this process, the "finishing step" for both chloride-process and sulfate-process TiO2 is "identical." (Engle, Tr. 2444). By the time the product gets to that step, the TiO2 "become[s] identical again." (Engle, Tr. 2445).

381. The manufacturing process (chloride vs. sulfate) has less of an impact on TiO2 pigment quality than the finishing process. (Engle, Tr. 2433). The "finishing is more important than the process [chloride or sulfate] to achieve the hundred percent TiO2, because you start from

automotive coatings, marine coatings, other transport coatings, plastics for packaging (i.e. mainly polyolefins), plastics for construction sector (i.e. mainly PVC), and laminate paper). (Christian, Tr. 918).

the same TiO2." (Turgeon, Tr. 2623). "If you don't do the finishing properly, your pigment won't work." (Turgeon, Tr. 2623).

382. The finishing process for chloride-process TiO2 and sulfate-process TiO2 are identical. (Engle, Tr. 2444). Finishing determines TiO2 opacity due to milling, which makes the right particle size and aids optical efficiency, and surface treatment, which determines particle dispersion. (Engle, Tr. 2453-54). In some cases, surface treatments, a part of the TiO2 finishing process, have reduced the TiO2 necessary for formulas by as much as 20 percent. (Engle, Tr. 2453-54). Furthermore, TiO2 durability is primarily a result of surface treatment, a part of the finishing process. (Engle, Tr. 2477-78, 2480).

C. Customers Can and Do Switch Between Chloride- and Sulfate-Process TiO2.

383. Customers can and do switch, or "substitute," between sulfate-process and chloride-process TiO2. (Mouland, Tr. 1224-25; Romano, Tr. 2238-41; Shehadeh, Tr. 3470-71). [redacted] Specifically, customers will switch if prices for chloride-process TiO2 increase relative to the prices for sulfate-process TiO2. (Mouland, Tr. 1224-25).

384. A TZMI industry report states that "[m]ost TiO2 customers do not have a preference for the process that produces the product they desire." (Shehadeh, Tr. 3311 (quoting RX1277.0090)). This is because "[c]ustomers are concerned primarily with the impact of purchased titanium dioxide on the end product's value in use, and the end customer design specifications for the TiO2 product as such." (Shehadeh, Tr. 3311 (quoting RX1277.0090)). The TZMI industry report goes on: "TiO2 end customers can and will switch to a producer with a different technology if the right arbitrage exists for the 'substitute' product and the product is capable of meeting the customer's requirements." (Shehadeh, Tr. 3312; RX1277.0090).

385. [redacted]

386. Tronox's chloride-process TiO2 is rivaled by sulfate-process TiO2 from producers Kronos, Venator, and Cristal, who "all make very good quality sulfate TiO2 that we compete with directly." (Romano, Tr. 2238). And "over [the] last ten to fifteen years and more importantly in the last five," Chinese producers "have become an extremely competitive" producer of sulfate TiO2, too. (Romano, Tr. 2239). All told, Tronox has "been competing head to head with sulfate TiO2" for at least 30 years. (Romano, Tr. 2239).

387. Customers that use chloride TiO2 also purchase sulfate TiO2, including for use in North America. For example:

a. [redacted]

[redacted]

388. Barclays, an independent observer of the TiO2 market, noted in 2016 that "there is enough fungibility between sulfate [and] chloride end-markets that a combined supply/demand is what impacts the economics." (Turgeon, Tr. 2736; Shehadeh, Tr. 3536; RX0251).

[redacted]

[43] [redacted]

389. [redacted]

390. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

395. Customers undertake "the same" effort to reformulate from one chloride grade to another chloride grade of TiO2 as they would need to undertake to reformulate from a chloride grade to a sulfate grade. (Mouland, Tr. 1225). [redacted]

Crucially, however, no customers testified that the qualification process for sulfate-process TiO2

is any more time-consuming or difficult than that for chloride-process TiO2. [redacted], tools of the TiO2 trade, such as the Weatherometer, can reduce the testing process to merely 144 hours. (Engle, Tr. 2479-80).[44]

D. Chloride-Process TiO2 Competes Directly Against Sulfate-Process TiO2.

396. Tronox, which "is a chloride-only producer," has to compete vigorously against sulfate companies in order to retain customers. (Turgeon, Tr. 2673-74). Tronox "[has] lost customer to people who have only sulfate plant." (Turgeon, Tr. 2674). Tronox "had to compete with that sulfate." (Turgeon, Tr. 2674).

397. [redacted] CR-826 is "one of [Tronox's] biggest products worldwide. It is produced in every plant, and it's a major coatings product for us." (Engle, Tr. 2460).

398. [redacted] The fact that Tronox competes with and loses customers to sulfate-only producers is real-world "proof that one can compete with the other." (Turgeon, Tr. 2674).

399. [redacted]

[44] [redacted]

[redacted]

400. [redacted] RX2005 shows the Tronox chloride-process TiO2 grades that compete with other Western producers' TiO2 grades, including both chloride-process and sulfate-process TiO2 grades. [redacted]

[redacted]

[45] Mr. Mouland, who oversees all of Tronox's sales efforts in North America and South America, has worked at Tronox or its predecessor since 1998. (Mouland, Tr. 1141).

401.

[redacted]

402.

d. [redacted]

404. [redacted]

[redacted]

[redacted]

405. [redacted]

c. [redacted]

407. As reflected in both RX2005 and RX2006, Tronox sells TiO2 by "specification" and for particular applications and subapplications. (Arndt, Tr. 1408; Mouland, Tr. 1236-37). As a result, "[r]egardless of which particular technology made that pigment, the pigment must meet the specification," so chloride-process and sulfate-process grades compete with each other where they can both meet the same specifications. (Arndt, Tr. 1408).

408. For this reason, Mr. Mouland does not even pay close attention to whether a customer or potential customer is using chloride-process or sulfate-process TiO2 because "it doesn't really matter"; from a competitive perspective, "whether they're buying chloride or sulfate doesn't make any difference." (Mouland, Tr. 1225-26).

409. Kronos manufactures TiO2 "using both [sulfate and chloride] processes."[47] (Christian, Tr. 751). Kronos manufacturers about 40 grades of TiO2; "about half" are sulfate and "about half" are chloride. (Christian, Tr. 897-98). [redacted]

[47] In fact, Kronos manufactures sulfate-process TiO2 in North America. (Christian, Tr. 752).

410. Kronos' sulfate grades "compete with some chloride grades." (Christian, Tr. 898). For example:

a. Kronos 2043 is a sulfate grade of TiO2 sold by Kronos that is "marketed for its excellent opacity and coatings above critical pigment volume concentration" and "good dispersion rate," which "makes it very economical in its use." (Christian, Tr. 900-01).

b. Kronos 2056 is a sulfate grade of TiO2 sold by Kronos that is marketed for its "good exterior durability on coatings and plastics." (Christian, Tr. 901-02).

c. Kronos 2101 is a sulfate grade of TiO2 sold by Kronos that is "suitable for architectural paint applications" and "plastics, primarily PVC." Kronos 2101 "imparts a good brightness and a neutral tone," and "develops good tinting strength and hiding power." (Christian, Tr. 902-04).

d. Kronos 2190 is an "important" and "high-volume grade" for Kronos. It is "a very large product from a volume perspective amongst our SP portfolio." (Christian, Tr. 904). Kronos 2190 "competes with chloride grades." (Christian, Tr. 906). It is "suitable for use in architectural paints in indoor and outdoor use," "has a very high gloss," "disperses readily," has "outstanding hiding power and tinting strength," and "imparts good outdoor durability" (i.e., "how well it can withstand the elements or withstand wiping or scrubbing"). Kronos 2190 is "highly economical in use." (Christian, Tr. 904-06).

411. [redacted]

[redacted]

412. Tronox's customer relationship management system (known as CRM") includes references to "customers seeking additional substitution for sulfate from chloride," which is "consistent with the rest of the economic evidence" indicating "the incentive and ability of customers to substitute between" chloride and sulfate rutile TiO2. (Shehadeh, Tr. 3319-21).

413. Chloride-process and sulfate-process TiO2 also compete because customers regularly "leverage" sulfate-process TiO2 prices in negotiations with suppliers over prices for chloride-process TiO2. (Romano, Tr. 2241; Christian, Tr. 933-35; Turgeon, Tr. 2675). [redacted]

416. [redacted]

E. Prices for Chloride- and Sulfate-Process TiO2 Are Highly Correlated, Indicating They Are Part of a Single Product Market.

419. "[T]here is a long-term relationship between sulfate and chloride titanium dioxide prices," which demonstrates that "the relevant market . . . is not limited to chloride-produced titanium dioxide . . . but also includes sulfate-produced rutile titanium dioxide." (Shehadeh, Tr. 3289).

[48] [redacted]

420. The prices of chloride-process and sulfate-process TiO2 are closely correlated because TiO2 customers not only "have the ability" to switch between chloride and sulfate TiO2, but also do switch "in a way that maintains the co-movement of prices across [rutile] titanium dioxide irrespective of the manufacturing process." (Shehadeh, Tr. 3316).

421. To evaluate the co-movement of chloride and sulfate rutile TiO2 prices, Dr. Shehadeh "reviewed pricing data . . . from a number of sellers," "both in North America and globally, and compared those prices over time and for different geographies." (Shehadeh, Tr. 3286). Dr. Shehadeh looked at TiO2 prices for Cristal, Kronos, and Venator, because those are three major producers of TiO2 who manufacture and sell both the chloride and sulfate processes. (Shehadeh, Tr. 3286-87).

422. [redacted]

[redacted]

423. [redacted]

[redacted] [redacted]

[redacted] [redacted]

428. [redacted]

429. All of these price correlations between chloride-process and sulfate-process TiO2 "show[] that the relevant market includes both chloride-produced and sulfate-produced titanium dioxide." (Shehadeh, Tr. 3288).

430. [redacted]

[redacted]

432. Dr. Shehadeh used statistical and economic methods to confirm the statistical co-movement of sulfate-process and chloride-process rutile TiO2 prices and to rule out other possible causes of this co-movement. (Shehadeh, Tr. 3233). The methods used by Dr. Shehadeh have been described by FTC economists as "among the broadly applied techniques" for defining antitrust markets. (Shehadeh, Tr. 3233-35). This is true for both geographic and product markets. (Shehadeh, Tr. 3237-38).

433. Using these methods, Dr. Shehadeh found a "statistically and economically significant" co-movement of sulfate and chloride rutile TiO2 prices. (Shehadeh, Tr. 3288). This economic analysis "shows that the relevant market includes both chloride-produced and sulfate-produced titanium dioxide." (Shehadeh, Tr. 3288).

F. The Increased Proportion of Sulfate TiO2 Imports into North America Shows the Incentive and Ability of Customers to Substitute.

434. The "proportion of imports" of sulfate TiO2 into North America "has increased over time, over the last few years." (Shehadeh, Tr. 3307-08). A "significant source" of the increased proportion of sulfate TiO2 imports into North America over the last few years is China. (Shehadeh, Tr. 3308).

435. This shift in the product mix of imports (i.e. the increased proportion of sulfate-process TiO2 imports into North America relative to chloride-process TiO2 imports into North

America) indicates "the incentive and ability of customers to substitute to sulfate-produced titanium dioxide." (Shehadeh, Tr. 3308).

436. When customers of TiO2 decide to "substitute outside of North America a source of supply, they consider . . . not only chloride-produced titanium dioxide but also sources of sulfate-produced titanium dioxide." (Shehadeh, Tr. 3285). Based on detailed data from a number of sources, "[o]ver time, patterns of trade showed that the imports of sulfate and chloride, the mix, . . . varied over time . . . ," demonstrating the ability and incentive of customers to substitute between chloride and sulfate-produced TiO2. (Shehadeh, Tr. 3284-85).

G. Dr. Hill's Product Market Analysis Artificially Limits the Ability and Incentive of Customers to Switch from Sulfate to Chloride.

437. Dr. Hill began his market definition by analyzing a market of sales of chloride-process TiO2 in the United States and Canada. (Hill, Tr. 1669-70; Hill, Tr. 1676). Ultimately, Dr. Hill ended his market definition inquiry right where he started—concluding that the "most relevant market" is "the sale of chloride titanium dioxide in the U.S. and Canada." (Hill, Tr. 1670). According to Dr. Hill, "[a]n important features of the capacity closure model is that it can also be applied to the world but for the merger." (Hill, Tr. 2000-01; Shehadeh, Tr. 3335-36).

438. Dr. Hill's product market definition analysis is "unreliable" because it "isn't consistent with the real world." (Shehadeh, Tr. 3202-03).[49] First, Dr. Hill's analysis "understate[s] the responsiveness of substitution to sulfate-produced rutile titanium dioxide from chloride titanium dioxide." (Shehadeh, Tr. 3285-86).

[49] Notably, Complaint Counsel's theory in this case regarding the product market for TiO2 cannot be reconciled with the FTC's own past positions. When reviewing TiO2 producer DuPont's proposed acquisition of the TiO2 division of Imperial Chemical Industries ("ICI") in 1998, the FTC found direct competition between chloride- and sulfate-process TiO2. In the merger review, the Commission found a single TiO2 market that included both sulfate- and chloride-process TiO2 and acknowledged the significant global trade in TiO2. (RX1598).

439. Second, Dr. Hill's product market definition analysis also suffers from "very similar" issues as those "in the geographic context."[50] (Shehadeh, Tr. 3298). Specifically, Dr. Hill's product market is "drawn too narrowly because of the constraints on substitution of customers that are imposed [by Dr. Hill] in his analysis." (Shehadeh, Tr. 3324). "[A]s a result, he inappropriately identifies a too narrow relevant product market." (Shehadeh, Tr. 3286).

440. Dr. Hill's implementation of the hypothetical monopolist test for product market suffers from the same flaws from his geographic market. (Shehadeh, Tr. 3285-86). Dr. Hill's methods "understate the responsiveness of substitution to sulfate-produced rutile titanium dioxide from chloride titanium dioxide." (Shehadeh, Tr. 3286). This defines the product market too narrowly "for the very similar reasons to what we saw in the context of his consideration of the responsiveness of imports to prices in North America," i.e., he understates the responsiveness. (Shehadeh, Tr. 3285-86).

441. Dr. Hill's critical loss analysis for product market definition is further flawed because his "methods skew his result to understate the relationship" between the price of chloride TiO2 in North America and price of chloride TiO2 in North America. (Shehadeh, Tr. 3296-97). This error "skew[s] his result to draw a narrower [product] market than the economic evidence indicates is appropriate." (Shehadeh, Tr. 3296-97).

442. Dr. Hill "performed a critical loss analysis in order to implement [his] hypothetical monopolist test." (Hill, Tr. 1907). Dr. Hill's critical loss analysis has two stages: calculating the critical loss and calculating the predicted loss. (Hill, Tr. 1907). The "critical loss calculation

[50] These flaws in Dr. Hill's critical loss analysis are described in the geographic market context in ¶¶ 349-55, *supra*. This evidence against Dr. Hill's critical loss analysis is fully incorporated for the product market context here. (Shehadeh, Tr. 3298).

calculates the percentage of sales that a hypothetical monopolist would have to lose to keep profit unchanged." (Hill, Tr. 1908).

443. As to the calculation of critical loss, the first stage of critical loss analysis, there are two inputs to Dr. Hill's calculation: SSNIP and margin on lost sales. (Hill, Tr. 1908). To calculate the margin on lost sales, Dr. Hill summed up the costs for all chloride plants in North America "then calculate[] a weighted average of the marginal cost." (Hill, Tr. 1910).

444. Dr. Hill's critical loss analysis for product market definition is unreliable because "[t]he key part of the calculation of the critical loss" is internal cost and margin data that Dr. Hill himself testified was unreliable and that "he would not rely on." (Shehadeh, Tr. 3295-96). To calculate the margin on lost sales, Dr. Hill summed up the costs for all chloride plants in North America "then calculate[] a weighted average of the marginal cost." (Hill, Tr. 1910). The basis for Dr. Hill's calculations on margin of lost sales was based on plant-level cost data from the 2016 TZMI Cost Study. (Hill, Tr. 1909-11; PX5000-050, n. 214; PX5000-145, ¶ 326). [redacted] At trial he confirmed that he was not willing to rely on "the TZMI data used in [his] capacity closure model to estimate internal costs" for Chemours, Kronos, and Venator because he does not have "any direct knowledge about how accurate it is." (Hill, Tr. 2012-13[51]).

445. Dr. Hill himself admitted that if if his "calculations for the margin on lost sales are incorrect, then [his] critical loss calculation could be wrong." (Hill, Tr. 1909).

[51] In fact, when Dr. Hill testified that he was not willing to rely on the 2016 TZMI cost study for estimated internal costs at his deposition, he had simply forgot that he had "used the exact same 2016 TZMI cost study to estimate internal costs when calculating marginal cost calculations for [his] hypothetical monopolist test." (Hill, Tr. 2016).

446. Dr. Hill further admitted that if his calculation of critical loss is incorrect, then his "implementation of a hypothetical monopolist test may be wrong." (Hill, Tr. 1907). Thus, Dr. Hill's calculation of critical loss for geographic market definition is "unreliable" because he uses data that he himself described as unreliable and something "that he is not willing to rely on." (Shehadeh, Tr. 3263).

447. In any event, Dr. Hill's critical loss calculation found that a SSNIP of 10 percent could be defeated if "15.4 percent or more" of chloride-process TiO2 sales were lost through arbitrage, customers no longer buying any TiO2 at all, or customers switching to sulfate-process TiO2. (Hill, Tr. 1908). In the second stage of his critical loss analysis, Dr. Hill calculated a "predicted loss" for each of the losses from arbitrage, discontinued buying and switching. (Hill, Tr. 1907-08).

448. Dr. Hill sets predicted losses through arbitrage at zero. As Dr. Shehadeh explained, this was wrong because Dr. Hill "again, inappropriately restricts the substitution that customers consider" outside the candidate market of North America. (Shehadeh, Tr. 3264). Thus, Dr. Hill "doesn't account for the real-world substitution that we observe in the variation of the trade data over time and in the economics literature." (Shehadeh, Tr. 3280).

[redacted]

450. To analyze the predicted switching to sulfate TiO2, Dr. Hill relied on his regression analysis of substitution between chloride-process TiO2 and sulfate-process TiO2. Dr. Hill's analysis of substitution between chloride-process TiO2 and sulfate-process TiO2 is unsound

because he "looks at just price levels [of chloride TiO2 only] as opposed to relative prices" of chloride and sulfate TiO2. This analysis is incorrect and unreliable because "the role of the SSNIP is to be a ***relative*** price increase." (Shehadeh, Tr. 3293 (emphasis added)). For example, Dr. Hill's use of a producer price index for his regression for product market definition "does not include sales of . . . titanium dioxide produced outside of the United States and sold to customers in North America." As a result, it "understate(s) the responsiveness of . . . substitution by customers to changes in price." (Shehadeh, Tr. 3298-99).

451. Because Dr. Hill's regression for product market definition "doesn't include relative prices" between chloride and sulfate TiO2, it therefore "can't answer [the] question" of "if the price of chloride went up and the price of sulfate didn't go up, what happens." (Shehadeh, Tr. 3298-3301).

VI. POST-MERGER MARKET CONCENTRATION IS TOO LOW TO RAISE THE PROSPECT OF ANTI-COMPETITIVE EFFECTS.

452. "The combined share of the postmerger Tronox and concentration overall would be too low to be consistent with either unilateral or coordinated competitive effects in the properly defined relevant market." (Shehadeh, Tr. 3325).

453. Under the properly defined geographic and product market (a global rutile[52] TiO2 market), the post-merger Herfindahl-Hirschman Index ("HHI"), a measure of market concentration, is "below 1500 and in fact below 1300 by any measure." (Shehadeh, Tr. 3326). This is true for both Dr. Shehadeh's and Dr. Hill's data for the relevant market. (Shehadeh, Tr.

[52] [redacted] Anatase TiO2 has a different crystal structure than rutile TiO2, and is often used in specialty products, such as food and pharmaceuticals. (Christian, Tr. 781-82).

3326). The Merger Guidelines say that these levels of concentration "are unlikely to raise the prospect of anticompetitive effects." (Shehadeh, Tr. 3325).

454. "[E]ven these low levels of concentration and shares would overstate the competitive significance" of the transaction in the real world because "shares and concentration are a static measure of competition," whereas the TiO2 industry is characterized by the "dynamic nature of competition in demand for and supply of titanium dioxide." (Shehadeh, Tr. 3327-28). Market shares "are just a snapshot" of a "dynamic" TiO2 industry. (Shehadeh, Tr. 3327-28). The dynamic nature of the TiO2 industry is manifest in "new capacity expansions, new plants coming online, high-cost capacity being driven out of the market, and . . . dynamic competition" between TiO2 suppliers. (Shehadeh, Tr. 3328).

455. Dr. Hill calculated market shares for two potential relevant markets: "the sales of rutile TiO2 to customers in North America" and "the sales of chloride TiO2 to customers in North America."[53] (Hill, Tr. 1919). Dr. Hill did not use or rely on any calculation of market shares or concentration for a worldwide market. (Hill, Tr. 1946). Dr. Hill calculates the HHI for his proposed North American chloride titanium dioxide market using "market share based on volume in metric tons of chloride TiO2 sold to customers in the United States and Canada." (Hill, Tr. 1919-20). Dr. Hill's market shares are calculated based on "sales to North American customers," not "total sales or capacity." (Hill, Tr. 1927).

456. Dr. Hill's market share calculations for his proposed North American chloride TiO2 market "don't consider global TiO2 capacity available to serve North America." (Hill, Tr. 1920).

[53] Dr. Hill's market share calculations for his proposed North American chloride titanium dioxide market "are not based on production capacity of chloride TiO2 in North America." (Hill, Tr. 1920). Dr. Hill's market share calculations for his proposed North American rutile titanium dioxide market "are not based on overall production capacity for rutile TiO2 in North America." (Hill, Tr. 1921).

The same is true for Dr. Hill's market share calculation for his proposed North American rutile TiO2 market: they "don't consider global capacity available to serve North American customers." (Hill, Tr. 1921).

457. Yet Dr. Hill admits that Chemours, Kronos, Venator, and Lomon Billions all produce titanium dioxide outside of North America. (Hill, Tr. 1925-26). And most sales of titanium dioxide by Chemours, Kronos, Venator, and Lomon Billions are outside of North America. (Hill, Tr. 1926).

458. Dr. Hill admitted that "if market shares should be calculated based on global rutile TiO2 capacity and not based on sales to North American customers, [he has] not analyzed whether this transaction is anticompetitive on a global basis." (Hill, Tr. 1948). Dr. Hill further admitted that "[i]f the market shares are based on global chloride TiO2 capacity, then [he has] not demonstrated that this transaction is anticompetitive in a global market." (Hill, Tr. 1948).

459. If market shares are calculated based on global rutile capacities, Dr. Hill believes that the total HHI "would be lower" than the HHIs he calculated for his proposed North American markets. (Hill, Tr. 1946). Indeed, in a global market for rutile TiO2, Cristal's market share would be only 12.3 percent and Tronox's market share would be only 7.8 percent—for a combined market share of 20.1 percent for the merged firm. (Hill, Tr. 1942).

460. The Merger Guidelines state that calculation of market shares should be "based on the best available indicator of firms' ***future*** competitive significance in the relevant market." (PX9085-020 (emphasis added)). The Merger Guidelines explain that "in markets for homogeneous products, a firms' competitive significance may derive principally from its ability and incentive to rapidly expand production in the relevant market in response to a price increase or output reduction by others in that market." (PX9085-020). Dr. Hill agrees. (Hill, Tr. 1924).

Dr. Hill admits that "chloride titanium dioxide is a homogenous product." (Hill, Tr. 1922). Dr. Hill also "agree[s] with the Guidelines that firms that clearly possess the necessary assets to supply into the relevant market rapidly may also be rapid entrants." (Hill, Tr. 1922; PX9085-019).

461. Yet Dr. Hill's market shares are calculated based on sales to North American customers in a single year: 2016. (Hill, Tr. 1919-20). Dr. Hill also admitted that "a firm's competitive significance may depend on its level of readily available capacity to serve the relevant market if that capacity is efficient enough to make such an expansion profitable." (Hill, Tr. 1924-25; PX9085-020). Dr. Hill also agreed that "in such markets capacities or reserves may better reflect the future competitive significance of suppliers than revenues." (Hill, Tr. 1925; PX9085-020).

462. [redacted]

VII. THE TIO2 INDUSTRY IS DYNAMIC AND FIERCELY COMPETITIVE.

A. TiO2 Producers Compete Vigorously in the Global Marketplace.

463. The TiO2 industry is "a very competitive industry." (Quinn, Tr. 2318-19). The market is "[v]ery competitive" on price.[54] (Christian, Tr. 887). There's "really significant, large competitors that have very low cost basis. There are foreign competitors, primarily the Chinese competitors, that have a very low cost basis." (Quinn, Tr. 2318-19; RX0236). The TiO2 industry has always historically been a competitive industry. (Turgeon, Tr. 2610). Today, competition in

[54] Mr. Christian agreed that "[f]iercely competitive . . . would probably be a good choice of words." (Christian, Tr. 887).

the industry is "very, very fierce," "owing to the low-cost positions of the two leaders in the industry." (Arndt, Tr. 1422).

464. Competition in the TiO2 industry is not limited to any particular geographic region. (Mouland, Tr. 1206). There are "good competitors" with "good grades that are fighting for business all the time in every region and part of the world." (Mouland, Tr. 1206).

465. Cristal manufactures TiO2 through both the chloride and sulfate process, and Tronox manufactures TiO2 through only the chloride process. (Mouland, Tr. 1209; Turgeon, Tr. 2673). Yet Tronox competes with Cristal everywhere in the world. (Mouland, Tr. 1209).

466. Tronox and Cristal's other major competitors are Chemours—which is the "800 pound gorilla" in the TiO2 industry—Lomon Billions, Venator, and Kronos. (Mouland, Tr. 1206; Quinn, Tr. 2344). Chemours is Tronox's largest competitor. (Mouland, Tr. 1207). Chemours competes everywhere in the world. (Mouland, Tr. 1207). Chemours is about three times larger than Tronox and is differentiated from other competitors due to their low cost-position and their proprietary technology. (Mouland, Tr. 1207). Chemours produces TiO2 through the chloride process only. (Mouland, Tr. 1207).

467. Lomon Billions is a Chinese producer that produces both chloride and sulfate titanium dioxide. (Malichky, Tr. 316; Stern, Tr. 3783). Tronox competes with Lomon Billions everywhere in the world. (Mouland, Tr. 1209). Lomon Billions is significantly expanding its chloride capability in China, and targeting the North American market as a growth market for its exports. (Engle, Tr. 2498-99 (discussing RX1642)). Lomon Billions is "becoming a force to be reckoned with after the merger between" Lomon and Billions. (Mouland, Tr. 1209). They are "getting much bigger, and given recent comments" the company is "looking to be number one" in the world terms of production. (Mouland, Tr. 1209; Turgeon, Tr. 2667).

468. It is generally acknowledged that Chemours and Chinese producers, especially Lomon Billions, are the lowest-cost producers in the business. (Engle, Tr. 2493-94; Stern, Tr. 3783).

[redacted]

[redacted]

471. Generally, Chinese producers are significantly concentrated on the left side of the TiO2 industry cost-curve, indicating that they are significantly low-cost plants. (Stern, Tr. 3788).

[55] A cost curve is a useful graphical way to explain the evolution of production costs as a function of capacity in any chemical business, certainly the TiO2 business, beginning with the lowest cost plants and escalating to the highest cost plants. (Stern, Tr. 3784).

Two Chinese plants have the highest profitability in the industry, meaning, according to TZMI, they are the most profitable plants in the world. (Stern, Tr. 3786).

472. The dynamic nature of the TiO2 industry is manifest in "new capacity expansions, new plants coming online, high-cost capacity being driven out of the market, and . . . dynamic competition" between TiO2 suppliers. (Shehadeh, Tr. 3328). The majority of new capacity and construction in the TiO2 industry is taking place in China. (Stern, Tr. 3774-75). Greenfield plants[56] are not being built in North America today, but they are being built in China. (Stern, Tr. 3774-75). It is less expensive to build greenfield plants in China than in the United States, for TiO2 as well as for other chemical products; a fair estimate is that it is somewhere between 30 and 40 percent less expensive to build these plants in China than it is in the United States. (Stern, Tr. 3775).

473. Lomon Billions has announced plans to expand its chloride capacity, and announced that they are building an additional 200,000 tons per year during the year 2019. (Engle, 2498-99; Stern, Tr. 3781). Its current chloride plant has 100,000 tons of capacity, and is currently operating at about 70,000 tons per year. (Stern, Tr. 3781; Mouland; Tr. 1243;). [redacted]

474. Tronox's competitor Venator manufactures TiO2 through both the chloride and sulfate process. Venator's plants are mostly outside the United States. Tronox competes with Venator everywhere around the world. (Mouland, Tr. 1208).

475. Tronox's competitor Kronos manufactures TiO2 through both the chloride and sulfate process. The "majority of Kronos' TiO2 facilities are located in Europe." (Christian, Tr.

[56] A "greenfield" plant is brand-new construction. (Stern, Tr. 3774).

859-60).[57] Tronox competes with Kronos everywhere around the world. (Mouland, Tr. 1208). Kronos ships product from each of its TiO2 facilities "all over the world." (Christian, Tr. 861).

476. In addition to its five primary competitors (Chemours, Lomon Billions, Cristal, Venator, and Kronos), Tronox competes with a number of other Chinese companies primarily in Asia, though they are "branching out" so the competition is becoming more global with them. (Mouland, Tr. 1210). Tronox also competes against a number of intermediate competitors globally; these other competitors are located in Eastern Europe, India (Kerala Minerals), and Japan (Ishihara). (Mouland, Tr. 1210).

B. Chinese Producers, Especially Lomon Billions, Are a Major—and Growing—Competitive Threat.

477. "Chinese producers have transformed the global market, continuing to take market share from Western producers." (Stern, Tr. 3704-05). Today, Tronox faces "significant competition from China in all world regions" (Quinn, Tr. 2348), and Chinese competition in the future is only going to get "more intense." (Quinn, Tr. 2348; PX0010).

478. China is a "competitive threat" because "their growth is just incredible for the last few years." (Engle, Tr. 2486). Furthermore, Chinese quality "has gotten so much better just over the last three or four years." (Engle, Tr. 2486). Overall, "it gets better every day." (Engle, Tr. 2488). Since 2015, the quality of Chinese TiO2 product "has increased significantly." (Arndt, Tr. 1411-12).

479. Although the TiO2 industry has "always been very competitive," it's "worse" today "because of China." (Turgeon, Tr. 2659).

[57] Except for one TiO2 plant in Canada and one TiO2 plant in Louisiana in which it has a 50% ownership stake, all of Kronos' TiO2 plants are in Europe. (Christian, Tr. 754).

480. Approximately 25 years ago, the TiO2 industry in China was virtually nonexistent. (Turgeon, Tr. 2659-60). There was "no TiO2 business in China." (Turgeon, Tr. 2660). But Chinese competitors, especially Lomon Billions, have "been very aggressive at growing their business in the last decade." (Turgeon, Tr. 2659-60[58]). The increase in Chinese capacity and exports in recent years is "the most significant change" in the entire TiO2 industry that Mr. Romano has observed in his 30 years of experience. (Romano, Tr. 2221).

481. From 2008 to 2017, production capacity for TiO2 in China has grown exponentially, essentially tripling over the nine-year period. (Stern, Tr. 3813-14; RX0171.0025). In total, Chinese production of TiO2 went from about 800,000 tons ten years ago to roughly 3 million tons today. (Engle, Tr. 2486-87). Over the last ten years, "China has added about two million tons of capacity." (Romano, Tr. 2221-22). Indeed, even over the past three years, "Chinese imports are considerably higher today than they were back in 2015 in all regions of the world." (Arndt, Tr. 1411).

482. The increasing Chinese production capacity has had an effect on the global TiO2 market. (Stern, Tr. 3814). Ten years ago, China exported roughly 400,000 tons of TiO2 per year and today exports about 1 million tons per year. (Engle, Tr. 2486-87).

483. The Chinese TiO2 companies that are "big player[s]" in the global TiO2 market are Lomon Billions, Bluestar, Xinli, and CNNC.[59] (Turgeon, Tr. 2661). These producers "export a

[58] Mr. Turgeon has first-hand knowledge of the changes in the TiO2 industry, including the changes in China. (Turgeon, Tr. 2659-60). Mr. Turgeon has had the opportunity to travel to China numerous times during his employment with Rio Tinto and Tronox in the past 25 years to observe developments in the industry. (Turgeon, Tr. 2610). Mr. Turgeon has traveled to China on a regular basis as a part of his work in the TiO2 industry throughout the past 25 years. (Turgeon, Tr. 2659-60).

[59] The TiO2 industry also includes "tier two" Chinese competitors who typically produce TiO2 at one site. The Chinese government is encouraging them to increase their size and quality so that they become more relevant. Tier two companies have combined in the past to become tier one companies. One such example is the combination of Lomon and Billions. (Turgeon, Tr. 2661-63).

lot of material, and their quality is as good as [Tronox's] today." (Turgeon, Tr. 2660-61). This change occurred within the last five or six years. (Turgeon, Tr. 2662). At that time, "none of them had good quality product," "but as they've been refining their process, investing tremendous amount of money in R&D and combining their strength," they have "improve[d] the quality" and "improve[d] the process." (Turgeon, Tr. 2662).

484. Today, Lomon Billions "is the number one producer in China," "the number four producer in the world," and "is bigger than Tronox." (Turgeon, Tr. 2660). Lomon Billions continues to grow. (Turgeon, Tr. 2659-60; Romano, Tr. 2243-44; Engle, Tr. 2493). The merger that created Lomon Billions led to a significant "jump" in the quality of its TiO2 pigment. (Turgeon, Tr. 2664).

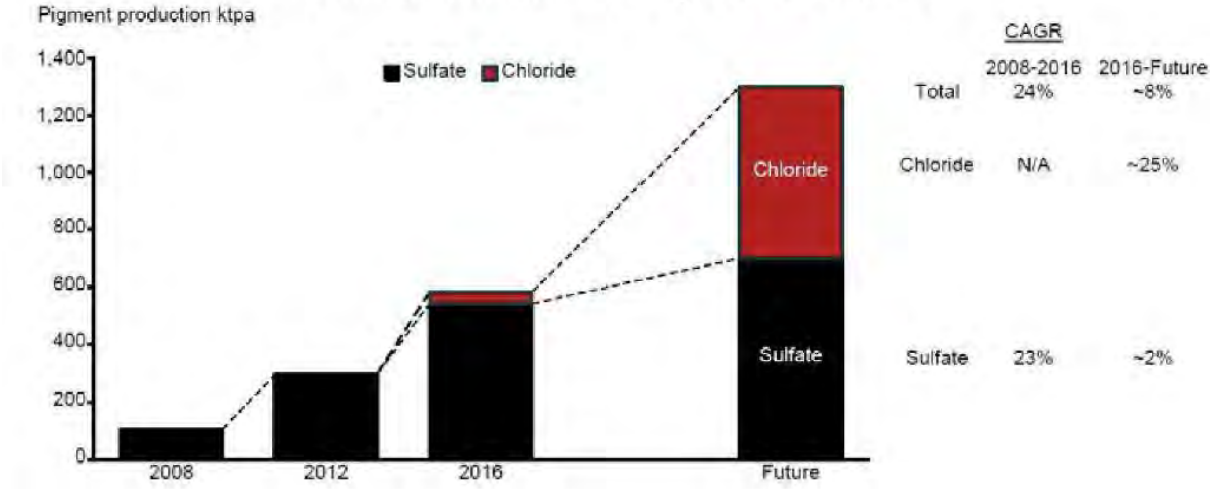
485. Lomon Billion "is also a vertically integrated producer," which makes them very competitive with Tronox and other global TiO2 producers. (Turgeon, Tr. 2663). By combining Lomon, who was "long" in feedstock and had a lot of mines, with Billions, who was "short" in feedstock and had a lot of pigment plants, the post-merger Lomon Billions "bec[a]me a vertically integrated producer with the same position as Tronox." (Turgeon, Tr. 2663). In fact, this vertical integration at Lomon Billions was "very beneficial for them" and "gave them a boost." (Turgeon, Tr. 2663). This is the same vertical integration strategy Tronox is pursuing in order to be more competitive. (Turgeon, Tr. 2663).

486. [redacted] Lomon Billions has "stated openly and publicly that their intent is to dominate this industry within the next few years." (Quinn, Tr. 2347).

487. Today, Lomon Billions has the capacity to produce over 705,000 tons of TiO2 pigment, compared to Tronox's current global capacity of 465,000 tons. (Engle, Tr. 2491-92).

Lomon Billions plans to ultimately expand capacity to 1.3 million TPA (*see* Stern Figure 8, RX0171.0040). Lomon Billions "plan[s] to become the global market leader with 1.3 million tons of pigment capacity by mid-2020s." (RX 1642.0005; Engle, Tr. 2493).

Figure 8[115]
Lomon Billions' Projected Growth



488. [redacted] As Mr. Romano testified, Lomon Billions is "the one that keeps me up at night." (Romano, Tr. 2243-44).

489. The Chinese have also "developed their chloride technology," which is "strong" today and is "getting stronger." (Engle, Tr. 2486).

490. The Chinese are also "getting larger, and then they're sophisticated. They're vertically integrated." (Engle, Tr. 2486).

491. [redacted]

[redacted]

492. Lomon Billions intends to expand its total TiO2 capacity to 1.3 million tons from its current level of 600,000 tons. (Turgeon, Tr. 2666-67). This is part of Lomon Billions' strategy to be the "number one producer of pigment in the world." (Turgeon, Tr. 2666-67).

a. The Chinese Are Rapidly Expanding Their Presence Across the Globe, Including in North America.

493. China dominates the TiO2 export market. (Stern, Tr. 3820).

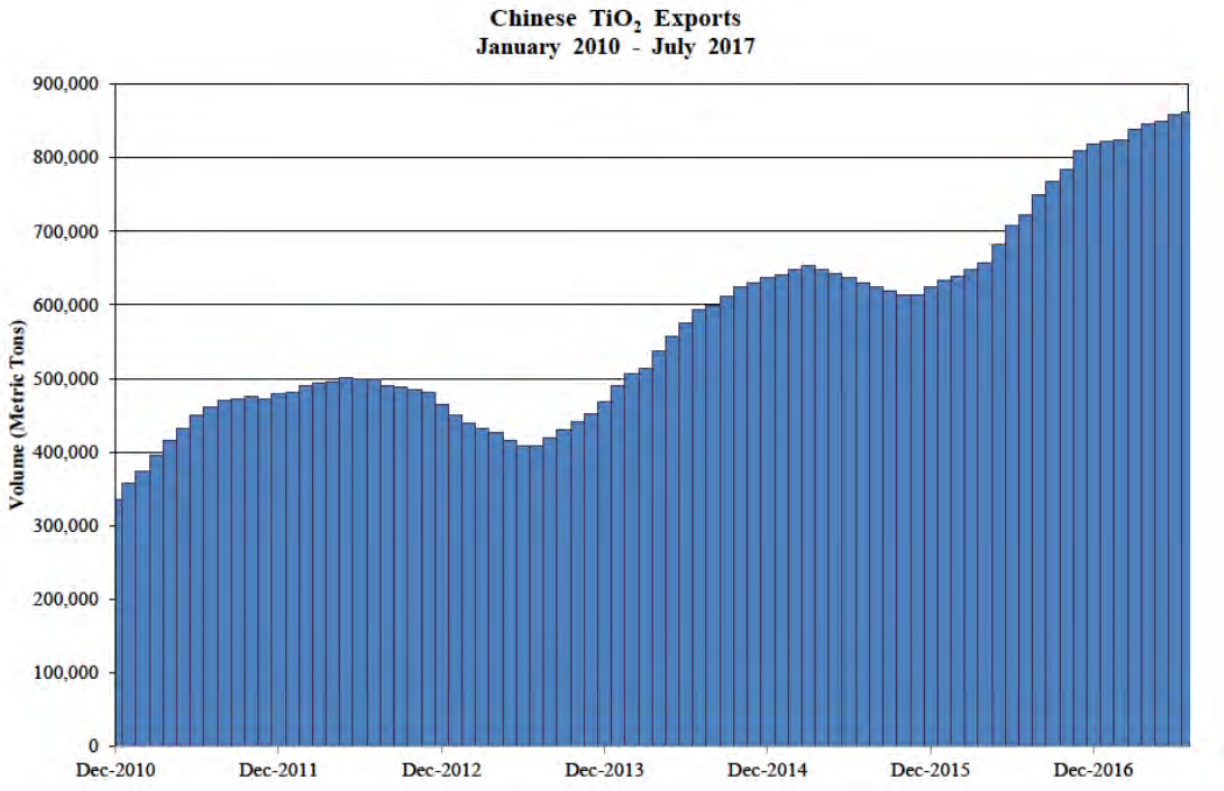
494. In 2008, exports of TiO2 from China into the rest of the world were about a hundred thousand tons per year. (Romano, Tr. 2221-22).

495. China became a net exporter of TiO2 in May 2013. (Turgeon, Tr. 2665). The amount it has exported has increased dramatically since. (Turgeon, Tr. 2665-66). From May 2013, five years ago, to today, "China has grown its export of pigment year after year, and today it's a million ton that is coming out of China." (Turgeon, Tr. 2666). When domestic demand slowed in China in late 2014, Chinese producers maintained their production levels and exported more TiO2. (Arndt, Tr. 1421-22).

496. Competition has continued to grow each year since China became a net-exporter of TiO2. (Turgeon, Tr. 2666-67). Indeed, while "Lomon Billions is the biggest," there are "tens" of Chinese companies that are "exporting pigment and competing with [Tronox] on a global scale." (Turgeon, Tr. 2666). As of the end of 2017, exports of TiO2 from China into the rest of the world were about "a million tons per year." (Romano, Tr. 2221-22).

497. Shehadeh Figure 48 (RX0170.0096) shows the rolling 12-month average of Chinese TiO2 exports from January 2010 - July 2017. (Shehadeh, Tr. 3223-24).

Figure 48



498. As shown by Shehadeh Figure 48 (RX0170.0096), even though Chinese exports to North America increased approximately five-fold from 2010 to 2016, the 50,000 tons of exports from China to North America in 2016 is still "a relatively small portion of total exports from China." (Shehadeh, Tr. 3224). The significant volume of exports "on the water" from China reflect "alternative sources of supply" for customers around the world, including in North America. (Shehadeh, Tr. 3224-26).

499. In 2017 and 2018, Chinese exports had two main impacts on the TiO2 market: First, they "[took] business from other sulfate producers, they [took] business from chloride producers." (Arndt, Tr. 1410). Second, they caused "dislocation" in the market from the business they take. (Arndt, Tr. 1410).

500. These Chinese producers are "very strong competitor[s]." (Turgeon, Tr. 2666).

501. Lomon Billions has "established a significant footprint with a sales and marketing group and staff in Europe, they've done the same in North America, so they are definitely not a Chinese company that's only supplying the Chinese market. They are a global company." (Romano, Tr. 2245). In some areas of the world, Chinese product has displaced product sold by Tronox "completely." (Romano, Tr. 2246).

502. Chinese competition is growing quickly in North America. [redacted]. From 2010 to 2016, Chinese imports of TiO2 into North American increased by "approximately five times." (Shehadeh, Tr. 3220-21). [redacted] Customers in North America initially began to use Chinese product to lower their costs. As Chinese quality has increased, customers have increased the amount of Chinese TiO2 they are purchasing. (Turgeon, Tr. 2670). Chinese imports into North America are "growing" and have "been growing since 2013." (Turgeon, Tr. 2671).

503. "[W]e are seeing… exports from China to the United States of both chloride and sulfate TiO2." (Stern, Tr. 3825). Additionally, Lomon Billions is significantly expanding its chloride capability in China, and targeting the North America for increased exports. (Engle, Tr. 2498-99 (discussing RX1642); Stern, Tr. 3825).

504. Turgeon agreed that Chinese TiO2 producers are "disruptors" in the global market. (Turgeon, Tr. 2733-34).

505. Lomon Billions' ability to produce at a low cost is a competitive advantage because it can "compete more aggressively" during both the up-cycles and down-cycles in price that characterize the TiO2 industry. (Engle, Tr. 2496).

506. Chinese companies are not publicly listed and have the freedom to invest capital in ways that are not responsive to shareholders as is typically required of Western producers. (Turgeon, Tr. 2666-67).

507. The shift toward Chinese product in Europe has followed a similar path to North America. (Turgeon, Tr. 2670). [redacted]

508. TiO2 producers in North America are losing market share to Chinese producers in their export markets. (Stern, Tr. 3828). [redacted].

509. [redacted]

b. Chinese Product Quality Is Continually Increasing.

511. The quality of Chinese TiO2 has improved in "recent year[s]" and "continue[s] to improve," in part because Chinese TiO2 producers are "very aggressive." (Turgeon, Tr. 2661).

512. Chinese TiO2 quality has rapidly improved since 2012, and this improvement continues. (Engle, Tr. 2486; Stern, Tr. 3745). Since 2012, Chinese companies have improved their sulfate grades such that they compete in certain specifications anywhere in the world. (Arndt, Tr. 1408). Indeed, some tier-one type producers from China produce TiO2 product that is indistinguishable from Western material. (Engle, Tr. 2486-89; Stern, Tr. 3840).

513. Tronox noted a significant increase in Lomon Billions' quality after the combination of the individual Lomon and Billions companies. (Turgeon, Tr. 2663-64). [redacted]

514. Today, Chinese sulfate products compete with Tronox's chloride products. (Romano, Tr. 2242). The Chinese "make very good grades, and in some instances those grades are better than [Tronox's]." (Romano, Tr. 2239). In particular, sulfate TiO2 from Lomon Billions "has continued to get better," such that "they have some grades that actually perform better than [Tronox's] in some architectural applications." (Romano Tr. 2244).

515. [redacted]

60 [redacted]

TiO2 manufactured by QianJiang Fangyuan was equal in performance to Kronos 2190 in multiple Behr paint products, including 1300, PR-010, PR-110, PR-130, PR-170, G-210, and G-230. (Pschaidt, Tr. 1005-06; PX4142). As of January 2018, Behr has been evaluating suppliers of chloride TiO2 in China. (Pschaidt, Tr. 1007).

516. Since 2012, China has made "great strides" in the commercialization of chloride-process TiO2 technology. (Arndt, Tr. at 1407). [redacted] Lomon Billions' current chloride plant is running at a capacity of 70,000 tons per year. (Romano, Tr. 2244). Lomon Billions will expand production at its chloride plant by 300,000 tons per year at the end of 2019. (Romano, Tr. 2244-45). Lomon Billions has plans to bring online a total of 500,000 additional tons of chloride TiO2 capacity, including building a facility of 300,000 tons of chloride-process TiO2 along with expanding its existing facility in Sichuan province by another 200,000 tons. (Romano, Tr. 2244).

517. In recent years, Chinese producers have also become "very competitive and aggressive" in terms of technical developments for upgrading ilmenite. (Turgeon, Tr. 2610). China is "where the most development has been done recently to upgrade ilmenite." (Turgeon, Tr. 2610). Chinese producers have "developed smelting technology." (Turgeon, Tr. 2610). Chinese producers have developed "new ways to upgrade" and "produce [synthetic rutile] in ways that [Turgeon]" has not seen before. (Turgeon, Tr. 2610-11).

[61] [redacted]

c. Customers Are Increasingly Switching Over to Chinese Suppliers.

518. Customers in North America initially began to use Chinese product "to lower their costs and keep [Tronox] more competitive." (Turgeon, Tr. 2670). As Chinese quality has increased, customers are now able to "put even more Chinese pigment in the mix of their product." (Turgeon, Tr. 2670).

519. "There is no question that Chinese-produced TiO2 competes with North American-produced TiO2 not only in other regions of the world but also in North America itself." (Stern, Tr. 3841).

520. In 2015, a leading paint and coatings industry trade magazine stated that "the speed at which Chinese pigment was brought to the world's market is matched by the speed by which it has become accepted by formulators. Both phenomena have taken China's international competitors by surprise." (Stern, Tr. 3841-42; RX1181).

521. Tronox has lost business to Chinese suppliers "[i]n all regions of the world." (Duvekot, Tr. 1343).

522. Chinese producers are a competitive threat to Tronox due to their rapid growth in capacity, improving quality, and low-cost production. (Engle, Tr. 2486). Tronox's customers threaten to purchase more product from China instead of Tronox if Tronox does not compete with Chinese prices. (Turgeon, Tr. 2671).

523. [redacted]

[redacted]

[redacted]

C. TiO2 Customers—Especially Big Global Companies—Have Significant Leverage, and Have Consolidated in Recent Years.

529. TiO2 customers are often "large multi-international customers." (Christian, Tr. 886). "Many of the customers [in the TiO2 industry] are large multinational companies." (Christian, Tr. 878-79). For Tronox, "well over half of our business is with the large, strategic, global multinationals." (Romano, Tr. 2231).

530. Customers "have a lot of power in the titanium dioxide industry." (Christian, Tr. 878). "Many of the customers [in the TiO2 industry] are large multinational companies." (Christian, Tr. 878-79). These large global customers "engage in very complex and strategic decisions in procuring their titanium dioxide." (Christian, Tr. 886).

[redacted]

[redacted]

532. Indeed, one "element" as to why the TiO2 industry is cyclical is "because the customers have . . . significant strength." (Christian, Tr. 881). This customer strength influences pricing of TiO2. (Christian, Tr. 881).

533. Many customers negotiate annual contracts with producers to govern terms of their purchases, but these contracts almost never set the price the customer must pay throughout the life of the contract. (Stern, Tr. 3727-29; *see also* Young, Tr. 710;). Instead, most contracts provide for *negotiated* prices and customers typically have the option under the contracts to switch suppliers if they find a better price. (Stern, Tr. 3727-29; *see also* Young, Tr. 710;). [redacted]

534. There has been significant consolidation among TiO2 customers in the paint and coatings segment over time. (Stern, Tr. 3847). In 2016 "the top ten global suppliers of paints and coatings represented more than 50 percent of the global market." (Stern, Tr. 3487). The consolidation in the paint and coatings industry has affected TiO2 pigment suppliers because it "confers greater buying power" to those customers. (Stern, Tr. 3847-48).

535. These large customers "continue to consolidate." (Romano, Tr. 2231). For example, as recently as 2017, Sherwin Williams, a large multinational paint and coatings company, acquired Valspar, another large multinational paint and coatings company. (Young, Tr. 631). Now, Valspar is a key brand for Sherwin Williams. (Young, Tr. 631). [redacted]

536. The paint companies already have considerable power—PPG Industries ("PPG"), one of Tronox's customers, is one of the largest paint and coatings companies in the world. (Malichky, Tr. 267-69; 343). [redacted] These sales are [redacted] times the size of Tronox's annual global sales, which are approximately $1.49 billion. (PX9053-012). In the United States, PPG sells architectural paint under the brand names Glidden, Pittsburgh Paint, Manor Hall, Liquid Nails, and others. (Malichky, Tr. 269). PPG also sells paint for industrial applications, like painting bridges or cars or airplanes. (Malichky, Tr. 269-70). [redacted]

537. Sherwin Williams another global paint and coatings company and a key customer purchasing large quantities of TiO2, produces architectural (consumer) paints as well as industrial coatings, used for automotives, marine uses, coils, and other industrial applications. (Young, Tr.

631).[62] Sherwin Williams' primary brand carries the company's own name. (Young, Tr. 631). Other key brands include recently-acquired Valspar as well as Dutch Boy and Cabot. (Young, Tr. 631). Sherwin Williams sells its products globally, in the Americas, Europe, Asia, Australia, South Africa, and India, and it manufacturers its products in all of the same locations, except India. (Young, Tr. 632). In North America, Sherwin Williams is the largest producer of coatings. (Young Tr. 633).

538. Masco Coatings Corporation ("Masco") is yet another a large-scale TiO2 customer in the paints and coatings industry. Masco produces paint for architectural coatings, like interior and exterior house paint. (Pschaidt, Tr. 963). Masco sells its paint under the brand names Behr and Kilz. (Pschaidt, Tr. 966).[63] [redacted]

539. True Value is another key customer of TiO2 producers like Tronox and Cristal. True Value is a hardware co-op business that includes a vertically-integrated paint business, meaning that True Value both manufactures paint and sells that paint through its hardware co-op stores. (Vanderpool, Tr. 157). True Value sells its paint at 2000 stores in the United States. (Vanderpool, Tr. 180). True Value also manufactures some paint for other companies. (Vanderpool, Tr. 185). True Value relies on a global sourcing team to track the availability of the

[62] A representative from Sherwin Williams, Mr. Young, testified at the trial, after providing prepared statements written at the FTC's direction, and after three phone calls with the FTC prior to his deposition. (Young, Tr. 700).

[63] Interestingly, in the Kilz primer, the resin is the ingredient that makes the product effect, rather than TiO2, which is "complementary." (Pschaidt, Tr. 969).

raw materials True Value needs to purchase. (Vanderpool, Tr. 222).

VIII. THE PROPOSED TRANSACTION WILL NOT LEAD TO UNILATERAL ANTI-COMPETITIVE EFFECTS.

540. The Tronox-Cristal transaction "does not present prospects for likely unilateral anticompetitive effects." (Shehadeh, Tr. 3201; 3329). This is true both for the global market for rutile TiO2, as well as "in the context of the models that Dr. Hill presented, which are limited to the market that he is proposing, sales to customers in North America." (Shehadeh, Tr. 3201-02).

A. Neither Tronox Nor Other Producers Have a History of Withholding TiO2 Output to Influence Market Prices.

541. Tronox has never "reduced output [of TiO2] in order to drive up prices of pigment." (Romano, Tr. 2253).[64] Tronox has also never attempted to control the supply or price of TiO2 feedstock to raise the price of pigment. (Romano, Tr. 2254).

542. Tronox has only temporarily reduced its TiO2 production during periods of historically low demand, when inventories were excessive and credit agencies were downgrading Tronox's bonds. (Arndt, Tr. 1402-03). When Tronox has reduced production, it did not decrease sales, increase prices, or increase profits. (Romano, Tr. 2251-53; 2169-70). At the times Tronox reduced production, including 2012 and 2015, Tronox was "fighting" for "survival." (Arndt, Tr. 1416).

[64] Mr. Romano's testimony is based on his 30 years of experience with Tronox and direct knowledge of decisions to reduce output of TiO2. (Romano, Tr. 2247-48, 2253).

543. Of course, there are times where Tronox, like every TiO2 producer, has to temporarily reduce its production or output for "maintenance, unplanned and planned." (Romano, Tr. 2252). At these times, Tronox will have to "slow the plant down to do the maintenance." (Romano, Tr. 2252).

a. On a Handful of Occasions, Tronox Has Been Forced by Severe Market Conditions and Unsustainable Financials to Temporarily Reduce TiO2 Production.

544. The period of 2008-2009 was a difficult period for Tronox, as well as many of its competitors. (Stern, Tr. 3742). In 2008, "there was a global credit crisis and demand fell off and we had to reduce the production output to avoid large volumes in inventory." (Duvekot, Tr. 1342). Tronox declared bankruptcy in January 2009. (Stern, Tr. 3742-43). During the bankruptcy process, Tronox was forced to close its Savannah, Georgia plant due to the plant's inability to run "within [its] own cash flow." (Romano, Tr. 2249; Dean, Tr. 2947). [redacted]

545. [redacted]

546. In addition to the 100,000 tons of TiO2 that were taken out of the market by the closure of Tronox's Savannah plant, an additional 280,000 tons were taken out of the market by other TiO2 producers due to poor market conditions. (Romano, Tr. 2249-50).

547. In 2012, Tronox was forced to temporarily reduce its TiO2 output because "from 2011 to 2012, our total sales profile dropped 21 percent year over year." (Romano, Tr. 2250-51).[65] As Mr. Romano explained: "In the fourth quarter of '11, it dropped 43 percent in Asia Pacific. We had to evaluate how we were going to move forward. Customers weren't interested in buying at any price at that stage because we had just—we were—that was the back end of the cycle, so prices at that stage had peaked. And they had peaked largely due to an exacerbated impact [of] panic buying, so we had some instances where we had very large customers . . . that had over 12 months of inventory. So in an effort to manage cash, we couldn't just continue to build inventory. We had nowhere to put the inventory. We made a decision to slow the plant down." (Romano, Tr. 2250-51). In 2012, worldwide demand in the TiO2 industry "declined precipitously." (Arndt, Tr. 1397, 1400). It declined worldwide "by approximately 20 percent over a very, very short period of time." (Arndt, Tr. 1397).[66]

548. Tronox was forced to temporarily reduce TiO2 and feedstock production in 2012 because it had "significant excess inventory." (Arndt, Tr. 1400). "[B]y July and August of that year, 2012, we were carrying twice—in fact, a little bit more than twice a normal level of inventory both at pigment, and then when you turn a pigment plant down, you require less feedstock, so inventory was building at both levels of our value chain." (Arndt, Tr. 1400).

549. Although Tronox temporarily reduced output of TiO2 in 2012, price continued to move down for the succeeding four years. (Romano, Tr. 2250-51).

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[65] Mr. Romano was personally involved in Tronox's decisions to temporarily reduce output in 2012 and 2015. (Romano, Tr. 2247-48).

[66] This worldwide decline in demand refers to demand of titanium dioxide, without any distinction between chloride-process or sulfate-process TiO2. (Arndt, Tr. 1410-11).

550. In 2015, Tronox was forced to temporarily reduce its TiO2 output because the TiO2 market was in a "very, very tough situation." (Turgeon, Tr. 2637). The industry was "in a crisis" in 2015. (Turgeon, Tr. 2667-68). 2015 was "the worst market conditions," or "annus horribilis." (Arndt, Tr. 1401).

551. In 2015, Tronox was in the midst of a "long period of downturn" in the TiO2 industry that lasted from approximately 2012 to 2016, in large part "because the supply was higher than the demand." (Turgeon, Tr. 2637). In 2015, Tronox was reporting losses in "each and every quarter." (Arndt, Tr. 1401). Tronox was "running our asset[s] at cost." (Turgeon, Tr. 2637). "[T]here was an oversupply of material, and the demand had kind of collapse[d], specifically in the second half of 2015." (Turgeon, Tr. 2637). Tronox's inventory levels were "very high." (Turgeon, Tr. 2637). Tronox "had close to a billion dollar of inventory, most of it being finished good," which was an "unacceptable business situation at the time." (Turgeon, Tr. 2637). The excess in inventory at Tronox was causing "significant financial penalties," as Tronox "had significant cash locked up in that finished TiO2 pigment and finished TiO2 feedstock sitting on the ground around the world." (Arndt, Tr. 1401-02).

552. The period at the end of 2015 and beginning of 2016 was the bottom of the trough in the extended four-year cyclical downturn—demand was weak; prices were weak; inventories were too high. (Stern, Tr. 3754-55). "Tronox didn't experience any unmet demand on the part of its customers" when output production declined; instead, Tronox's "inventory levels were growing during this period of time." (Stern, Tr. 3756-57; Arndt, Tr. 1402-04).

553. In 2015, market prices for TiO2 were at their lowest point in at least the preceding 28 years. (Turgeon, Tr. 2638). Mr. Turgeon "never thought it would reach such a low level." (Turgeon, Tr. 2638). From approximately 2012 to 2016, there was a steady decline in prices

through the end of 2015, into 2016, for both Cristal and Tronox. (Arndt, Tr. 1399-1402; Stern, Tr. 3771). The continuing decline in TiO2 prices between 2012 and 2016 demonstrates that, in the face of output reduction by suppliers, supply still "outstripped demand, leading to a weak pricing environment and producers who were struggling to reduce supply by trying to reduce inventory." (Stern, Tr. 3771).

554. Mr. Romano explained the market conditions that forced Tronox to temporarily reduce TiO2 production in 2015: "[W]e were basically evaluating the same circumstances we were in 2012, although it was a bit different because price was significantly lower than it was at that stage. In 2015, at that stage, you have to remember we were now three years into a down cycle. We had been trying to move the price up. As I mentioned in earlier testimony, we'd made announcements in March of 2015, trying to get additional profitability based on what we saw as far as demand. So demand wasn't in the same shape, but our profitability was very bad. So we were looking at how we could manage cash. We didn't have enough cash to continue to build inventory, so we slowed the plant down." (Romano, Tr. 2250-52).

555. After March 2015, TiO2 "[p]rice continued to move down for a full year." (Romano, Tr. 2226).

556. Tronox had to temporarily reduce output of TiO2 in 2015 "when the company was in a dire financial situation and we had to reduce the output just to stop the bleeding." (Duvekot, Tr. 1342).

557. Mr. Turgeon put it bluntly: "[W]e would have gone to bankruptcy if we had continue on the path that we were [on]." (Turgeon, Tr. 2638).

558. On the TiO2 pigment side, Tronox temporarily "shut down two line[s] in Hamilton and we shut down a line in Kwinana." (Turgeon, Tr. 2648). Tronox was also forced to reduce

production of TiO2 feedstock in 2015 due to low demand and building inventory. (Romano, Tr. 2253). On the TiO2 feedstock side, Tronox "shut down one furnace at Namakwa Sands in the west side and one furnace at KZN in the east side." (Turgeon, Tr. 2648). Tronox did this "because, again, we were producing more than we could sell, and our inventory was maxed out, so we had no option." (Turgeon, Tr. 2648).

559. Tronox, like other TiO2 producers, had no real option to address these market circumstances other than to temporarily reduce output of TiO2 in an effort to stop the growth of their own inventories: "[Y]ou can't take the product and … dump it in the ocean. You can't drink it. It's either you sell it or you stop making it." (Stern, Tr. 3747). "[T]he only lever that they have is reducing production." (Stern, Tr. 3747; *see also* Turgeon, Tr. 2637-39, 2648-49).

560. Tronox did not temporarily reduce output to drive prices; rather, it sought only to manage Tronox's "profitability or lack thereof" in light of unsustainably weak demand, low prices, limited cash flows, and excessive inventory. (Romano, Tr. 2251-52). Tronox reduced output temporarily because "we need[ed] to survive as a company." (Turgeon, Tr. 2638).

561. Tronox only made the decision to halt the production lines and furnaces because at the time Tronox was selling product below the cost of production, which was unsustainable for the business. (Turgeon, Tr. 2649). The decision to idle a production line is "never easy" to make in an industry with "high fixed costs." (Turgeon, Tr. 2650). It is generally desired to "produce as much as possible because that's how you can lower your cost." (Turgeon, Tr. 2650). The decision to idle was only made when inventory reached point where stockpiles and warehouses were full. (Turgeon, Tr. 2650).

562. Even though Tronox reduced production at this time, Tronox still "maintain[ed] our sales" by "sell[ing] more out of inventory." (Turgeon, Tr. 2649-50). "[O]ne thing is clear; we shut down production, but we never stopped selling." (Turgeon, Tr. 2648-49).

563. Global prices of TiO2 were still falling when Tronox brought its pigment production lines back to full capacity, but Tronox restarted its pigment lines, anyway, because inventory had fallen back to "normal" levels. It was always Tronox's intention to restart the plants as soon as inventory normalized as to not miss any opportunity for sales. (Turgeon, Tr. 2652-53).

564. After the 2015 idling, Tronox brought all its pigment lines back to full production by the second quarter of 2016 and brought all its smelting facilities to full production by the beginning of 2017. Since being brought back into production, all smelting and pigment facilities have been running at full capacity. (Turgeon, Tr. 2652).

565. Indeed, overall, Tronox and Cristal have each increased their capacity over the last 20 years, largely by debottlenecking. (Stern, Tr. 3774).

b. Tronox Faced Serious Financial Penalties in 2015 as a Result of Its Reduced Output, Diminished Cash Flow, and High Debt.

566. Tronox faced serious financial penalties in 2015 from temporarily idling its TiO2 production; namely, from its reduced run rate and diminished cash flow. (Arndt, Tr. 1403). Moody's downgraded Tronox's credit rating in 2015 because of its reduced cash flow, high inventory, and high debt. (Arndt, Tr. 1403). Specifically, Moody's downgraded Tronox in the fourth quarter of 2015 with a negative outlook. (Stern, Tr. 3751-52; RX1561). This was "at or near the very trough of the last cyclical downturn." (Stern, Tr. 3753).

567. If Tronox had not reduced production during this time period, they would have continued building unsold inventory, and tying up working capital that the company did not have. Simply put, if Tronox had continued to produce at its prior rates in 2015, Tronox "likely would

have found themselves right back in Chapter 11 [bankruptcy]." (Stern, Tr. 3747; Turgeon, Tr. 2638).

568. During the period of 2015-2016, when the market was in the trough and Tronox reduced production, Tronox did not experience increased profitability. (Stern, Tr. 3768). Tronox instead experienced "losses from operations during four quarters in a row, beginning with the second quarter of 2015 through the first quarter of 2016." (Stern, Tr. 3768). From 2015-2016, Tronox was reporting losses from operations during four quarters in a row, beginning with the second quarter of 2015 through the first quarter of 2016. (Stern, Tr. 3768).

569. In 2015, Tronox had $875 million in working capital that was frozen in stockpiled inventory. In order to avoid bankruptcy, Tronox launched a three-component program to generate cash. (Turgeon, Tr. 2639).

a. The first leg of Tronox's cash generation program was to increase revenue. Tronox accomplished this by attempting to gain market share wherever possible. (Turgeon, Tr. 2640-41).

b. The second leg of Tronox's cash generation program was to restructure the company. This restructuring was called "Project Rising Star." Project Rising Star involved standardizing roles across the company and resulted in a 15% reduction in Tronox's workforce. (Turgeon, Tr. 2641-42). One of the philosophies behind Project Rising Star was for Tronox to "earn the right to grow." (Turgeon, Tr. 2642). Tronox's business philosophy was that in a commodity business, it is essential to establish a low-cost position to better compete against other producers. (Turgeon, Tr. 2642). By lowering its cost structure, Tronox sought to be in a position to better survive the 2015 and future down cycles. (Turgeon, Tr. 2641-43). The rationale is that "in the up cycle,

if you're the lowest-cost producer, you have the best margin, but in the down cycle, if you're the lowest-cost producer, you can outrun all of your competitor[s]." (Turgeon, Tr. 2642).

c. The third leg of Tronox's cash-generation program was developing the Tronox Way—a standard of best practices that maximizes output and lowers the company's cost-position at every plant that it operates. (Turgeon, Tr. 2648).

570. During the same time period as Project Rising Star, Tronox developed an internal operational excellence program that it called the "Tronox Way." (Turgeon, Tr. 2643-44). The Tronox Way was developed by creating standards and practices among Tronox employees "who had years of experience at running mines, smelter[s] and pigment plant[s]." (Turgeon, Tr. 2644). The Tronox Way started with a pilot program in the company's Hamilton, Mississippi plant and was then adapted company-wide. Through implementing the Tronox Way, the company lowered its cost-per-ton of TiO2 production by $200. (Turgeon, Tr. 2643-45). This was a "tremendous" success. (Turgeon, Tr. 2645).

571. The Tronox Way was the foundation for "how to run a titanium business the most cost-efficient way." (Turgeon, Tr. 2644). Tronox's "mantra" became that the company needed to be "the best at mining, the best at smelting, and the best at making pigment." (Turgeon, Tr. 2642). By "best," Tronox sought to ensure "safe, quality, low-cost ton for our customer[s]." (Turgeon, Tr. 2642). This series of best practices was "part of that restructuring of the business and developing the standard." (Turgeon, Tr. 2643).

B. TiO2 Plants Are Generally Run Flat-Out; Producers Incur Substantial Costs by Reducing or Shutting Down Production.

572. In the TiO2 industry, producers "have an incentive to run their plants at high operating rates." (Stern, Tr. 3712). "[T]his is true of TiO2 as well as virtually any chemical you

can think of." (Stern, Tr. 3712). This is because the TiO2 industry is "highly capital-intensive." (Stern, Tr. 3712). TiO2 plants "are large, cost a great deal of money to build, and so the harder you run them, the lower your fixed costs per pound of product produced." (Stern, Tr. 3712).

573. Tronox typically runs its plants "all out," or "flat out," with the exception of a few occasions when the company was in financial distress. (Quinn, Tr. 2321; Duvekot, Tr. 1342). To run a plant "all out" means "running at full capacity," i.e., nameplate or above nameplate capacity, "subject obviously to good maintenance practices." (Quinn, Tr. 2321). In the TiO2 industry, like the mining industry, "everybody wants to run their mine or their pigment plant at full capacity, because that's the most economical way to run them." (Turgeon, Tr. 2636-37).

574. The advantage to running TiO2 plants all-out is that it "reduces your costs." (Quinn, Tr. 2321). It takes "the same fixed costs and spreads that out over a broader production volume, so you get lower cost." (Quinn, Tr. 2321). If production rates at TiO2 plants are reduced, the per-unit cost of TiO2 "increases significantly." (Arndt, Tr. 1414). This is because the TiO2 industry is a "very high fixed cost business." (Arndt, Tr. 1414).

575. TiO2 producers have "an incentive to run their plants at high operating rates" because the industry is "highly capital-intensive[:] Plants are large, cost a great deal of money to build, and so the harder you run them the lower your fixed costs per pound of product produced." (Stern, Tr. 3712).

576. If Tronox runs its TiO2 plants at a reduced rate, it incurs fixed cost or absorption penalties, which Tronox bore in 2015. (Arndt, Tr. 1402).

577. When production is curtailed at Tronox, it increases the cost of production and reduces margins. (Arndt, Tr. 1414-15). It also results in restricted cash flow due to excess inventory building up feedstock plants and mines in the supply chain. (Arndt, Tr. 1414-15).

Because producers must remain cost-competitive and produce as much TiO2 as possible, even small reductions in sales can have a disproportionate negative impact. (Stern, Tr. 3773).

578. It is not easy to restart a TiO2 plant after an outage. It is not "as easy as flipping a switch." (Stern, Tr. 3751). In order to restart a plant after an outage, plants must reach certain conditions of temperature; the plant must also meet certain conditions of material flow. If an obstruction has formed, they require someone to come in with a jackhammer to clear the obstruction out of the way. (Stern, Tr. 3751).

579. Restarting a production line at a pigment plant is very expensive. (Turgeon, Tr. 2651-52). Once a production line has been idled, the corrosive environment of the plant requires significant maintenance and capital costs that can include relining a chlorinator. (Turgeon, Tr. 2651-52).

580. Indeed, other TiO2 producers agree that TiO2 plants "have high fixed costs." (Christian, Tr. 864). The TiO2 industry is a high fixed cost industry, and "[a]ny business that operates with fixed and variable costs, when you reduce your volume, your fixed costs per unit of measure are going to increase, and that has an impact on financials." (Christian, Tr. 881).

581. As a result, there are "[a]bsolutely" "costs involved in curtailing capacity" at its TiO2 plants, including "opportunity costs" and "dislocation involving technology, workers and facilities." (Christian, Tr. 864-65).

582. There are also there are "significant costs in starting [TiO2 facilities] back up again" after being shut down. (Christian, Tr. 865). Kronos agreed that "there are significant problems with stopping production and restarting production" at chloride TiO2 plants. (Christian, Tr. 869).

583. According to Kronos, it is "not a wise strategy to curtail" production at TiO2 facilities because "there's significant cost to doing that." (Christian, Tr. 865-66).

584. "[T]here are good economic reasons to run plants flat-out." (Christian, Tr. 864). For this reason, Kronos "runs its plants flat-out." (Christian, Tr. 864). Kronos agreed that "a well-run titanium dioxide plant is one that runs at full capacity" (Christian, Tr. 862), and "a well-run plant is going to produce as much product as possible." (Christian, Tr. 863). In the TiO2 industry, "[i]f there's a market to sell the product, you want to run full-out and sell everything that you make." (Christian, Tr. 866).

585. Moreover, TiO2 plants cannot simply be "dialed back." (Christian, Tr. 866-67). "[T]here's no dial that can just dial back production" at Kronos' TiO2 facilities. (Christian, Tr. 864). And Kronos is "not aware of" any other major TiO2 producer that has "more of a dial for adjusting its production" than Kronos. (Christian, Tr. 866-67).

586. Further, it is more difficult to reduce TiO2 production at chloride-process facilities than sulfate-process facilities. (Christian, Tr. 868). Kronos agreed that "[i]t's even harder to manage output by adjusting your production levels at a chloride facility than a sulfate facility." (Christian, Tr. 868). During weak cycles, Kronos has "seen more curtailment coming out of sulfate plants" than chloride plants. (Christian, Tr. 869-70).

587. "In this current environment," the big western TiO2 producers "are running chloride process plants at 100 percent of practical capacity right now." (Christian, Tr. 871). The last down cycle when Kronos did not run its plants full-out was in the "2008-2009 time frame," i.e. "roughly ten years ago." At this time, "there were titanium dioxide manufacturers declaring for bankruptcy." (Christian, Tr. 866).

588. Kronos could not identify a single TiO2 producer, including Kronos, that—at any time—"cut production at a plant solely for purposes of trying to increase price." (Christian, Tr. 873).

589. Indeed, even after extensive discovery in this matter, Complaint Counsel still could not identify a *single* example where *any* TiO2 producer adjusted output "for the purpose of supporting higher prices rather than maintenance or operational issues." (FTC Response to Cristal Interrogatory No. 1).

590. It is unlikely that the combined Tronox Cristal entity would reduce output at Hamilton or Ashtabula because they are the lowest cost posture plants for both Tronox and Cristal. (Stern, Tr. 3853). There is no "business logic" that would underlie reducing production at the Ashtabula and Hamilton plants, particularly at the present time in an industry upswing and given their posture as the lowest cost plants for the companies. (Stern, Tr. 3853).

591. Today, Tronox is "making every ounce [of TiO2] we can, selling every ounce we make." (Arndt, Tr. 1422). Indeed, Tronox "wish[es] we had more product." (Arndt, Tr. 1422).

C. The FTC's Theory of Withholding Output Fails to Reflect a Realistic or Accurate Portrayal of the Commercial Dynamics of the TiO2 Industry.

592. The FTC's theory of withholding output and the "conclusions [Dr. Hill] reaches [regarding withholding output] don't comport with the way the real world works in the chemical industry." (Stern, Tr. 3854).

593. For example, Dr. Hill fails to acknowledge the status of the TiO2 price cycle when he criticizes TiO2 producers for controlling output during economic downturns. (Stern, Tr. 3748). Dr. Hill cites excerpts from Cristal and Tronox documents to support his opinions regarding output reductions in the industry; these interpretations do not consider the context of the industry cycle, "which is well-proven, goes back decades, and is a significant driver of company strategy in the chemical industry generally, and the TiO2 business in particular." (Stern, Tr. 3757-58).

594. [redacted]

[redacted]

595. Dr. Hill cites to the fact that a number of TiO2 plants closed as evidence that TiO2 producers closed plants to drive up price. However, these plants were closed primarily due to weak TiO2 markets. There were also situations were some of the plants Dr. Hill cited were either too small to be cost-competitive, or they were producing a product no longer needed by the market. (Stern, Tr. 3771; 3773). The period of 2012-2016, when Tronox's and Cristal's prices were steadily declining, is the same period of time that Dr. Hill asserts TiO2 producers were reducing output to drive up price. (Stern, Tr. 3770).

596. The FTC's theory also ignores the key role of demand dynamics in the TiO2 industry, and on any impact of changes in supply on TiO2 market prices. (Stern, Tr. 3710). For instance, Dr. Hill admitted that he did not analyze "changes in the level of TiO2 demand from year to year in his report." Dr. Hill also did not analyze "the causes of" changes in TiO2 demand from year to year. (Stern, Tr. 3710).[67]

597. The FTC's theory fails to appreciate that TiO2 prices were dropping from 1995 until 2009-2010. (Stern, Tr. 3738-39; RX0171.0070). [redacted]

[67] By "assuming that demand remains steady" and ignoring the demand side of the equation, Chief Judge Chappell likewise observed that the FTC "seem[ed] to be posing somewhat of a hypothetical with missing information" (Judge Chappell, Tr. 1378-79).

598. Stern Figure 25 (RX0171.0070) shows "the cyclical behavior of the business." (Stern, Tr. 3737). As reflected in Stern Figure 25 (RX0171.0070), the TiO2 industry "hit a pricing and profitability peak" during the late 1980s. (RX0171.0069). The "peak shown in the TiO2 business [in 1988-89] occurred at the same time as a peak in the chemical industry" more broadly. (Stern, Tr. 3737). The next peak in the chemical industry occurred in 1995, and the following peak occurred in 2005. (Stern, Tr. 3737-38). Then, there was "a rise in 2011-2012, and that is the result of the feedstock shortage period . . . that resulted in a significant price increase." (Stern, Tr. 3738). From the period 1995 to 2009, TiO2 prices were largely dropping. (Stern, Tr. 3738-39). They didn't recover and "mov[e] upward" until "following the Great Recession of 2008-2009." (Stern, Tr. 3739).

599. Stern Figure 27 (RX0171.0074) illustrates pricing for feedstock between 2005 and 2017, and shows the feedstock pricing reflecting feedstock shortages, culminating a peak in feedstock pricing in the early part of 2012. (Stern, Tr. 3744).

600. Stern Figure 27 (RX0171.0074) shows "very rapid rises in feedstock pricing, culminating in a peak in the early part of 2012." (Stern, Tr. 3744).

601. The FTC's theory also ignores that ***prices*** and ***margins*** do not move in tandem in the TiO2 industry. (Stern, Tr. 3729-30).

602. Stern Figure 18 shows that margins dropped more rapidly than price in the 2012-2013 and also the 2015-2016 time periods. (Stern, Tr. 3730-31; RX0171.0055). Margins were dropping more rapidly than price between 2012-3013 and between 2015-2016 because there was a significant cyclical downturn during the period of 2012-2016, lasting about four years. (Stern, Tr. 3731; RX0171.0055).

603. Although "[a] lot of capacity" was "taken offline" during the 1995 to 2010 time frame "as a result of poor financial performance of the industry," these closures were prompted by "downturns either in the general economy or specifically in the TiO2 industry." (Christian, Tr. 766).

604. Furthermore, Dr. Hill does not take into account "costs and the influences of costs on the price of TiO2 in his analysis." (Stern, Tr. 3723). But manufacturing costs are a significant determinant of price levels; manufacturing costs are the largest, with the small addition of selling, general, and administrative costs (SG&A), research and development costs (R&D), and freight

costs. (Stern, Tr. 3721-22.) Total manufacturing cost is comprised of feedstock costs, chemical costs, fixed costs, waste (for environmental management purposes), and utilities. (Stern, Tr. 3723; RX0171.0054).

605. The FTC's theory also ignores that TiO2 plants experience ups and downs in operating rates, many as the result of both planned and unplanned outages. (Stern, Tr. 3750).

606. The FTC's theory also ignores the role of inventory levels. (Stern, Tr. 3749). Stern Figure 28 illustrates the Hamilton plant's operating rates superimposed against its inventory levels. (Stern, Tr. 3749; RX0171.0078).

607. Stern Figure 28 shows that, in periods such as 2012, 2013, and 2015, when inventories began to grow to unacceptable levels, production was slowed to reduce excess inventories. (Stern, Tr. 3749; RX0171.0078).

608. In the second quarter of 2015, "Tronox suffered a downgrade from Moody's because of the unacceptable level of working capital tied up in inventory." (Stern, Tr. 3749).

D. Dr. Hill's Capacity Closure Model Suffers from Numerous Fundamental Flaws, Including Ignoring Real-World Competition, Which Cause the Model to Artificially Predict Competitive Effects.

609. Dr. Hill supports his opinions regarding unilateral competitive effects using the "capacity closure" model.[68] (Hill, Tr. 1957-58, 1759).

610. [redacted] Instead, Dr. Hill's model only predicts whether the "merger is likely to lead to increased ***incentive*** for the merged firm to withhold output, and that withholding of output will lead to a higher market price." (Hill, Tr. 1760 (emphasis added)).

611. For these reasons and those set forth below, Dr. Hill's capacity closure model is "invalid" because it is "inconsistent with the real world." (Shehadeh, Tr. 3329-30).

a. Dr. Hill's "Capacity Closure" Model Has Never Been Accepted by Courts or Subject to Peer Review.

612. Dr. Hill developed the "capacity closure" model himself. (Hill, Tr. 1958).

613. Dr. Hill's "capacity closure" model "has not ever been published in an academic journal." (Hill, Tr. 1962). Dr. Hill's "capacity closure" model also "has not been subject to peer review" "in the publication of a paper." (Hill, Tr. 1961-62).

614. Neither Dr. Hill's report nor his testimony identified anyone other than Dr. Hill who has used his "capacity closure" model. (Hill, Tr. 1659-60, 1967). Dr. Hill testified that his "capacity closure" model "was accepted by a court" in "one case": the Tunney Act proceedings for the Abitibi-Bowater matter. (Hill, Tr. 1962, 1771). However, the Abitibi-Bowater court

[68] The second model Dr. Hill uses to support his opinions regarding unilateral competitive effects, the Cournot model, is discussed *infra* at ¶¶ 686-704.

explained that "the relevant inquiry is whether the United States' conclusion about the adequacy of the Snowflake divestiture," which was based on the "capacity closure" model, "was reasonable, ***not whether it was correct***." (RX2010.0006 (emphasis added); Hill, Tr. 1964 (emphasis added)).

615. In fact, Dr. Hill's "capacity closure" model has never been accepted by any appellate court. (Hill, Tr. 1771). Moreover, Dr. Hill "didn't testify as an expert in court for that case." (Hill Tr. 1962). Dr. Hill also never submitted an expert report in that case. (Hill, Tr. 1967). Dr. Hill was not deposed in that case. (Hill, Tr. 1967). Dr. Hill claims that he was previously "retained as a potential testifying expert" in three cases, but Dr. Hill did not submit an expert report, was not deposed, and did not testify in any of those cases. (Hill, Tr. 1659-60; Hill, Tr. 1967).[69]

616. Nowhere in the Merger Guidelines is there a reference to the "capacity closure" model that Dr. Hill used in his analysis for this case. (Hill, Tr. 1918).

b. Dr. Hill's Capacity Closure Model Fails Dr. Hill's Own Basic Model Validity Test.

617. Dr. Hill claims that the capacity closure model's "ability to accurately predict current behavior confirms that it is attuned to industry reality." (Shehadeh, Tr. 3336-37). Dr. Hill claims that with the "capacity closure" model "you can check whether [the] model predicts that stand-alone firms have an incentive to withhold output and thereby confirm that the model's predictions are consistent with observed behavior in the real world." (Hill, Tr. 2001).

618. Dr. Hill agrees "that today, Chemours has the largest market share in [his] defined market of sales of chloride titanium dioxide to North American customers." (Hill, Tr. 2002). As

[69] For most of his professional life, Dr. Hill has worked on behalf of federal antitrust agencies. (PX5000-123). Prior to joining Bates White in July 2017, Mr. Hill worked for over a decade for federal antitrust agencies. (PX5000-123) Almost immediately after leaving government service, Dr. Hill was retained by Complaint Counsel around August 2017. (Hill, Tr. 1661).

a result, it's "especially important to run that model validity test for Chemours" because "[t]he logic of his model is that if you are a larger supplier, you have a greater incentive to withhold supply." (Shehadeh, Tr. 3337-38).

619. Dr. Hill "runs [the capacity closure model validity] test for Tronox and Cristal." (Shehadeh, Tr. 3330-31). However, Dr. Hill did not run his capacity closure model for a stand-alone Chemours in any of his reports. (Hill, Tr. 2002; Shehadeh, Tr. 3330-31). Dr. Shehadeh did. (Shehadeh, Tr. 3331).

620. [redacted] Dr. Hill admitted that his code was designed so as to "not permit you to run a stand-alone scenario for Chemours." (Hill, Tr. 2004).

621. Dr. Hill's capacity closure model fails this model validity test for Chemours. (Shehadeh, Tr. 3331, 3338).

622. When Dr. Hill's capacity closure model is run "for Chemours using his model and his data, it shows that Chemours' behavior predicted by the model is inconsistent with the behavior of Chemours as reflected in the" real world, and thus is not "attuned to industry reality." (Shehadeh, Tr. 3331, 3338). Dr. Hill acknowledged that his capacity closure model "predicted that Chemours should supply less to North America than Chemours is actually supplying according to Dr. Hill's model and data." (Hill, Tr. 2010).

623. Dr. Hill's capacity closure model fails the model validity test "because the competitive constraints in the real world are more significant than the competitive constraints that Dr. Hill allows in his model." (Shehadeh, Tr. 3340-41, 3363).

624. Dr. Hill admitted that he has "no reason to believe [Dr. Shehadeh] incorrectly ran the model" for stand-alone Chemours. (Hill, Tr. 2011).

625. More fundamentally, Dr. Hill "analyzed stand-alone Tronox premerger to see if it would have an incentive to withhold output absent the merger." (Hill, Tr. 2001). Dr. Hill's capacity closure model actually predicts that pre-merger Tronox "does ***not*** have an incentive to withhold output." (Hill, Tr. 2001 (emphasis added)). Indeed, Dr. Hill acknowledged that his model's prediction that pre-merger Tronox does not have an incentive to withhold output "is consistent with observed reality." (Hill, Tr. 2001). In other words, the prediction that pre-merger Tronox does not have an incentive to withhold output is consistent with "data for Tronox on its utilizations," which shows Tronox operating "at full utilization." (Hill, Tr. 2001).

626. [redacted]

627. Dr. Hill also analyzed stand-alone Cristal and his model predicted that "stand-alone Cristal would not have an incentive to withhold output." (Hill, Tr. 2060; Hill, Tr. 2001-02). [redacted]

628. Dr. Hill's capacity closure model is invalid because "if a model can't explain the world as it is today, then it can't be relied on to explain the world as it could be with a change or could be in the future." (Shehadeh, Tr. 3334).

c. Dr. Hill's "Capacity Closure Model" Does Not Allow for Competitive Responses by Rivals, Thereby Predetermining Its Conclusion.

629. Dr. Hill "imposes constraints on the responses of rivals" in his capacity closure model. (Shehadeh, Tr. 3331).

630. Dr. Hill's capacity closure model has three categories of imposed constraints on competitive responses of rivals: (1) no repatriation of exports by North American rivals; (2) no increased production or capacity by North American rivals; and (3) no increase in imports by North American rivals. (Shehadeh, Tr. 3331-32).[70]

631. Dr. Hill "does not let these reactions happen"; it's "built into the model" such that "that reaction is not something that can happen within the model." (Shehadeh, Tr. 3332-33).

632. Dr. Hill acknowledges that these are the three possible responses that rivals could take in response to a reduction of TiO2 output in North America: "if they changed their exports and used it to increase sales in North America, that would be one. Two would be increasing their imports into North America. And three would be bringing excess capacity if they had to to bear." (Hill, Tr. 1981-82).

633. Dr. Hill's capacity closure model is "inconsistent with the real world through the imposition of these constraints." (Shehadeh, Tr. 3333-34). Because Dr. Hill's capacity closure model "does not reflect competition in the real world," it is "not reliable for evaluating the likely competitive effects of the proposed acquisition by Tronox of Cristal." (Shehadeh, Tr. 3386-87).

634. Dr. Hill's imposed constraints on competition in the capacity closure model "result[s] in [its] predictions of price increases." (Shehadeh, Tr. 3329-30). Dr. Hill's imposed "constraint on the responses of customers and competitors" in his merger simulation models "lead him to conclude that there would be price effects [i.e., anti-competitive price increases] inappropriately." (Shehadeh, Tr. 3203).

i. Dr. Hill's Model Permits No Export Repatriation by Rivals in Response to a SSNIP.

[70] After receiving Dr. Shehadeh's criticisisms, Dr. Hill re-ran his model to allow imports, but still assumed away any possible export repatriation or output expansin. (Hill, Tr. 1982-83).

635. Dr. Hill's "capacity closure model does not allow for expansion of capacity" by any competitor "above and beyond the growth of demand." (Hill, Tr. 1983).

636. Instead, Dr. Hill's "capacity closure model assumes that no competitor will take TiO2 that it currently exports out of North America and instead sell it in North America if there's a reduction of output." (Hill, Tr. 1983-84). In other words, Dr. Hill's capacity closure model "assumes that there is no export repatriation back into North America in response to [North American] price changes." (Hill, Tr. 1984). The assumption that North American rivals "won't keep some of those exports home in response to higher prices in his model" is deliberately "imposed" by Dr. Hill on his capacity closure model. (Shehadeh, Tr. 3341-42). As Dr. Hill succinctly put it: "There's no export repatriation allowed." (Hill, Tr. 1983).

637. Dr. Hill's assumption of no export responses in his capacity closure model does not depend at all on how big or small the hypothetical price increase is. (Shehadeh, Tr. 3342-43). In other words, Dr. Hill's capacity closure model assumes no export response in North America even for the highest price increases predicted by his model. (Shehadeh, Tr. 3342-43).

638. For instance, Dr. Hill's capacity closure model "assumes no redirection of exports currently leaving North America so that they'd stay in North America even after a [domestic] price increase of ***61 percent***." (Hill, Tr. 1984 (emphasis added)). Even "[u]nder the scenario where price in North America increased ***79 percent***, [Dr. Hill's] model still assumes that no firm w[ould] repatriate any exports." (Hill, Tr. 1992 (emphasis added)).

639. Dr. Hill's assumption of no export responses in his capacity closure model "doesn't depend on market definition." In other words, even if there were a discrete North American market, "a company selling into two distinct markets would still consider the relative profitability of those markets and respond." (Shehadeh, Tr. 3343).

640. Dr. Hill described his assumptions that (i) North American producers of TiO2 will ***never*** redirect exports to be sold instead within North America; (ii) North American producers will ***never*** increase capacity or output of TiO2; and (iii) North American producers will ***never*** increase imports into North America as "intentional modeling choice[s]." (Hill, Tr. 1980-81.) Indeed, Dr. Hill affirmed that "precluding North American rivals from responding at all" is "a modeling feature" of his capacity closure model. (Hill, Tr. 1977, 1980; PX5004-069).

641. Even though Dr. Hill imposed these "intentional modeling choice[s]" and "modeling features" into his model, Dr. Hill conceded that one thing a firm could consider when "contemplating whether to change its export behavior" is to "compare the price currently obtained by selling outside of North America to the price to be obtained by selling in North America." (Hill, Tr. 1980-81, 1934). Dr. Hill "noted that it's possible that if the domestic price increases, domestic producers may reduce their exporting behavior and instead sell some of that output in the domestic market." (Hill, Tr. 1931).

642. Dr. Hill also acknowledged that "if one firm withholds output, then other firms may react in a way that may make that withholding unprofitable" for example if a competitor brings "a significant amount of their capacity to bear on the market and that capacity is low-cost, it may render the attempt to increase price unprofitable." (Hill, Tr. 1772).

643. Dr. Hill further admitted that because Chemours is "the low-cost producer, presumably it could serve more of the North American market than it presently does," such as by repatriating exports. (Hill, Tr. 1935-36).

644. [redacted]

[redacted]

648. Dr. Hill further acknowledged that "if a firm increases its sales" in the domestic market "because of export repatriation, it would in some way mitigate the anticompetitive effect" of another firm withholding output. (Hill, Tr. 1931-32).

649. Dr. Hill's imposed constraint of no export responses in his capacity closure model is "inconsistent with the literature on the elasticity of exports of the United States for titanium dioxide." (Shehadeh, Tr. 3343-44).

650. Dr. Hill's export regression is flawed because he "finds that exports don't respond at all to changes in prices," which is "inconsistent with economic logic." (Shehadeh, Tr. 3343-44). It is also inconsistent with the "significant variation over time in the volume of exports out of North America" from a low of "approximately 425,000 [metric] tons" to "as high as maybe

700,000 metric tons." (Shehadeh, Tr. 3346). Put differently, Dr. Hill's assumption of no export responses by North American rivals to a sustained price increase "flies in the face of economic logic." (Shehadeh, Tr. 3343-44).

651. Dr. Hill's assumption of no export responses in his capacity closure model has the effect of "making withholding strategies more profitable, and more profitable than they would be in the real world and, thus, creating an incentive where none exists." (Shehadeh, Tr. 3344-45).

652. After Dr. Shehadeh criticized Dr. Hill for not allowing Chemours, Venator, or Kronos to respond at all, Dr. Hill adjusted his code and released new results in his May 10 rebuttal report. (Hill, Tr. 1977-78). In his new model, he allowed North American rivals to adjust imports, but his model from May 10 "still doesn't allow any competitor to vary exports out of North America or to bring excess capacity to bear." (Hill, Tr. 1982-83).

ii. Dr. Hill's Model Permits No Capacity Expansions by Competitors in Response to a SSNIP.

653. In addition to restricting the repatriation of exports, Dr. Hill "imposes" on his capacity closure model that rivals "cannot expand production, including through expanding capacity" in response to the price increases that his model predicts. (Shehadeh, Tr. 3332).

654. Dr. Hill's imposed constraint of no production or capacity increases by North American rivals is inconsistent with the "significant capacity additions year-in and year-out" undertaken by TiO2 producers "in order to serve new demand." (Shehadeh, Tr. 3356-58).

655. In fact, the capacity expansions that are currently taking place year-in and year-out in the TiO2 industry "are happening at current prices" and "would only be hastened and expanded in response to" a price increase in North America. (Shehadeh, Tr. 3358).

656. Dr. Hill's imposed constraint of no production or capacity increases by North American rivals is also inconsistent with the economic data showing the "ability to bring new

capacity online, whether through debottlenecking and increasing the capacity of existing lines or adding lines to existing plants." (Shehadeh, Tr. 3357-58). Thus, Dr. Hill's "assumption in his model" of no competitive responses in terms of capacity expansions "is inconsistent with what we see as the adjustment to capacity in the real world." (Shehadeh, Tr. 3362).

iii. Dr. Hill's Model Restricts Imports into North America by Rivals in Response to a SSNIP.

657. In addition to restricting exports and capacity expansions, Dr. Hill further "imposes" on the capacity closure model the "assumption that rivals to Tronox and Cristal cannot and will not increase imports into North America in response to the higher prices that his model predicts." (Shehadeh, Tr. 3332).

658. Specifically, Dr. Hill's capacity closure model "does not allow Chemours, Kronos or Venator to import any additional material into North America in response to a price increase by the merged firm." (Hill, Tr. 1983). For example, Dr. Hill's model imposes the assumption that "Chemours' plant in [Altamira], Mexico, cannot increase its supply to Dr. Hill's candidate North America in his capacity closure model." (Shehadeh, Tr. 3332).

659. By restricting import responses, Dr. Hill's capacity closure model predicts price increases "that won't arise in the real world because it fails to account for the real world competitive constraints, in this case the ability of customers in North America to seek supply from international sources of supply." (Shehadeh, Tr. 3369).

660. Dr. Hill's restriction on import responses by North American rivals in his capacity closure model is inconsistent with the economic evidence, which shows "imports responding to new demand," and the economic literature, which shows "the responsiveness of imports" to prices. (Shehadeh, Tr. 3365-66).

d. If Dr. Hill's Capacity Closure Model Allowed Even Slight Competitive Responses of Rivals, It Would Show All Unilateral Reduction Scenarios to Be Unprofitable.

661. Once "one accounts for the responses in the real world that would arise in response to the price increases" predicted by Dr. Hill's capacity closure model, that model "would no longer predict the price increases that Dr. Hill references." (Shehadeh, Tr. 3330).

662. If Dr. Hill's capacity closure model allowed for export responses to price increases in North America, "[i]t would predict that no price increase would be profitable and no capacity closure would be profitable." (Shehadeh, Tr. 3355).

663. Dr. Shehadeh found that allowing a competitive response by rivals of just 24 kilotons per year ("ktpa") "would render the prices increases across all of his model scenarios unprofitable." (Shehadeh, Tr. 3370-71; Shehadeh, Tr. 3382-83). 24 ktpa is a relatively miniscule amount. (Shehadeh, Tr. 3371-72). For example, 24 ktpa is "less than 2 percent of the chloride produced titanium dioxide capacity in the hands of rivals." (Shehadeh, Tr. 3371).

664. In other words, if Dr. Hill's model "were to permit only 2 percent of global-produced [chloride-process only] titanium [dioxide] capacity in the hands of rivals to respond to these prices increases in North America, then the model would no longer predict the price increases that Dr. Hill proposes." (Shehadeh, Tr. 3371-72).

665. 24 ktpa is also equivalent to "approximately 0.4 percent" of all global TiO2 capacity, irrespective of chloride-process or sulfate-process. (Shehadeh, Tr. 3372).

666. If Dr. Hill's model were to permit only 0.4 percent of all global TiO2 capacity, irrespective of chloride-process or sulfate-process, to respond to his model's predicted prices increases in North America, then the model "would no longer find those price increases profitable." (Shehadeh, Tr. 3372-73).

667. To be clear, a 24 ktpa response would be sufficient to render ***all*** of Dr. Hill's model scenarios unprofitable, including price increases that "range from 5 percent to as high as 61 percent across his capacity closure models." (Shehadeh, Tr. 3370-71, 3373).

668. 24 ktpa "is a small number . . . given that we're talking about a foreseeable and sustained relative price increase" as high as 61 percent. (Shehadeh, Tr. 3373-74).

669. Dr. Hill acknowledges that "a rival response of 24,961 [ktpa] is sufficient to render closing three production lines unprofitable." (Hill, Tr. 1985). Dr. Hill never calculated whether rival responses of 25 ktpa would render any other scenarios unprofitable. (Hill, Tr. 1986).

e. Dr. Hill Admittedly Made a Number of "Mistakes" and "Errors" in His "Capacity Closure" Model.

670. Dr. Hill admitted to making "errors" and "mistakes" in his capacity closure model. (Hill, Tr. 1969, 1828-29,).

671. Dr. Hill submitted an initial expert report dated April 6, 2018. (Hill, Tr. 1967-68; RX1649). After Dr. Hill submitted his April 6 report, he "discovered that there were some errors in the code" "related specifically to some MATLAB code that [he] had used for the capacity closure model." (Hill, Tr. 1969).

672. [redacted]

673. But Dr. Hill claimed "that there are only a few errors to the code." (Hill, Tr. 1972). At his deposition, Dr. Hill could only remember one change to the code which he described "as literally a case of a minus sign that should have been a plus sign or vice versa." (Hill, Tr. 1969-70).

674. Dr. Hill retracted his April 6 report and issued a corrected expert report dated April 18. (Hill, Tr. 1967-68).

675. Dr. Hill never mentioned his April 6 report on direct examination. (Hill, Tr. 1968).

676. In Dr. Hill's April 6 report, his capacity closure "model predicted that the most profitable scenario to the merged firm was to idle two lines at Hamilton." (Hill, Tr. 1968). By contrast, in Dr. Hill's "April 18 report, [his] model run with its revised code no longer shows idling two lines at Hamilton as the most profitable scenario for the merged firm"; instead, the "revised code predicts that idling three lines at Hamilton is the most profitable scenario for the merged firm." (Hill, Tr. 1976).

677. But even comparing results from the two lines at Hamilton scenarios show dramatic changes: in the April 18 report, the two-line scenario is "no longer the most profitable scenario," it would result in "a 31 percent predicted price increase," and would result in "a net gain of 122 million" to the merged firm. (Hill, Tr. 1990-91).

678. Dr. Hill's April 6 report predicted the most profitable scenario "resulted in a net gain [to the merged firm] of $22 million." (Hill, Tr. 1968-69). But "after a few corrections" to his code, Dr. Hill's "revised April 18 report calculates a net gain of $32 million" to the merged firm under the most profitable scenario. (Hill, Tr. 1976).

679. The errors and mistakes in Dr. Hill's capacity closure model result in "very, very significant changes in the predictions of the model," and therefore show "the underlying sensitivity and ultimately unreliability of the model." (Shehadeh, Tr. 3437-39). These substantial errors and mistakes in Dr. Hill's capacity closure model, and the inherent unreliability of the model partly explain why the model fails "validity tests" and fails "to incorporate real-world competitive responses." (Shehadeh, Tr. 3439-40).

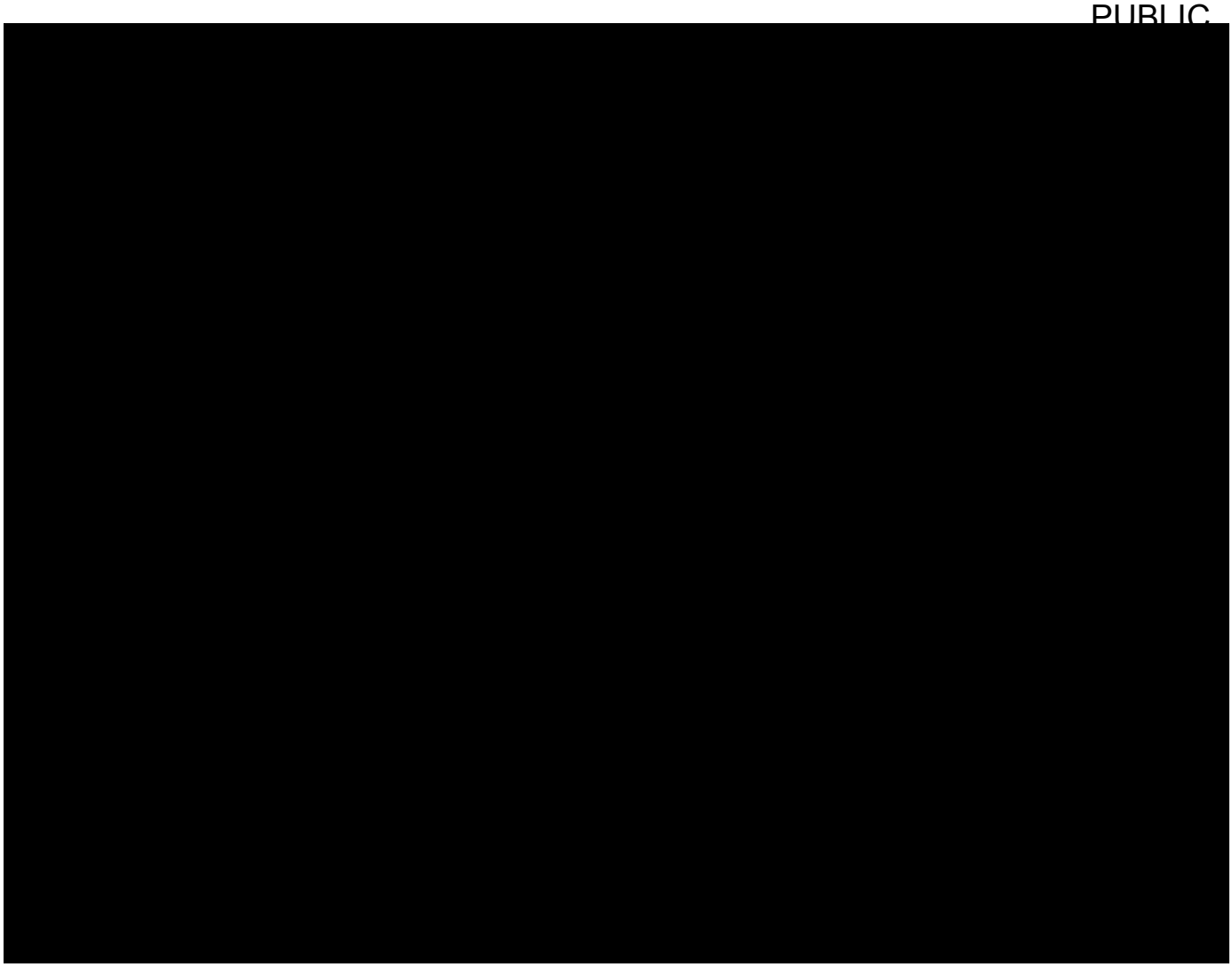
680. The inherent unreliability and sensitivity of Dr. Hill's capacity closure model can be observed simply by evaluating the "predicted price change in the preferred strategy in his

coordinated capacity closure model." (Shehadeh, Tr. 3440). By comparing the original results of his model to the new results of his model, it shows "very significant differences in which strategies are preferred." (Shehadeh, Tr. 3440-41).

681. [redacted]

682. [redacted]

683. The errors and mistakes also substantially affect the profitability rankings of Dr. Hill's model scenarios. [redacted]



685. These errors and mistakes in Dr. Hill's model, and the resulting "changes from one iteration of Dr. Hill's model to the next iteration of his model," "go directly to the sensitivity of the model." (Shehadeh, Tr. 3439-41; Shehadeh, Tr. 3516-17).

E. Dr. Hill's Cournot Model Suffers from Numerous Fundamental Flaws and Fails Multiple Model Validity Tests.

686. In addition to his capacity closure model, Dr. Hill supports his opinions regarding the likelihood of unilateral competitive effects using a Cournot model. (Hill, Tr. 1957-58; Hill, Tr. 1759). The Cournot model "is a model of competition in homogeneous goods." (Shehadeh, Tr. 3387).

687. Dr. Hill uses the Cournot model "to calculate what is called a compensating marginal cost reduction." (Shehadeh, Tr. 3387). The question the calculation seeks to answer is "[h]ow much marginal cost reduction would be required to offset the effects in the Cournot model?" (Shehadeh, Tr. 3387). Dr. Hill "concludes from that model that unrealistically high marginal cost reductions will be required to offset what this model shows, and as a result, he concludes that . . . the proposed transaction would lead to anticompetitive effects, namely, price increases." (Shehadeh, Tr. 3387).

688. [redacted]

689. The "Horizontal Merger Guidelines do not suggest the use of the Cournot model in any analysis." (Hill, Tr. 1917).

a. Dr. Hill's Cournot Model Is Unreliable and Useless Because It Cannot Pass Even Basic Model Validity Tests.

690. Dr. Shehadeh "conducted three validity tests" for Dr. Hill's Cournot model "to compare how that model performs" under those tests. (Shehadeh, Tr. 3388). Dr. Hill's Cournot model "fails all three of those validity tests." (Shehadeh, Tr. 3388).

691. Dr. Shehadeh investigated why Dr. Hill's Cournot model "failed those validity tests" and found that "the failure of [Dr. Hill's Cournot] model relative to those validity tests arises

again because of the constraints that the model imposes on the responses of rivals as well as how the model is inconsistent with real-world operations." (Shehadeh, Tr. 3388).

692. Because Dr. Hill's Cournot model failed these model validity tests, the model "can't be relied on to predict likely anticompetitive effects in the real world." (Shehadeh, Tr. 3398). For these reasons, Dr. Hill's Cournot model "should be set aside." (Shehadeh, Tr. 3388).

i. Dr. Hill's Cournot Model Predicts Anti-Competitive Price Increases for Mergers Involving Unconcentrated Markets.

693. The first model validity test involved evaluating the predictions of Dr. Hill's Cournot model of anti-competitive price increases for a merger that would involve an "unconcentrated market under the Merger Guidelines." (Shehadeh, Tr. 3390).

694. Dr. Hill's Cournot model fails this basic model validity test because it "predicts a price increase" for a merger involving an "unconcentrated market." (Shehadeh, Tr. 3394-95). In other words, "Dr. Hill concludes that a price increase would in fact occur even in markets that the FTC . . . Horizontal Merger Guidelines[] would say is a market in which, because it's unconcentrated, anticompetitive effects are unlikely to occur and then typically require no further inquiry." (Shehadeh, Tr. 3395).

695. The reason Dr. Hill's Cournot model fails this model validity test is because of the "imposition in the model of limited competitive responses of rivals and customers and as a result the assignment of too much market power relative to the real world." (Shehadeh, Tr. 3397). "[T]he implication is is that the model is both inconsistent with the guidelines as well as the recognition in economics of real-world competitive constraints because of the way it constrains economic behavior of rivals and of customers." (Shehadeh, Tr. 3395). For this reason, Dr. Hill's Cournot model is invalid. (Shehadeh, Tr. 3394-95).

ii. Dr. Hill's Cournot Model Conflicts with Industry Reality Because It Predicts the Merger Would Not Be Profitable.

696. The second model validity test that Dr. Hill's Cournot model fails is that it predicts that "the merger is unprofitable." (Shehadeh, Tr. 3390). Specifically, Dr. Hill's "Cournot model predicts that in the North American chloride titanium dioxide market, the merger will be unprofitable with respect to the variable costs." (Hill, Tr. 1781-82). This prediction does not "make sense." (Shehadeh, Tr. 3399). In fact, the merger will be profitable in North America. (Romano, Tr. 2217).

697. As a result, Dr. Hill's Cournot model is "inconsistent with real-world actions, namely, undertaking this transaction." (Shehadeh, Tr. 3390, 3399-3400; Hill, Tr. 1781-82). The fact that Dr. Hill's Cournot model "makes predictions that are inconsistent with real-world actions" means that "it can't be relied on to predict real-world outcomes." (Shehadeh, Tr. 3400). Because the model "cannot explain very significant real-world actions, it's not valuable for predicting the likely competitive effects of the transaction." (Shehadeh, Tr. 3400).

iii. Dr. Hill's Cournot Model Suffers from What FTC Economists Have Recognized as a "Glaring Inconsistency."

698. The third model validity test that Dr. Hill's Cournot model fails is that it suffers from an inherent "bias built into it" that "inserts too much market power." (Shehadeh, Tr. 3391). Dr. Hill's Cournot model "assigns too much market power, relative to what's in the real world, to suppliers with large shares." (Shehadeh, Tr. 3390). As a result of this bias, Dr. Hill's Cournot model "implies that those large suppliers have unrealistically low costs." (Shehadeh, Tr. 3390).

699. This bias, or predisposition, of the Cournot model as used by Dr. Hill is inherent to—or "built into"—the Cournot model as used by Dr. Hill. (Shehadeh, Tr. 3391). As a result, this bias of the Cournot model as used by Dr. Hill exists "in any case or instance in which that particular model is used." (Shehadeh, Tr. 3391).

700. This bias in the Cournot model as used by Dr. Hill is "evident" because "you can take a guidelines merger, by which I mean a merger that leads to an unconcentrated market postmerger, and it will still show consistent price effects." (Shehadeh, Tr. 3391).

701. This bias of the Cournot model as used by Dr. Hill is "generally accepted in the field." (Shehadeh, Tr. 3391). An FTC economics working paper called this bias a "glaring inconsistency between the real world and what the Cournot model predicts in terms of costs." (Shehadeh, Tr. 3390). The FTC economics working paper proposed corrections to the Cournot model "because it recognized this glaring inconsistency between the model and the way commodity markets work and so proposed some corrections to the model to account for real-world competition." (Shehadeh, Tr. 3391).

b. Once Dr. Hill's Cournot Model Is Corrected Using FTC Methods for Addressing Its "Glaring Inconsistency," It Predicts No Anti-Competitive Effects of the Transaction.

702. Dr. Shehadeh applied the "extension of the Cournot model developed by three FTC economists and presented in an FTC Bureau of Economics working paper" to Dr. Hill's Cournot model in this case. (Shehadeh, Tr. 3388-89). Once the FTC economist-developed corrections to Dr. Hill's Cournot model were applied, the anti-competitive price effects that Dr. Hill's Cournot model predicts "largely disappear." (Shehadeh, Tr. 3388-89, 3391). Indeed, Dr. Shehadeh found "no anticompetitive effect even before incorporating efficiencies." (Shehadeh, Tr. 3403-06).

703. Unlike Dr. Shehadeh, Dr. Hill did not apply these adjustments from the FTC working paper to his Cournot model in this case. (Shehadeh, Tr. 3392).

c. Dr. Hill's Capacity Closure and Cournot Models Are "Static" Models that Fail to Account for "Dynamic" Competition and Expansion in the TiO2 Industry.

704. Dr. Hill's capacity closure model and Cournot model are both "static" models. (Shehadeh, Tr. 3408). Because these models are static, they do not account for "dynamic

competition" in the TiO2 industry, and thus "they overstate the likelihood and the magnitude of any anticompetitive effects." (Shehadeh, Tr. 3408).

IX. THE TRONOX-CRISTAL ACQUISITION DOES NOT INCREASE THE LIKELIHOOD OF COORDINATED EFFECTS IN THE TIO2 INDUSTRY.

705. The Tronox-Cristal transaction "is unlikely to lead to anticompetitive effects through coordinated interaction and will not increase the likelihood of such coordinated interaction." (Shehadeh, Tr. 3409).

706. The Tronox-Cristal transaction does not increase the likelihood of coordinated effects in the TiO2 industry because it "decreases transparency in the market and increases the diversity of incentives in the relevant market," which do not suggest an increased likelihood of coordinated interaction among suppliers post-merger. (Shehadeh, Tr. 3409).

707. The varied incentives and cost structures of suppliers in the TiO2 industry, as well as the lack of transparency regarding actual pricing and output, render any potential effort to coordinate pricing pricing or production behavior extremely difficult to conceive, monitor, and enforce. (Stern, Tr. 3793).

708. Diversity of incentives between TiO2 producers "frustrates the ability of rivals to reach terms of agreement, to monitor terms of agreement and ultimately to enforce the terms of the agreement to punish, which are the requirements for sustaining tacit coordination." (Shehadeh, Tr. 3410).

A. The FTC's "Evidence" Does Not Identify Any Actual History of Coordination Among TiO2 Producers.

709. [redacted]

710. [redacted]

711. Tronox does not "tacitly or explicitly communicat[e] with competitors about what prices are doing and what we should be setting them at." (Romano, Tr. 2288).

712. [redacted]

713. Tronox is not "aware of any instances where Mr. Casey and the heads of these other companies ever got together to discuss whether they should coordinate output." (Arndt, Tr. 1415-16).

B. The FTC's Theory of Coordination Is Inconsistent with Industry Reality.

714. The FTC's theory of price coordination is inconsistent with industry reality. [redacted]

715. The FTC's theory of coordinated withholding of output is also inconsistent with the real world. In Mr. Stern's experience in the chemical and petroleum industries, he has never seen the type of behavior Dr. Hill posits: he has never seen a company idle its capacity so long as its competitor does the same, and then permanently de-idle its capacity if its competitor doesn't play along. (Stern, Tr. 3801).

716. Mr. Stern, who has spent four decades in the field, testified that in all of his experience, he had never seen the type of coordinating behavior predicted by Hill's model, branding it a "ridiculous theory." (Stern, Tr. 3801).

C. Diversity of Incentives Among TiO2 Producers Frustrates Coordination.

717. The Tronox-Cristal transaction "is unlikely to lead to anticompetitive effects through coordinated interaction and will not increase the likelihood of such coordinated interaction . . . because the proposed transaction decreases transparency in the market and increases the diversity of incentives in the relevant market." (Shehadeh, Tr. 3409).

718. Dr. Shehadeh found "diversity of costs, diversity in the sales and distribution footprints of competitors," "diversity of scale, and ultimately the diversity of competitive outcomes" among TiO2 producers. (Shehadeh, Tr. 3410). "[T]hat diversity of incentives is relevant in consideration of coordinated competitive effects because a diversity of incentives

frustrates the ability of rivals to reach terms of agreement, to monitor terms of agreement and ultimately to enforce the terms of the agreement to punish, which are the requirements for sustaining tacit coordination." (Shehadeh, Tr. 3410).

719. Indeed, the existence of "diversity of… incentives" among TiO2 producers "frustrate[s] coordination" today, and would frustrate coordination "posttransaction." (Shehadeh, Tr. 3417). In fact, the transaction would ***increase*** diversity of incentives, making it ***less likely*** that TiO2 producers would coordinate post-transaction. (Shehadeh, Tr. 3417-18). Specifically: "When we look at the effects of the transaction, it increases diversity, including by increased vertical integration, which leads to lower costs, including from the reduction of double marginalization through internal supply. It increases diversity by lowering the costs of expansion for the postmerger entity both upstream and downstream. And it increases diversity by increasing the global network of plants and customers over which the postmerger entity will be optimizing its supply and sales." (Shehadeh, Tr. 3417-18).

720. The reason diversity of incentives would frustrate coordination among TiO2 producers is because "to have tacit coordination," TiO2 producers would need to "reach terms of agreement, monitor terms of agreement and then, if they see their rivals not participating, to punish or enforce the terms of agreement. And both the existing diversity and the diversity that's created by the transaction will frustrate each of those steps." (Shehadeh, Tr. 3418).

721. This diversity of incentives among TiO2 producers "show[s] that the proposed transaction is unlikely to give rise to coordinated effects or unlikely to increase the likelihood of coordinated effects posttransaction." (Shehadeh, Tr. 3421).

D. Dr. Hill's Coordinated Capacity Closure Model Suffers from the Same Flaws and Shortcomings as the Unilateral Version.

722. Dr. Hill's "coordinated capacity closure" model is designed "to evaluate coordination between Chemours and the postmerger Tronox in his candidate relevant market." (Shehadeh, Tr. 3410-11).

723. Dr. Hill's coordinated capacity closure model is "very similar" to the unilateral capacity closure model in several key respects. (Shehadeh, Tr. 3411). For example, like the unilateral version, Dr. Hill's coordinated capacity closure model "assumes that rivals in North America cannot respond and do not respond by export repatriation, by increasing imports for those North American producers, or by expanding capacity or production." (Shehadeh, Tr. 3411). In other words, like the unilateral version, the coordinated capacity closure model "imposes" restrictions on the competitive responses of rivals in his model. (Shehadeh, Tr. 3414-15). In other ways, the coordinated capacity closure model is different from the unilateral capacity closure model. (Shehadeh, Tr. 3411-12). For instance, the coordinated capacity closure model assumes a "tit-for-tat strategy" of coordination, whereby "Chemours responds in kind to a reduction in supply by Tronox." (Shehadeh, Tr. 3411-12).

724. Dr. Hill's coordinated capacity closure model "does not provide reliable evidence on any increased incentive or likelihood of coordinated competitive effects." (Shehadeh, Tr. 3409). For example, Dr. Hill's coordinated capacity closure model predicts that "price will increase by 61 percent in North America . . . relative to the rest of the world," and yet "even in the face of those very significant price effects," the model shows no competitive responses of rivals whatsoever. (Shehadeh, Tr. 3414-15). This is because Dr. Hill "imposes . . . assumptions about the responses of rivals that are unrealistic." (Shehadeh, Tr. 3415). The ultimate effect of the defects in Dr. Hill's coordinated capacity closure model is that "the price effects that he predicts

are unreliable because they are inconsistent with real-world competitive behavior." (Shehadeh, Tr. 3414-15).

a. Dr. Hill's Coordination Model Fails Basic Model Validity Tests.

725. Dr. Hill's coordinated capacity closure model fails the same key validity tests as the unilateral capacity closure model. (Shehadeh, Tr. 3412).[71]

726. For example, Dr. Hill's coordinated capacity closure model "predicts behavior that is inconsistent for Tronox and Chemours relative to what we observe in the real world." (Shehadeh, Tr. 3412-13). When Dr. Hill's capacity closure model is run "for Chemours using his model and his data, it shows that Chemours' behavior predicted by the model is inconsistent with the behavior of Chemours as reflected in the" real world, and thus is not "attuned to industry reality." (Shehadeh, Tr. 3330-31, 3337-38). For these reasons, Dr. Hill's coordinated capacity closure model is invalid. (Shehadeh, Tr. 3412-13).

b. Dr. Hill's Coordination Model Is Purely Academic; It Does Not Even Purport to Model How Coordination Might Take Place in Reality.

727. Dr. Hill admitted that his use of the coordinated capacity closure model "was not an intent to prove that coordination was likely." (Hill, Tr. 1815). Dr. Hill admitted that he is "not predicting through [his] modeling a specific form of coordination that [he] believe[s] will take place" in the real world. (Hill, Tr. 1992). Instead, Dr. Hill admitted that he simply used his coordinated capacity closure model "to estimate the incentive for coordination between Chemours and the merged firm." (Hill, Tr. 1988). Dr. Hill acknowledged that although his coordinated capacity closure model predicts an "incentive" to coordinate between Tronox and Chemours, this

[71] The failure of multiple model validity tests of Dr. Hill's capacity closure model is discussed *supra*, at ¶¶ 609-685. These failures are fully incorporated for the coordinated capacity closure model. (Shehadeh, Tr. 3413-16).

does not mean that's what would actually "occur in the real world." (Shehadeh, Tr. 3424-25, 3437).

c. Dr. Hill's Coordination Model Is Based on Unrealistic Assumptions.

728. Dr. Hill's "capacity closure model for coordination between Chemours and the merged firm are based on assumptions." (Hill 1992).

a. The first assumption Dr. Hill makes in his modeling is that he assumed coordination between the merged firm and Chemours. (Hill, Tr. 1815).

b. A second assumption that Dr. Hill makes in his his modeling is "costless adjustment of production by Chemours." (Hill, Tr. 1993).

c. A third assumption by Dr. Hill is "perfect communications about closure strategies between Chemours and the merged firm." (Hill, Tr. 1994). This assumption of "perfect communication" between the postmerger Tronox and Chemours is an "unsupportable assumption." (Shehadeh, Tr. 3413-14).

729. For coordination to be a viable real-world strategy between TiO2 producers, "there would have to be communication about exactly how much is being reduced from supply in North America in order to match that under Dr. Hill's strategy. And further, there would have to be perfect communication about what's actually being done in response." (Shehadeh, Tr. 3413). In fact, "neither of those is observable, because [Dr. Hill's] model treats North America as an island in terms of supply and it is not, including because of the significant exports, and so those frustrate the ability to engage in the perfect communication that Dr. Hill's model requires." (Shehadeh, Tr. 3413-14).

d. Dr. Hill's Model Actually Predicts No Incentive to Coordinate.

730. Dr. Hill's coordinated capacity closure model "does not actually predict coordination of the type that Dr. Hill proposes." (Shehadeh, Tr. 3412-13). This is because

"Chemours in fact does not have the incentive in his model to coordinate." (Shehadeh, Tr. 3412-13). "Rather, it has the incentive, according to his model, of . . . free riding and not participating in coordination." (Shehadeh, Tr. 3413).

731. Dr. Hill assumes that Chemours will coordinate with the merged firm and reduce supply, even though his coordinated capacity closure model shows that "the payoff for maintaining supply is higher than the payoff for reducing supply over the course of the model run." (Hill, Tr. 1998; RX0170.0302-03).

732. Even though the model shows the payoff for Chemours is higher if it does not coordinate, Dr. Hill argues that coordination between Chemours and the merged firm can pay off over time. (Hill, Tr. 1998). Dr. Hill bases that possibility for coordination on "a particular game theory strategy" "known as the grim trigger strategy." (Hill, Tr. 1999).

733. In this game theory strategy, the merged firm will idle capacity "so long as Chemours idles the equivalent capacity but permanently de-idles its capacity if Chemours doesn't play along." (Hill, Tr. 1999). For the grim trigger strategy to work, "the essential point is that Chemours has to realize what Tronox is going to do." (Hill, Tr. 1999-2000).

734. But Dr. Hill is "not aware of any evidence of Tronox or Cristal ever sending a message to rivals that they intend to implement a grim trigger strategy." (Hill, Tr. 2000). Dr. Hill admitted that he has "no way to estimate the likelihood that the merged firm in the real world will actually embark on a grim trigger strategy." (Hill, Tr. 2000).

e. If Dr. Hill's Coordinated Capacity Closure Model Allowed Even Slight Competitive Responses of Rivals, It Would Show All Coordination Scenarios to Be Unprofitable.

735. Just like the unilateral capacity closure model, if Dr. Hill allowed for "an expansion of supply by rivals and substitution by customers in North America" of just 24 ktpa in response to

the modeled coordination scenario, this "would be sufficient to render the proposed price increases" in Dr. Hill's coordinated capacity closure model "unprofitable." (Shehadeh, Tr. 3415-16). In other words, if Dr. Hill's coordinated capacity closure model "account[ed] for real-world responses of exports," "account[ed] for real-world responses of imports," or "account[ed] for real-world expansions of supply that we observe over time," it would show no anti-competitive effects. (Shehadeh, Tr. 3416).

736. In the real world, a competitive response of at least 24 ktpa is "virtually certain to occur" in response to sustained price increases of "61 percent in his preferred scenario" in North America. (Shehadeh, Tr. 3416).

737. Therefore, "it's inappropriate to predict likely anticompetitive effects" using either Dr. Hill's unilateral or coordinated capacity closure models. (Shehadeh, Tr. 3416.)

PROPOSED CONCLUSIONS OF LAW

I. COMPLAINT COUNSEL HAS THE ULTIMATE BURDEN OF PROOF AS TO EACH ELEMENT OF ITS SECTION 7 CLAIM.

738. Complaint Counsel alleges that the merger between Tronox and Cristal violates Section 7 of the Clayton Act, as amended, 15 U.S.C. § 18. (Administrative Complaint, Docket No. 9377, December 5, 2017)).

739. Section 7 of the Clayton Act prohibits a corporation from acquiring another where "the effect of such acquisition may be substantially to lessen competition, or to tend to create a monopoly." 15 U.S.C. § 18.

740. Complaint Counsel also challenges the transaction under Section 5 of the FTC Act, which "declare[s] unlawful" "[u]nfair methods of competition in or affecting commerce." 15 U.S.C. § 45. "The allegation that the acquisition is a Section 5 violation, as well as a Section 7 violation, does not require an independent analysis." *In re Polypore Int'l, Inc.*, No. 9327, 2010

WL 9434806, at *164 (FTC Mar. 1) (citation omitted), *adopted as modified* by 2010 WL 5132519 (FTC Dec. 13, 2010).

741. In a case challenging a transaction under the Clayton Act, Complaint Counsel has the "ultimate burden of proving a Section 7 violation." *United States v. Sungard Data Sys., Inc.*, 172 F. Supp. 2d 172, 180 (D.D.C. 2001). Complaint Counsel has the "the burden on every element of their Section 7 challenge, and a failure of proof in any respect will mean the transaction should not be enjoined." *FTC v. Arch Coal, Inc.*, 329 F. Supp. 2d 109, 116 (D.D.C. 2004).

A. Complaint Counsel Bears the Burden of Proof and Persuasion of the Relevant Geographic and Product Markets.

742. Analysis of the likely competitive effects of a merger requires determinations of (1) the relevant product market in which to assess the transaction, (2) the geographic market in which to assess the transaction, and (3) the transaction's probable effect on competition in the relevant product and geographic markets." *Arch Coal*, 329 F. Supp. 2d at 117.

743. First, "Complaint Counsel bears the burden of proving [the] relevant market within which" the transaction is likely to have "anticompetitive effects." *In re Polypore Int'l*, 2010 WL 9434806, at *165 (citation omitted). The relevant market has two component parts. "First, the 'relevant product market' identifies the product and services with which the defendants' products compete. Second, the 'relevant geographic market' identifies the geographic area in which the defendant competes in marketing its products or service." *Arch Coal*, 329 F. Supp. 2d at 119; *see also FTC v. CCC Holdings Inc.*, 605 F. Supp. 2d 26, 37 (D.D.C. 2009) (same); *In re Polypore Int'l.*, 2010 WL 9434806, at *165.

744. "Not only is the proper definition of the relevant product market the first step in this case, it is also the key to the ultimate resolution of this type of case, since the scope of the market will necessarily impact any analysis of the anticompetitive effects of the transaction."

SunGard Data Sys, 172 F. Supp. 2d at 181. "Determination of the relevant product and geographic markets is 'a necessary predicate' to deciding whether a merger contravenes the Clayton Act." *United States v. Marine Bancorporation, Inc.*, 418 U.S. 602, 618 (1974) (citations omitted).

745. Complaint Counsel "bears the burden of proof and persuasion in defining the relevant market." *Arch Coal*, 329 F. Supp. 2d at 119 (citing *SunGard Data Sys.*, 172 F. Supp. 2d at 182-83). Complaint Counsel's case fails if it cannot define a relevant market. *FTC v. Lab. Corp. of Am.*, No. SACV 10-1873 AG (MLGx), 2011 WL 3100372, at *17 (C.D. Cal. Feb. 22, 2011) ("The failure to properly define a relevant market may lead to the dismissal of a Section 7 claim); *FTC v. Cardinal Health, Inc.*, 12 F. Supp. 2d 34, 45 (D.D.C.1998) ("Defining the relevant market is critical in an antitrust case because the legality of the proposed merger[] in question almost always depends upon the market power of the parties involved); *Bathke v. Casey's Gen. Stores, Inc.*, 64 F.3d 340, 345 (8th Cir. 1995) ("Antitrust claims often rise or fall on the definition of the relevant market).

B. Complaint Counsel Bears the Burden of Proving Anti-Competitive Effects of the Transaction.

746. After proving its product and geographic market, Complaint Counsel must prove the effect of the transaction "may be substantially to lessen competition, or to tend to create a monopoly." *In re Polypore Int'l*, 2010 WL 9434806, at *165 (citation omitted). To meet this burden, Complaint Counsel cannot simply demonstrate the "mere possibility" of harm. *United States v. AT&T Inc.*, 310 F. Supp. 3d 161, 189-90 (D.D.C. 2018) (citation omitted). Instead, Complaint Counsel must "demonstrate that the substantial lessening of competition will be 'sufficiently probable and imminent' to warrant relief." *Arch Coal*, 329 F. Supp. 2d at 115 (quoting *Marine Bancorporation*, 418 U.S. at 623 n.22).

747. Courts commonly employ a three-step burden-shifting framework for determining whether the effect of the transaction "may be substantially to lessen competition, or to tend to create a monopoly." *FTC v. H.J. Heinz Co.*, 246 F.3d 708, 714 (D.C. Cir. 2001) (quoting Section 7 of the Clayton Act, 15 U.S.C. § 18). First, Complaint Counsel must establish a *prima facie* case by showing that the transaction would "produce a firm controlling an undue percentage share of the relevant market, and would result in a significant increase in the concentration of firms in that market." *Id.* (alterations and citation omitted).

748. If Complaint Counsel can establish a *prima facie* case, the burden shifts to Respondents to "show that the market-share statistics give an inaccurate prediction of the proposed acquisition's probable effect on competition." *FTC v. Staples, Inc.*, 970 F. Supp. 1066, 1083 (D.D.C. 1997). "Respondents are not required to 'clearly' disprove future anticompetitive effects, because such a requirement would impermissibly shift the ultimate burden of persuasion." *In re Chicago Bridge & Iron Co.,* 138 F.T.C. 1024, 1339-40 (2004) (quoting *United States v. Baker Hughes Inc.*, 908 F.2d 981, 991 (D.C. Cir. 1990)). Respondents may rely on a variety of factors to rebut Complaint Counsel's prima facie case, including "a showing of sufficient efficiencies" resulting from the transaction, *United States v. H&R Block, Inc.*, 833 F. Supp. 2d 36, 89 (D.D.C. 2011), or "the trend of the market either toward or away from concentration, [and] the continuation of active price competition." *In re Chicago Bridge & Iron*, 138 F.T.C. at 1340.

749. If Respondents successfully rebut the *prima facie* case of anticompetitive effects, "the burden of producing additional evidence of anticompetitive effect shifts to the government, and merges with the ultimate burden of persuasion, which remains with the government at all times." *H.J. Heinz*, 246 F.3d at 715 (citation omitted).

II. THE MERGER WILL RESULT IN PRO-COMPETITIVE BENEFITS.

750. The court can consider whether a merger allow the merged firm to "be a stronger competitive force in a post-merger market than [the seller] has been or will be if no merger occurs." *Arch Coal,* 329 F. Supp. 2d at 157. Evidence of efficiencies can be used in two ways: (1) to rebut a plaintiff's *prima facie* case, *H.J. Heinz,* 246 F.3d at 720; *FTC v. Univ. Health, Inc.,* 938 F.2d 1206, 1222-23 (11th Cir. 1991) ("[A] defendant may rebut the government's prima facie case with evidence showing that the intended merger would create significant efficiencies in the relevant market); *Baker Hughes,* 908 F.2d at 982-83; or (2) to assess the competitive effects of the transaction, *FTC v. Sysco Corp.*, 113 F. Supp. 3d 1, 82 (D.D.C. 2015). "Yet even if evidence of efficiencies alone is insufficient to rebut the government's *prima facie* case, such evidence may nevertheless be 'relevant to the competitive effects analysis of the market required to determine whether the proposed transaction will substantially lessen competition). *Arch Coal*, 329 F. Supp. 2d. at 151.

751. The Tronox-Cristal transaction will generate significant output-enhancing efficiencies that will create an increase of TiO2 in the global market. FOF ¶¶ 112-217. And increase in the global supply of TiO2 will benefit TiO2 purchasers by decreasing prices and increasing quality. FOF ¶ 100-02, 130.

752. Because the transaction will result in the merged firm increasing its output and reducing its costs, this Court concludes that the merger is procompetitive. This Court also finds that Tronox/Cristal "will be a stronger competitive force" than without the merger, making Complaint Counsel's alleged anticompetitive effects unlikely. *Arch Coal*, 329 F. Supp. 2d at 157. Specifically, the output-enhancing that will result from the transaction is entirely inapposite to Complaint Counsel's theory that the merged firm would reduce output after the transaction. Therefore, Complaint Counsel has not met its burden of proving a Clayton Act Section 7 violation

and this Court will issue an order dismissing the Complaint with prejudice and entering judgment in favor of Respondents.

III. COMPLAINT COUNSEL FAILED TO PROVE ITS ALLEGED PRODUCT MARKET.

753. The relevant product market is comprised of "products that have reasonable interchangeability for the purposes for which they are produced—price, use and qualities considered." *United States v. E.I. du Pont de Nemours & Co.*, 351 U.S. 377, 404 (1956).

754. "The outer boundaries of a product market are determined by the reasonable interchangeability of use or the cross-elasticity of demand between the product itself and substitutes for it." *Brown Shoe Co. v. United States*, 370 U.S. 294, 325 (1962). "[A] product market includes all goods that are reasonable substitutes, even though the products themselves are not entirely the same." *Sysco*, 113 F. Supp. 3d at 25.

755. "An analytical method often used by courts to define a relevant market is to ask hypothetically whether it would be profitable to have a monopoly over a given set of substitutable products. If so, those products may constitute a relevant market." *H&R Block*, 833 F. Supp. 2d at 51; *see also United States v. Oracle Corp.*, 331 F. Supp. 2d 1098, 1111-12 (N.D. Cal. 2004); *Arch Coal*, 329 F. Supp. 2d at 119-20; *accord* PX9085-011-013 (Horizontal Merger Guidelines § 4.1.1). "[C]ourts determine the degree to which price increases will cause marginal buyers to turn to other products." *Oracle,* 331 F. Supp. 2d at 1118.

756. A well-defined product market "must correspond to the commercial realities of the industry and be economically significant" and should "recognize competition, where, in fact, competition exists." *Brown Shoe*, 370 U.S. at 326, 336-37 (footnote omitted) (emphasis added); *see also Cardinal Health*, 12 F. Supp. 2d at 46 (same); *PepsiCo, Inc. v. Coca-Cola Co.*, 114 F. Supp. 2d 243, 249 (S.D.N.Y. 2000) (rejecting PepsiCo's contention "that a bundle of product

(fountain syrup) and services (system distribution) utilized by certain customers comprises a separate market").

757. Furthermore, a product market cannot be established based on customer testimony and preferences when plaintiffs fail to present a sufficiently representative set of customers. *Oracle,* 331 F. Supp. 2d at 1167 ("Drawing generalized conclusions about an extremely heterogeneous customer market based upon testimony from a small sample is not only unreliable, it is nearly impossible." (citing *Sungard Data Sys.,* 172 F. Supp. 2d at 182-83)). The relevant question is whether customers—specifically, marginal customers—would divert enough of their demand to competitors in other channels that a SSNIP would be unprofitable. *Oracle*, 331 F. Supp. 2d at 1118.

758. "[A]ntitrust theory and speculation cannot trump facts, and . . . cases must be resolved on the basis of the record evidence relating to the market and its probable future." *Arch Coal*, 329 F. Supp. 2d at 116-17. Relying on "formalistic distinctions rather than actual market realities [is] generally disfavored in antitrust law." *Eastman Kodak Co. v. Image Tech. Servs., Inc.*, 504 U.S. 451, 466-67, 482 (1992).

759. The Complaint alleges a product market consisting only of TiO2 produced using the chloride process. *See* Adminstrative Complaint, Docket No. 9377, December 5, 2017. However, the record shows that chloride-process TiO2 and sulfate-process TiO2 are reasonably substitutable for the vast majority of end uses. FOF ¶¶ 369-77. About 80% of TiO2 end products can be made with either the sulfate or chloride processes. FOF ¶ 369. Testimony from Tronox and other TiO2 producers confirms this. FOF ¶¶ 360-69. [redacted] Furthermore, the real-world commercial evidence indicates that TiO2

customers can and do switch between chloride- and sulfate-process TiO2. FOF ¶¶ 383-393. Because of this, pricing for chloride- and sulfate-process TiO2 are highly correlated. FOF ¶¶ 419-433.

760. Testimony from a small number of TiO2 customers and purchasers is not sufficient to establish a chloride-process TiO2 market, as it does not answer the key question of whether customers would switch their purchases to sulfate-process TiO2 in the face of a price increase for chloride-process TiO2. That a small number of customers might not change their purchases in response to a SSNIP does not outweigh the significant evidence that shows marginal customers can and do substitute sulfate-process TiO2 for chloride-process TiO2 in response to even small changes in price. FOF ¶¶ 383-395.

761. Therefore, this Court concludes that Complaint Counsel's alleged market for chloride-process TiO2 must fail because they have not met their burden of proving that a narrow market for chloride-process TiO2—which excludes sulfate-process TiO2— exists. *See Arch Coal*, 329 F. Supp. 2d at 122 ("The burden . . . is squarely on plaintiffs to establish that [the product at issue] is a separate relevant market); *SunGard Data Sys.*, 172 F. Supp. 2d at 182-83; *Oracle,* 331 F. Supp. 2d at 1172.

762. This Court concludes that the relevant market includes all TiO2 of the rutile crystal structure, whether manufactured by the chloride process or the sulfate process.

IV. COMPLAINT COUNSEL FAILED TO PROVE ITS ALLEGED GEOGRAPHIC MARKET.

763. A properly defined geographic market charts "the region in which the seller operates, and to which the purchaser can practicably turn for supplies." *Cardinal Health*, 12 F. Supp. 2d at 49 (citation omitted). The "evidence must address where consumers could practicably go, not . . . where they actually go." *FTC v. Tenet Health Care Corp.*, 186 F.3d 1045, 1052 (8th

Cir. 1999); *see also Bathke v. Casey's Gen. Stores, Inc.*, 64 F.3d 340, 346 (8th Cir. 1995) (articulating the test as the distance "customers will travel in order to avoid doing business at" the entity that has raised prices rather than the distance customers would travel absent a price increase) (citation omitted).

764. Like the relevant product market, courts apply the hypothetical monopolist test to determine whether a geographic market has been properly defined. *Sysco Corp.*, 113 F. Supp. 3d at 33 (quoting U.S. Dep't of Justice & Fed. Trade Comm'n, *Horizontal Merger Guidelines* § 4.1.1 (2010)). "If buyers would respond to the SSNIP by shifting to products produced *outside* the proposed geographic market, and this shift were sufficient to render the SSNIP unprofitable, then the proposed geographic market would be too narrow." *Arch Coal*, 329 F. Supp. 2d at 123.

765. [redacted] Complaint Counsel's economist, however, did not analyze whether TiO2 is a global market, even though he admitted the transaction is a "worldwide merger." FOF ¶ 330. The record shows there is significant international trade of TiO2. FOF ¶¶ 271-284. In addition, TiO2 prices rise and fall together across geographic regions. FOF ¶¶ 306-325. There is a substantial amount of evidence that shows marginal customers can and do purchase TiO2 from other places around the world in response to even small changes in price.

766. Based on the Court's foregoing findings of fact and the applicable legal standards and principles set forth here, the Court concludes that Complaint Counsel has failed to prove its alleged relevant geographic market. This Court concludes that the relevant geographic market in which to analyze the effects of the merger is worldwide.

V. COMPLAINT COUNSEL HAS FAILED TO SHOW THAT THE MERGED FIRM IS LIKELY TO UNILATERALLY HARM COMPETITION.

A. Market Shares Do Not Predict the Competitive Effects of the Merger

767. "[S]tatistics concerning market share and concentration are 'not conclusive indicators of anticompetitive effects.'" *Arch Coal*, 329 F. Supp. 2d at 130 (quoting *United States v. Gen. Dynamics Corp.,* 415 U.S. 486, 498 (1974)). Market shares do not "as a matter of logic, necessarily give a proper picture of a company's future ability to compete." *Gen. Dynamics.*, 415 U.S. at 501. "Evidence of market concentration simply provides a convenient starting point for a broader inquiry into future competitiveness." *Baker Hughes*, 908 F.2d at 984. "That the government can establish a prima facie case through evidence on only one factor, market concentration, does not negate the breadth" of the competitive effects analysis. *Id.*

768. "[T]he court must engage in a comprehensive inquiry into the future competitive conditions in a given market." *AT&T*, 310 F. Supp. 3d at 190 (citations omitted). "[D]etermining the existence or threat of anticompetitive effects has not stopped at a calculation of market shares" and, therefore, "[a] finding of market shares and consideration of [the presumption created by market shares] should not end the court's inquiry." *Oracle*, 331 F. Supp. 2d at 1111; *see also Baker Hughes,* 908 F.2d at 992. Courts must also assess the "structure, history and probable future" of the relevant product market. *Gen. Dynamics*, 415 U.S. at 498.

769. Based on these findings, this Court concludes that Complaint Counsel's calculation of market shares, even if they were the proper shares to calculate for this case, are not indicative of likely anticompetitive effects from the merger. Therefore, a presumption of anticompetitive effects based on market concentration does not satisfy Complaint Counsel's burden of proof to establish a violation of Clayton Act Section 7.

B. Complaint Counsel Has Failed to Produce Evidence that the Merger Will Result in Anticompetitive Effects in Its Alleged Relevant Market.

770. "Analysis of the likely competitive effects of a merger requires [a determination] of . . . the transaction's probable effect on competition in the relevant product and geographic

markets." *Arch Coal*, 329 F. Supp. 2dat 117. "[A]ntitrust theory and speculation cannot trump facts, and . . . cases must be resolved on the basis of the record evidence relating to the market and its probable future." *Id.* at 116-117. Therefore, Complaint Counsel cannot "simply [make] conclusory allegations that . . . the merger will significantly limit competition without any evidence." *Advocacy Org. for Patients & Providers v. Mercy Health Servs.,* 987 F. Supp. 967, 974 (E.D. Mich. 1997). Rather, they must show "anticompetitive effects . . . that will result from the merger." *Id.*

771. Where competitors in the same market combine businesses, the transaction may have unilateral anticompetitive effects "if the acquiring firm will have the incentive to raise prices . . . independent of competitive responses from other firms." *H&R Block*, 833 F. Supp. 2d at 81. Anticompetitive effects are also more likely when "the merger would result in the elimination of a particularly aggressive competitor in a highly concentrated market." *Staples*, 970 F. Supp. at 1083. Complaint Counsel claims that Tronox's acquisition of Cristal will lead to unilateral output decreases, but in fact, the evidence demonstrates ***no*** incentive for the combined company to decrease production unilaterally. FOF ¶¶ 730-734.

772. "[O]rdinary course-of-business documents, including those generated by the defendants," can be probative of whether a proposed merger is likely to result in competitive harm. But as with any other piece of documentary evidence, assessing the probative value of defendants' own documents and statements requires an examination of the context, circumstances, and foundation of the proffered evidence." *AT&T*, 310 F. Supp. 3d at 204. However, "a trial by slide deck leaves much to be desired!" *Id.* at 208. "[C]areful consideration should be given to to the views of individuals whose responsibilities, expertise, and experience relating to the issues in

question provide particular indicia of reliability." PX9085-007 (Horizontal Merger Guidelines § 2.2.1).

773. "It is beyond dispute that, to be probative in a particular case, expert testimony must incorporate assumptions that are 'reasonable' in light of the record evidence." *AT&T*, 310 F. Supp. 3d at 221 (*citing Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 242 (1993) ("When an expert opinion is not supported by sufficient facts to validate it in the eyes of the law, or when indisputable record facts contradict or otherwise render the opinion unreasonable, it cannot support a jury's verdict.")). An expert's opinion cannot be relied upon when "facts adduced at trial regarding the real-world operation of [the industry] demonstrated that his testimony 'rests on assumptions' that are 'implausible and inconsistent with record evidence.'" *AT&T,* 310 F. Supp. 3d at 221-22 (dismissing an expert's model) (quoting *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.,* 475 U.S. 574, 594 n.19 (1986)); *see also Brook Grp.,* 509 U.S. at 242; *FTC v. CCC Holdings, Inc.*, 605 F. Supp. 2d 26, 70-72 (D.D.C. 2009) (dismissing an expert's model because "the data and predictions cannot reasonably be confirmed by the evidence"). "When an expert opinion is not supported by sufficient facts to validate it in the eyes of the law, or when indisputable record facts contradict or otherwise render the opinion unreasonable, it cannot support a jury's verdict." *Brooke Grp.,* 509 U.S. at 242.

774. Complaint Counsel claims that the merged firm would reduce its output of TiO2. (Administrative Complaint, Docket No. 9377, December 5, 2017). Evidence shows exactly the opposite—the merged firm plans to increase its production after the transaction. FOF ¶¶ 121-130, 22. Complaint Counsel did not present any credible testimony or data indicating that the merged firm planned to decrease its production of TiO2 after the transaction. Furthermore, prior instances where Tronox has temporarily reduced its production were not attempts to influence price, but

instead due to mechanical issues, regular maintenance, or weak market conditions and unsustainable financial positions. FOF ¶¶ 544-565. Furthermore, the commercial realities of TiO2 production incentivize producers to run their plants "flat out." FOF ¶¶ 572-91.

775. Similarly, Complaint Counsel's economic expert fails to reflect a realistic or accurate portrayal of the dynamics of the TiO2 industry. FOF ¶¶ 609-704, 722-737. His analysis also contains a number of fundamental mistakes and errors including the inability of his models to accurately reflect the real-world TiO2 industry. FOF ¶¶ 670-85. This Court concludes that the Complaint Counsel's economic expert's econometric analysis rests on assumptions that "do[] not make sense as a matter of logic and, more importantly, that have not been supported by sufficient real-world evidence." *AT&T,* 310 F. Supp. 3d at 224. Therefore, it "is not supported by sufficient facts to validate it in the eyes of the law" and "cannot support a decision." *Tenet Health Care*, 186 F.3d at 1053 n.13.

776. Complaint Counsel's failure to present any credible evidence of anticompetitive effects in its alleged relevant market is fatal to their case as to that alleged relevant market. *See Oracle,* 331 F. Supp. 2d at 1172.

VI. COMPLAINT COUNSEL HAS FAILED TO PROVE THAT THE MERGED ENTITY WILL LIKELY COORDINATE WITH OTHER TIO2 PRODUCERS.

777. The government must "put forward sufficient evidence to show more than a theoretical 'possibility' of coordination." *AT&T,* 310 F. Supp. 3d at 246. Because "Section 7 involves *probabilities*, not certainties or possibilities," Complaint Counsel must show that it is not only possible, but more likely than not, that the merger will "enabl[e] or encourag[e] post-merger coordinated interaction among firms in the relevant market that harms [consumers]." *Baker Hughes*, 908 F.2d at 984; *FTC v. OSF Healthcare Sys.*, 852 F. Supp. 2d 1069, 1086 (N.D. Ill.

2012); *Oracle*, 331 F. Supp. 2d at 1109 (rejecting government claim where it had not proved that defendants "would likely engage in coordinated interaction").

778. Coordination "describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power . . . by recognizing their shared economic interests and their interdependence with respect to price and output decisions." *Brooke Grp.*, 509 U.S. at 227. Where the government asserts that coordinated effects will be likely post-transaction, the government must prove that such effects are probable. *See Baker Hughes*, 908 F.2d at 984; *see also Oracl*, 331 F. Supp. 2d at 1109 (rejecting Section 7 claim where government failed to prove that market participants "would likely engage in coordinated interaction" post-merger).

779. Complaint Counsel advances a theory that "the mechanism of tacit coordination that is most strongly supported by the evidence is a form of output restriction in which the major" TiO2 producers "would constrain their production so that increases in supply would lag behind increases in demand, thereby creating an upward pressure on price." *Arch Coal,* 329 F. Supp. 2d at 131. "What this means is that the FTC must show projected future tacit coordination, which itself may not be illegal, which is speculative and difficult to prove, and for which there are few if any precedents." *Id*. This "makes [Complaint Counsel's] burden to establish anticompetitive effects in the post-merger . . . market more difficult." *Id.* at 132.

780. "A market is conducive to tacit coordination, then, where producers recognize their 'shared economic interests and their interdependence with respect to price and output decisions.'" *Arch Coal,* 329 F. Supp. 2d at 131 (quoting *Brooke Group*, 509 U.S. at 227). "Successful coordination requires two factors: (1) reaching terms of coordination that are profitable to the firms involved and (2) an ability to detect and punish deviations that would undermine the coordinated

interaction." *Arch Coal,* 329 F. Supp. 2d at 131. Coordination, at a minimum, "requires harmonizing the incentives of participating firms and mitigating firm uncertainty concerning rival firms, so that they can effectively coordinate their behavior." *In re B.F. Goodrich Co.*, No. 9159, 1988 WL 1025464, at *65 (FTC Mar. 15, 1988), modified by 1989 WL 1126669 (FTC Apr. 5, 1989). Coordination also requires the ability to successfully enforce the consensus. Firms will not coordinate production or pricing unless they can "retaliate effectively if and when cheating occurs." *Id.*; *see also* PX9085-028 (Horizontal Merger Guidelines § 7) (noting the "ability of rival firms to engage in coordinated conduct depends on the strength and predictability of rivals' responses to a price change or other competitive initiative")).

781. In order to assess whether a transaction will increase the risk that producers will engage in coordinated output-constraining behavior, the court will proceed by examining the competitive state of the market today, determining whether coordinated interaction is feasible and, if so, whether there is evidence that actual or tacit coordination has occurred, and then examining the structure and dynamics of the market, the competitive strength of the merging parties, and the likely roles that their competitors would play in a post-merger market. *Arch Coal,* 329 F. Supp. 2d at 132. This broad analysis "is necessary to determine whether the FTC has carried its burden to persuade the Court that the proposed transactions increase the risk of coordinated interaction that will likely substantially lessen competition." *Id.*

782. Complaint Counsel has failed to produce evidence to make the required showing. Complaint Counsel merely claims that the merged firm might have an incentive coordinate post-merger, but does not even purport to offer any economic modeling predicting the type of coordination that would occur in the real world. FOF ¶¶ 722-727. Complaint Counsel's modeling

suffers from numerous fundamental flaws. FOF ¶¶ 722-737. Complaint Counsel cannot establish that such coordination is probable and likely to occur as a result of the merger.

783. To the contrary, the trial record confirms that Tronox/Cristal and other TiO2 producers would lack both the ability and shared incentive to engage in the anticompetitive coordination scheme the government hypothesizes. TiO2 suppliers have different incentives and cost structures, which makes coordination extremely difficult and highly unlikely. Each producer's incentives are unique to its particular circumstances, making aligning those incentives through coordination difficult or impossible. FOF ¶¶ 717-721. Although TiO2 producers sell similar products, their methods and the costs of producing TiO2 products differ dramatically from producer to producer. Specifically, TiO2 producers have a diversity of (1) cost positions and (2) scales of operations, such as capacity and production. This wide diversity of incentives among competing producers, both globally and within North America, frustrates the ability of competitors even to reach terms of agreement for a coordinated scheme, much less to monitor performance under or enforce any agreement.

VII. EXHIBIT INDEX

- *See* **Exhibit A**

VIII. WITNESS INDEX

- *See* **Exhibit B**

Dated: August 7, 2018

Respectfully submitted by:

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CERTIFICATE OF SERVICE

I hereby certify that on August 8, 2018, I filed the foregoing document electronically using the FTC's E-Filing System, which will send notification of such filing to:

Donald S. Clark
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The Honorable D. Michael Chappell
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I also certify that I caused the foregoing document to be served via email to:

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CERTIFICATE FOR ELECTRONIC FILING

I certify that the electronic copy sent to the Secretary of the Commission is a true and correct copy of the paper original and that I possess a paper original of the signed document that is available for review by the parties and the adjudicator.

August 8, 2018

By: /s/ Michael F. Williams
Michael F. Williams

EXHIBIT A

DEFENDANTS' EXHIBIT INDEX

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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX0004	TZMI Presentation: Global Ti02 Pigment Producers Comparative Cost & Profitability Study: A Study of 2015 Costs	149:6-149:9			
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX0009	Tronox 3(b)-01: Transaction Agreement between The National Titanium Dioxide Company Limited, Tronox Limited and, solely for purposes of Articles I, II. VIII, IX and XIII, Cristal Inorganic Chemicals Netherlands Coöperatief W.A.	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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PX0021	Cristal Entities' Responses and Objections to Complaint Counsel's First Set of Requests for Production	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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PX0026	Cristal Entities' Responses and Objections to Complaint Counsel's Second Set of Requests for Production	149:6-149:9			
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PX0029 - PX0999	Intentionally Not Used				
PX1000	Tronox Presentation: Strategic foundation for Tronox: Fundamentals	149:6-149:9	2509:15-2514:15 (6/8/2018) 2554:18-2557:22 (6/8/2018) 2509:15-2514:15 (6/8/2018)		
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PX1007	Intentionally Not Used				
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PX1013	Intentionally Not Used				

Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1019 - PX1020	Intentionally Not Used				

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PX1031	Email from Jeff Engle to John Romano re: China_Update_Tom.pptx w/Attach: China_Update_Tom.pptx	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1033	Email from Jimmy Chen to Jeff Engle, Tony Tan, John Romano, et al. re: ChinaChloridePlants.xlsx	149:6-149:9			

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PX1035	Intentionally Not Used				
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PX1044	Intentionally Not Used				

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PX1049	Intentionally Not Used				
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PX1051	Email from Jeff Engle to John Romano, Aijen Duvekot, Jeroen Peters, et al. re: Hunstman call, w/Attach: HUN Q4-14 Earnings Call.docx	149:6-149:9			
PX1052	Email from Jeff Engle to Jilliann McGuire, Robin de Bondt, Bruno Dietmar, et al. re: Notes from Chemours Earnings Transcript	149:6-149:9			
PX1053	Email from Willem Van Niekerk to Machiel Keegel re: 2Q16 Chemours Conf Call Transcript w/Attach: 2Q16 CC Conf Call Transcript (unedited) 8-9-16.pdf	149:6-149:9	2124:6-2144:7 (6/7/2018)		

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PX1054	Email from Jeff Engle to John Romano, AijenDuvekot, Larry Bradley, et al. re: Huntsman transcript	149:6-149:9	2544:15-2540:23 (6/8/2018)		
PX1055	Email from Brennen Arndt to Tom Casey, Kathy Harper, Jean-Francois Turgeon, et al. re: HUN 2Q16 confrerence call transcript and slides w/Attach: HUN 2Q16 Conf Call Transcript.pdf; HUN 2Q16 Conf Call Slides-Final.pdf	149:6-149:9			
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PX1058 - PX1059	Intentionally Not Used				
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PX1061	Intentionally Not Used				
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PX1063 - PX1064	Intentionally Not Used				
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PX1066	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1067	Email from Jeff Engle to Chris Larson re: Henan Billions (Chinese)- New CRM post	149:6-149:9	2520:17-2521:21 (6/8/2018) 2574:5-2575:14 (6/8/2018)		
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PX1069 - PX1071	Intentionally Not Used				
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PX1078	Intentionally Not Used				
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PX1080 - PX1082	Intentionally Not Used				
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PX1092	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1100	Email from John Romano to Jean- Francois Turgeon re: The Chemours Company - Chemours Announces Titanium Dioxide Price Increase	149:6-149:9	2201:1-2208:9(6/7/2018)		
PX1101	Intentionally Not Used				

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PX1115	Intentionally Not Used				
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PX1117	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1119	Email from Tom Casey to John Romano, Jean-Francois Turgeon re: Visit	149:6-149:9			
PX1120-PX1122	Intentionally Not Used				
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PX1127	Intentionally Not Used				
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PX1129	Email from Jolm Romano to Robert Gibney re: Tom's answer	149:6-149:9			
PX1130	Email from postmastcn7 tami.com to Machiel Keegel re: Undeliverable: Re: The Chemours Company - Chemours Consolidates and Strengthens Ti02 Business as Part of Five-Point Transformation Plan w/Attach: The Chemours Company - Chemours Consolidates and Strengt	149:6-149:9			
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PX1134- PX1135	Intentionally Not Used				
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PX1137	Email from Willem Van Niekerk to Jean-Francois Turgeon, Tom Casey re: Lomon Billions w/Attach: saiZ V9KcMZU 8fhXkvU siT urU VW 3 Fh	149:6-149:9	2709:3-2712:7 (6/13/2018)		
PX1138	Email from Macliiel Keegel to Marco De Angelis re: Good news!! CC shutthing down Edge Moor and 1 line at New Jolmsonville	149:6-149:9			
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PX1141	Email from Willem Van Niekerk to Macliiel Keegel re: SW	149:6-149:9			
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PX1143	Email from Willem Van Niekerk to Willem Van Niekerk re: B. Riley and UBS reports on price increase announcements w/Attach: UBS Price Increase Report 5-31-13.PDF	149:6-149:9			

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PX1144	Intentionally Not Used				
PX1145	Email from John Romano to Aijen Duvekot, IanMouland re: Westlake Pricing	149:6-149:9			
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PX1152-PX1153	Intentionally Not Used				
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PX1155 - PX1156	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1157	Email from Ian Mouland to Aijen Duvekot, John Romano re: Deceuninck, NA	149:6-149:9			
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PX1159-PX1160	Intentionally Not Used				
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PX1169-PX1170	Intentionally Not Used				
PX1171	Email from John Thomett to John Romano, Edwin Capendale, Gerhard Grobler, et al. re: Iluka production suspension at Eucla Basin w/Attach: Iluka Eucla Basin suspension.pdf	149:6-149:9			
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PX1173	Intentionally Not Used				
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PX1177	Intentionally Not Used				
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PX1179	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
PX1182	Intentionally Not Used				
PX1183	Email from Jean-Francois Turgeon to John Romano re: Chemours	149:6-149:9			
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PX1185	Intentionally Not Used				
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PX1189	Email from Jeff Engle to John Romano, Aijen Duvekot, Jeroen Peters, et al. re: Ti-Cons	149:6-149:9			
PX1190	Intentionally Not Used				
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	[redacted]	[redacted]			[redacted]
PX1194	Intentionally Not Used				
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]	[redacted]		[redacted]
PX1197- PX1198	Intentionally Not Used				
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	[redacted]	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]	[redacted]		[redacted]

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PX1203	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
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PX1207 - PX1208	Intentionally Not Used				
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	[redacted]				
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PX1217 - PX1218	Intentionally Not Used				
	[redacted]				
	[redacted]				

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1224	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1226 - PX1227	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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PX1232	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX1234	Email from Willem Van Niekerk to Tom Casey, Jean-Francois Turgeon, Machiel Keegel, et al. re: Iron ore w/Attach: SD_20150401.pdf; China Iron Ore Slides Nov 2014.pptx	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX1236	Email from Willem Van Niekerk to Tom Casey, Paul Dexter, John Dorost, et al. re: Hexagon Meeting	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX1238	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX1240	Email from Willem Van Niekerk to Kathy Harper, Brennen Arndt, Jean-Francois Turgeon, et al. re: Morning Chemical News 02-12-15 - Huntsman capacity reduction	149:6-149:9			

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PX1241	Email from Willem Van Niekerk to Tom Casey re: HUN Closes SA pigment plant	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1243	Email from Willem Van Niekerk to Tom Casey re: Kronos FY 2014 SEC Filing w/Attach: KRONOSWORLDWIDEINC 10K 201 50312.pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1245	Intentionally Not Used				
PX1246	Email from Willem Van Niekerk to Chuck Mancini, Tom Casey, Machiel Keegel re: Tronox Media Update - 12.17.2015	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1248	Email from Willem Van Niekerk to Machiel Keegel re: [no subject]	149:6-149:9			
PX1249	Email from Machiel Keegel to Willem Van Niekerk re: [no subject]	149:6-149:9			
PX1250	Email from Willem Van Niekerk to Peter Johnston re: Info w/Attach: Review of Data Room.docx; 2016 01 23 SFX MarketingDoc.pdf; TZMIP994 Market Assessment Update.pdf; Project Rodeo - Buyer Profiles (5.21.2017j.pdf	149:6-149:9			

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	[redacted]				
PX1258	Intentionally Not Used				
	[redacted]				

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PX1260	Email from Willem Van Niekerk to Brennen Arndt re: Draft v6: 1Q17 Earning Release, Financial Schedules, Conference Call Script and Slides	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1263	Email from Willem Van Niekerk to Tom Casey, Jean-Francois Turgeon, John Romano, et al. re: Heat map	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1265	Email from Willem Van Niekerk to John Romano, Jean-Francois Turgeon re: Ilmenite Supply w/Attach: letter of authority FromDoguide 18092016.pdf	149:6-149:9			
PX1266	Email from Willem Van Niekerk to Jean-Francois Turgeon, Tom Casey, John Romano, et al. re: GS Research: Americas: Chemicals: Ti02: Industry challenges continue	149:6-149:9			
PX1267	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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PX1271	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
PX1275	Email from Willem Van Niekerk to Talal Al-Shair re: Status Assessment December 2016.docx	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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PX1289	Email from John Romano to Jeff Engle re: PPF11Q1 w/Attach: PPF11Q1 (Tronox).pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
PX1296	Email from Tom Casey to Daniel Blue re: Google Alert - tronox	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1298	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
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PX1323	Email from Robert Gibney to Tom Casey re: Substitution of Ti02 presentation w/Attach: 8-TZMI-Michael- D-Brown.pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1325	Email from Tom Casey to Brennen Arndt, Kathy Harper, Jean-Francois Turgeon, et al. re: Good news!! CC shutthing down Edge Moor and 1 line at New Jolmsville	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1329	Email from Jeff Engle to John Romano re: China	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1331	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1337	Email from Tom Casey to John Romano re: Argex Titanium Inc.- New CRM post	149:6-149:9			
PX1338	Email from Tom Casey to Brennen Arndt re: 10Q language on curtailments	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1341	Intentionally Not Used				
PX1342	Email from Tahlee Wallace to Tim Fetters, Stan Newman re: Coatings Reference Material w/Attach: Tronox Grades for Coatings 2015Oct.pdf; TronoxGradeComparisons2015 forNA (final).pdf	149:6-149:9	1229:1-1234:12 (5/30/2018)		

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[redacted]	[redacted]	[redacted]			[redacted]
PX1346	Email from Tom Casey to Brae Hardeman re: Investor Presentation w/Attach: 2012 Investor Presentation (04242012-r02).pptx; 2012 Investor Presentation (04242012-r02).pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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PX1354	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1386	Email from Jeff Engle to Jilliann McGuire re: Ti02 Market-Rumor Page- New CRM post	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
PX1392	Email from Machiel Keegel to Willem VanNiekerk, Hennie Goldberg re: Map of China's titanium industry	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1395	Email from Jean-Francois Turgeon to Michele Astrom re: Hexagon/4Q16 Q&A w/Attach: Hexagon and 4Q16 Q&A 2-17-17 330PM.docx	149:6-149:9	2712:8-2272:3 (6/13/2018) 2728:25-2734:2 (6/13/2018)		
[redacted]	[redacted]	[redacted]			[redacted]
PX1397	Intentionally Not Used				
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PX1402	Email from John Romano to Brennen Arndt, Tom Casey, Kathy Harper, et al. re: HUN NA price increase	149:6-149:9			
PX1406	Email from Sarah Staton to John Romano re: 10Q language on curtailments w/Attach: 10-Q 3 31 16 10Q DC.docx	149:6-149:9			

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1407	Email from Eric Castorina to Timothy Carlson, Edward Prosapio, Brennen Arndt re: Confidential: Moody's Draft Research for your review w/Attach: Tronox Credit Opinion Draft.pdf	149:6-149:9			
PX1408	Email from Eric Castorina to Timothy Carlson, Edward Prosapio, Brennen Arndt, et al. re: Confidential: Moody's Draft Research for your review w/Attach: Tronox Credit Opinion Draft.pdf; PBC_1090894_20170908142158.pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1412	Email from Timothy Carlson to Sara Benazzi, Edward Prosapio, Brennen Arndt, et al. re: Tronox - Pricing Page	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]

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	[redacted]	[redacted]			[redacted]
PX1417	Email from Chuck Mancini to Willem Van Niekerk, Machiel Keegel re: Yanbu TiC14 supply to Toho JV sponge plant	149:6-149:9			
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]			[redacted]
PX1421	Email from Chuck Mancini to Mark Stoll, Dick Dean, Graham Hewson, et al. re: Yanbu Summit Tenns of Reference and Agenda	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
PX1458 - PX1468	Intentionally Not Used				

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PX1470	Email from Jeffry Quinn to Ilan Kaufthal re: [No Subject]	149:6-149:9			
PX1471	Email from Jeffry Quinn to Timothy Carlson re: Tomorrow	149:6-149:9			
PX1472	Email from Jeffry Quinn to John Romano re: Hello	149:6-149:9			
PX1473	Email from John Romano to Jeffry Quinn re: Gibney	149:6-149:9			
[redacted]	[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1477	Email from Karen Crosswell to TZMI Publications re: Ti02 Market Insight - Issue 43: Oct 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp 417D_filesimage001 jpg, UserskcrosswellAppDataLocalTemptmp 417D_filesimage001 .gif	149:6-149:9			
PX1478	Intentionally Not Used				
PX1479	Email from Willem Van Niekerk to Machiel Keegel, David Von Horn, Jeff Engle re: Lomon SR	149:6-149:9			
PX1480	Email from Jeff Engle to Diana Smith, Sarah Staton, Machiel Keegel re: Dual Steam Slide	149:6-149:9			

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PX1481	Intentionally Not Used				
PX1482	Email from Jeff Engle to Machiel Keegel re: China pigment plant quarterly update	149:6-149:9			
PX1483	Email from Jeff Engle to Jilliann McGuire re: Ti02 Pigment Supply/Demand Qtly: Aug 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp E50C_filesimage001 .jpg	149:6-149:9			
PX1484	Email from Karen Crosswell to Jeff Engle re: Titanium Feedstock Supply/Demand: Aug 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp 41 A3_filesimage001 .jpg	149:6-149:9			
PX1485	Email from Ren Jianxin to Jeffry Quinn re: Update	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]			[redacted]
PX1491	Email from Aijen Duvekot to Pia Bruno re: news from the Gennan market	149:6-149:9			

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PX1492	Email from Jeroen Peters to Lars Staring, Zoubida Ozkaya, Robin de Borg, et al. re: Huntsman transcript	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1500	Email from Dick Dean to Graham Hewson re: Saudi Discussions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1510	Tronox Presentation: TI02 Pigment Price Forecast	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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PX1513	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1515	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1517	Intentionally Not Used				
PX1518	Tronox Document: Competition Chart Edition July 2015	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1522	Intentionally Not Used				
PX1523	Email from Jeff Engle to Jillian McGuire re: TiC14 Request	149:6-149:9			
PX1524	Intentionally Not Used				
PX1525	Email from Jilliann McGuire to Terry Doherty, Chris Larson, Ian Mouland, et al. re: KRO Eamings-Q3 2017	149:6-149:9			

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1526	Email from Jilliann McGuire to Terry Doherty, Chris Larson, Ian Mouland, et al. re: CC Eamings-Q3 2017	149:6-149:9			
PX1527 - PX1528	Intentionally Not Used				
PX1529	Email from Jeff Engle to Jilliann McGuire re: Mineral Sands Report - Issue 265: Nov 2017 - RE-ISSUE	149:6-149:9			
PX1530	Email from Jeff Engle to Jilliann McGuire re: Ti02 Market Insight - Issue 44: Nov 2017	149:6-149:9			
PX1531	Email from Jillian McGuire to Jillian McGuire, Clifford Wang, Krislman Vizia Bala, et al. re: Lomon Billions (formerly Lomon) - New CRM Note added	149:6-149:9			
PX1532	Email from Jeff Engle to Jilliann McGuire re: [TRX Suspicious file] Global Ti02 Pigment Producers Cost & Profitability Study 2017	149:6-149:9			
PX1533	Email from Jeff Engle to Jillian McGuire re: Titanium Feedstock Price Forecas: Novt 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp B5 A7_filesimage001 .jpg	149:6-149:9			
PX1534	Email from Jeff Engle to Jillian McGuire re: Ti02 Pigment Price Forecast: Nov 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp 174B_filesimage001 .jpg	149:6-149:9			
PX1535	Email from Willem Van Niekerk to Fadi M. Trabzuni, John Ferreira, Jason Stansbury, et al. re: Slagger	149:6-149:9			
PX1536	Email from Willem Van Niekerk to John Ferreira, Fadi M. Trabzuni, Steven Grossman, et al. re: Proposed agenda points and Jazan	149:6-149:9			

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PX1538	Email from Jilliann McGuire to Jenny Ang, Brennen Arndt, Dietmar Borg, et al. re: China Trade Report-October 2017	149:6-149:9			
PX1539	Email from Willem Van Niekerk to Machiel Keegel, Peter Johnston, Brennen Arndt, et al. re: VNTR *a* STRH - Raising PT to $27 on Global Ti02 Pricing Strength	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1541	Email from Willem Van Niekerk to John Ferreira, Fadi M. Trabzuni re: Neels Oosterhuis Scope of work	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1543	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1547	Email from Willem Van Niekerk to Machiel Keegel Jean-Francois Turgeon, Peter Johnston re: China Ti02 Newsflash	149:6-149:9			
PX1548	Email from Willem Van Niekerk to Machiel Keegel re: China Titanium Dioxide Producer	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1552	Email from Willen Van Niekerk to Chuck Mancini, Paul Mitnick re: [no subject]	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1555	Intentionally Not Used				
PX1556	Email from Jeff Engle to Jilliann McGuire re: Global Ti02 Pigment Producers - Comparative Cost Study: Excel Data File w/Attach: UserskcrosswellAppDataLocalTemptmp FFCFfilesimageOO 1 .jpg	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1560	Email from Ian Mouland to John Romano, Jared Sposato, Aijen Duvekot, e al. re: 2018 Preliminary Sales Budget	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1566	Email from Jeff Engle to Ian Mouland, Terry Doherty, Blake Wilson re: Weekly ICIS Report	149:6-149:9			
PX1567	Tronox Document: Goals	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1569	Email from Jilliann McGuire to Jenny Ang, Dietmar Borg, Pia Bruno, et al. re: China Trade Report-October 2017	149:6-149:9			
PX1570	Email from Jeff Engle to Jilliann McGuire re: Ti02 Pigment Monthly Trade Data:Jul 2017 w/Attach: UserskcrosswellAppDataLocalTemptmp 9C24_filesimage001 .jpg	149:6-149:9			
PX1571	Email from Willem Van Niekerk to Peter Johnston, Machiel Keegel, Brennen Arndt re: KRO (S>, STRH - Ti02 Pricing Strength Continues. Raising PT to $24 w/Attach: mim-attachment	149:6-149:9			
PX1572	Email from Jasmine Okure to Jean-Francois Turgeon, Michele Astrom re: Speaker Confirmation: Ti02 World Summit 2017 3-5 October 2017 Alicante, Spain	149:6-149:9			
PX1573	Email from Jasmine Okure to Peter O'Sullivan, Red Adams, CCM/Kcomber, et al. re: CommentsOnAgendaForAlicante	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1575	Intentionally Not Used				

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PX1577	Tronox Spreadsheets	149:6-149:9			
PX1578	Email from Brennen Arndt to Tom Casey, Kathy Harper, Jean-Francois Turgeon, et al. re: RBC HY Credit View: Tronox (TROX) - Highlights from the RBC Industrials Conference (RBC SPARC)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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PX1588	Email from James Koutras to Tony Martin, Richard J. Steinel, Dean Dick, et al. re: Ops & R&D and Technology Cross Functional Discussion	149:6-149:9			
PX1590	Email from James Koutras to Machiel Keegel, Christine Williams, David Von Horn re: Cleanteam request	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
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PX1606	Meeting Request from Jared Sposato to Jilliann McGuire, Linda Veazey, Jeff Engle, et al. re: Global Forecasting Tool charter review 8/24/2017 3pm-4pm	149:6-149:9			
PX1610	Email from Linda Veazey to Jilliann McGuire re: Packaging info	149:6-149:9			

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PX1618	Tronox Document: Coinmercial Organization	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX1636	Email from Brennen Arndt to John Romano re: quick question	149:6-149:9	2137:18-2142:5 (6/7/2018)		
PX1637	Email from John Romano to Brennen Arndt re: 3Q17 QA - Key Topics 11-7-17.docx	149:6-149:9			
PX1638	Email from Trevor Arran to Tom Casey re: Cristal Global "Slagger"	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1641	Email from Tom Casey to Brennen Arndt re: GS Research: Ti02 conference takeaway - upcycle set for multi-year ran	149:6-149:9	1380:21-1385:10 (5/31/2018)		
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX1647	Email from Willem Van Niekerk to Tom Casey re: VLC: What's in A Can of Paint	149:6-149:9			
PX1648	Email from David Marshall to Tom Casey, Robert Gibney re: Argox	149:6-149:9			
PX1649	Email from Brennen Arndt to Tom Casey, John Romano, Kathy Harper, et al. re: Jefferies report onHUN-ROC transaction	149:6-149:9			
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	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
PX1656	Tronox Document: RBC HY Credit View: Tronox (TROX) - Highlights from the RBC Industrials Conference	149:6-149:9			
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
PX1660	Email from Brennen Arndt to Macon Thompson re: Tronox research	149:6-149:9			

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX1661	Email from Richard Malnight to Brennen Arndt, Benjamin Harrison re: FTC conf call	149:6-149:9			
PX1662	Email from P.J. Juvekar to Brennen Arndt re: Ti02: FTC Puts a Hold on Ti02 Consolidation; Read-throughs to CC and VNTR -1 page(s)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]

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PX1671	Email from Ilan Kaufthal to Tom Casey, Daniel Blue, Wim De Klerk, et al. re: China consolidation update	149:6-149:9			
PX1672	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1674	Email from Machiel Keegel to Willem Van Niekerk, Jean-Francois Turgeonre: Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1676	Email from Dietmar Borg to Jeff Engle, Robin de Bondt, Ad Hofrnan, et al. re: Wettbewerbspigmente aus China	149:6-149:9			
PX1677	Email from Jeff Engle to Larry Bradley, Tony Tan, Jimmy Chen, et al. re: Pira Conf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX1680	Email from Tom Casey to Wang Gan, Willem Van Niekerk re: Visit in Beijing	149:6-149:9			

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PX1683	Email from Machiel Keegel to Eric Bender, John Romano re: Latest and greatest events - CONFIDENTIAL	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX1685 - PX1689	Intentionally Not Used				
PX1690	Email from Eric Bender to Jeffry Quinn re: Tronox CEO Advisory PresentationPRE READ.pdf	149:6-149:9			
PX1691 - PX1698	Intentionally Not Used				
PX1699	Tronox Spreadsheet: Second Request Spec 8(b)	149:6-149:9			
PX1700 - PX1708	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX1710 - PX1720	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX1722 - PX1723	Intentionally Not Used				

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PX1725 - PX1726	Intentionally Not Used				
PX1729 - PX1731	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
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PX1746 - PX1999	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2001	Email from Mark Stoll to Omar Najjar, Abdalla Ibrahim, Art A. Seibel, et al. re: CG Monthly Report - August	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2003	Cristal Presentation: Strategic Planning Review 2009: Coimnercial Focus and Direction	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2005	Cristal Presentation: Marketing Team Meeting R&D Project Discussion	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2010	Email from Mark Stoll to Richard Gillette, James Clover, Ciro Marino, et al. re: Kronos' View of the Market	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2012	Cristal Presentation: Strategic Planning Review 2009: Coimnercial Focus and Direction	149:6-149:9			
PX2013	Email from Mark Stoll to Jamal Nahas, John Hall, ●marNaj[jar, et al. re: Coimnercial & Supply Chain DSIKPI Request - 2011 STIP Plan	149:6-149:9	2087:24-2094:9 (6/6/2●18)		
[redacted]	[redacted]	[redacted]			[redacted]
PX2015	Email from Thomas VanValkenburgh to Mark Stoll re: Coimnercial & Supply Chain DSI KPI Request - 2011 STIP Plan	149:6-149:9			

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PX2017	Intentionally Not Used				
PX2018	Email from Mark Stoll to Fahad Nackshabandi re: Draft Minutes / Action items - Cristal Global Steering Body Phone Meeting Tuesday, 22nd May 2012 w/Attach: SB Meeting May 2012 Rv.4.docx; SB Meeting May 2012 Rv 4.pdf	149:6-149:9			
PX2019	Email from Jamal Nahas to Mark Stoll re: Market Dynamics	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2022	Email from Mark Stoll to John Hall re: Project Ivory Slides w/Attach: Project Ivory Commentary Mstoll September 2010_Final.ppt	149:6-149:9	1822:16-1824:7(6/1/2018) 2069:13-2074:17(6/6/2018)		
PX2023	Email from Omar Najjar to John Hall, Art Seibel, Jamal Nahas, et al. re: Commerical & Supply Chain DSIKPI Request - 2011 STIP Plan	149:6-149:9			
PX2024	Cristal Presentation: LyonDell Inorganics 2006 LRP Review	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2028	Email from Alaaddin Bawazire to Mark Stoll re: January Outlook for 2012	149:6-149:9	2074:21-2081:23 (6/6/2018)		
[redacted]	[redacted]	[redacted]			[redacted]
PX2030	Email from Mark Stoll to Jamal Nahas, Talal Al Shair, Russ Snider re: Approval Requested: Q2-2013 Revised Floor Prices	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2032	Email from Russ Snider to Cathy Swift re: Russ's 3 Commercialrl.pptx w/Attach: Russ's 3 Coimnercial rl.pptx	149:6-149:9			
PX2033 - PX2034	Intentionally Not Used				
PX2035	Email from Thomas VanValkenburgh to Russ Snider re: Tronox Announces Titanium Dioxide Global Price Increase Effective January 1, 2016	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
PX2037	Email from Mark Stoll to Richard Gillette re: Tronox Earnings Conference Call - M&A	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2040	Email from Fahad Nackshabandi to Christian Gunther, Jean-Yves Gigou, Graham Hewson, et al. re: Nov '16 Cristal Insight for TMT Review w/Attach: Cristal Insight- November '16 for TMT Review.pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2043	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2044	Email from Paul Facchine to Russ Snider re: Price increase announcements	149:6-149:9			
PX2045	Email from Nada Malki to Mark Stoll, Berhan Bishaw re: SL Book '13 Segment for your Review; Coimnercial w/Attach: imageOOl.png; 35-64 (Mark Stollj.pdf; COMMERCIAL - MARK STOLL.docx	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2048	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2051	Email from Mark Stoll to Jamal Nahas re: CRISTAL Arabia October 2012 Performance	149:6-149:9			
PX2052	Email from Chad Verrett to Emad AlJunaidi re: Higlilights from TZMI conference w/Attach: Ti-Feedstock Supply-Demand-Price Update per TZMI (01-28-15).pptx	149:6-149:9			
PX2053	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2056	Cristal Document: Cristal Senior Leaders Conference: Summary	149:6-149:9			
PX2057 - PX2058	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2063 - PX2064	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2066 - PX2067	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2071	Email from Thomas VanValkenburgh to Fahad Nackshabandi, Sam Livingston, Abdalla Ibrahim, et al. re: Material for upcoming Board Meeting w/Attach: Board Slides- 31 March 2014.pptx	149:6-149:9			
PX2072	Email from Pierre Jaquet to Brian Pickett re: ACS presentation w/Attach: ACS Presentation 2016.pptx	149:6-149:9			
PX2073	Email from Emad AlJunaidi to Ingo Mecke re: Merger between Iluka Resources and Sierra Rutile w/Attach: Questionnaire for competitors.docx; Questionnaire for customers.docx	149:6-149:9			
PX2074 - PX2076	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2078	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2079	Email from Russ Snider to Greg Parks, Johan Soenen, Jean-Yves Gigou, et al. re: Outlook call today	149:6-149:9			
PX2080 - PX2082	Intentionally Not Used				
PX2083	Email from Mark Stoll to Omar Najjar, Abdalla Ibrahim, Art Seibel, et al. re: CG Monthly Report - August	149:6-149:9			
PX2084	Intentionally Not Used				
PX2085	Email from Mark Stoll to Abdalla Ibrahim, Art Seibel, Dr. Talal Al-Shair, et al. re: URGENT: Coimnercial Update - Concerning Market Dynamics w/Attach: Market Dynamics February 2012 UpdateCommercialMStoll.ppt	149:6-149:9			
PX2086	Intentionally Not Used				
PX2087	Email from Dr. Talal Al-Shair to Mark Stoll, Jamal Nahas, Abdalla Ibrahim, et al. re: KRONOS WORLDWIDE, INC. ANNOUNCES A PRICE INCREASE FOR ALL TITANIUM DIOXIDE PRODUCTS SOLD OUTSIDE OF NORTH AMERICA AND EUROPE	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]			[redacted]
PX2095 - PX2097	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2099	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2101	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2103	Intentionally Not Used				
PX2104	Email from Russ Snider to Pierre Jaquet, Gary Yorke Robinson re: Price offer Q2 2017 Axalta / Cristal	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2107	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2111	Email from Russ Snider to Brian Pickett, Jean-Yves Gigou, Pierre Jaquet, et al. re: 2016 Miscellaneous Tariff Bill 2972 for pigments based on Titanium Dioxide	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2114-PX2115	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
PX2117	Email from Russ Snider to Mark Stoll re: Price increase announcements w/Attach: PriceIncrease NA EUR MEA LA AP-1 Apr 2013.doc	149:6-149:9			
PX2118	Email from Russ Snider to Mark Stoll re: Price increase announcement update	149:6-149:9			
PX2119	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2126 - PX2127	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2131	Cristal Presentation: Dr. Gunther, new Exec. VP, outlines five goals for Cristal	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2136	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2139	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2141	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2145	Email from Fadi Trabzuni to Mutlaq Almorished re: VISA w/Attach: NDA 06 2●16.pdf; ATT0●●01.htm	149:6-149:9			
PX2146	Cristal Document: Cristal - T - NDA-8435501-v3 JMF.DOC	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2148	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2150	Email from Christian Gunther to Mark Stoll, Graham Hewson re: Yanbu recruitment / Project Amsterdam	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2159	Email from Mark Stoll to Jamal Nahas, Talal Al Shair, Thomas VanValkenburgh re: DuPont considers spin alternatives - Reverse Morris Trust	149:6-149:9			
PX2160	Email from James Clover to Mark Stoll re: Approval Requested: Q2-2013 Revised Floor Prices	149:6-149:9			
PX2161	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2166	Email from Thomas VanValkenburgh to Chad Verrett re: Key messages w/Attach: key messages final.docx	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2168	Intentionally Not Used				
PX2169	Email from Mark Stoll to Christian Gunther, Richard Gillette, Edward Kossalkowski re: Chemours shutdown announcement	149:6-149:9			
PX2170	Email from Mark Stoll to Christian Gunther re: Chemours Plant Closures	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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PX2176	Cristal Presentation: Cristal Strategy Coimnercial Meetings v4.pptx	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
PX2182	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2185	Intentionally Not Used				
PX2186	Email from Scott Stray er to Eyad Hajjar, Graham Hewson, Daniel Cordell re: Pieter - travel to Yanbu	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2188	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2191	Intentionally Not Used				
PX2192	Cristal Presentation: 2010 Yanbu Gap Analysis Update	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
PX2194	Email from Mark Stoll to Edward Kossakowski, Richard Gillette, Douglas Hermann, et al. re: URGENT: Project Amsterdam - Request for Additional Team Members	149:6-149:9			
PX2195	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
PX2203	Email from Fadi Trabzuni to Mutlaq Al-Morished, Christian Gunther, Moazzam Khan re: Meeting with TiZir	149:6-149:9			
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2212	Email from Christian Gunther to Mark Stoll, Graham Hewson re: Yanbu recruitment / Project Amsterdam	149:6-149:9			
PX2213 - PX2214	Intentionally Not Used				
PX2215	Cristal Presentation: Cristal Global Business Update	149:6-149:9			
PX2216	Email from Jamal Nahas to Thomas VanValkenburgh re: announced price increase & UF performance	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2222 - PX2226	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2229	Email from Beth Howard to David Murrer, James Clover re: DuPont Products w/silane- coimment from Valspar w/Attach: Complete Hide Film Thickness.pptx	149:6-149:9			
PX2230 - PX2231	Intentionally Not Used				
PX2232	Email from Jean-Yves Gigou to Mark Stoll re: G v D : Gold vs Dirt	149:6-149:9	2096:16-2098:24 (6/6/2018)		
PX2233	Email from Jamal Nahas to Thomas VanValkenburgh, Talal Al-Shair, Mustafa AlShaer, et al. re: Cristal Orders xlsx / Milford Benjamin Moore	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2235	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
PX2237 - PX2238	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2240	Email from James Clover to Mark Stoll, David Muner, Teresa Ensor re: PPG Contract File	149:6-149:9			
PX2241	Email from John Hall to Art Seibel, Sam Livingston, Thomas VanValkenburgh re: Actions from G●T meeting : Preparations for SB call	149:6-149:9			
PX2242	Cristal Presentation: Steering Body Meeting Commercial Update	149:6-149:9	2082:2-2087:16(6/6/2018)		
PX2243	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2255	Email from Anastasia Ivanova to Thomas VanCalkenburgh, Petri Jokinen, Fahad Nackshabandi, et al. re: Conf call re: TZMI event w/Attach: Key Messages - draft 1-6 August 2013 (clean).docx	149:6-149:9			
PX2256	Cristal Presentation: COT Meeting, Business Review	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2260	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2261	Email from James Clover to Mark Stoll re: North America Commercial Monthly Report - March 2013	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX2263	Intentionally Not Used				
PX2264	Cristal Presentation: Cristal Inorganic Chemicals Limited	149:6-149:9			
PX2265	Email from Jean-Yves Gigou to Thomas Van Valkenburgh, Russ Snider re: Tronox	149:6-149:9			
PX2266	Email from Mark Stoll to Richard Gillette re: Quotes from Tom Casey - Tronox Earnings Conference Call	149:6-149:9			
PX2267	Email from Richard Gillette to Mark Stoll re: Tronox Earnings Conference Call - M&A	149:6-149:9			
PX2268	Email from Moazzam Khan to Mutlaq Almorished, Fadi Trabzuni, Talal Al- Shair et al re: Q2-2016 Earnings Presentations: Chemours and Tronox w/Attach: Tronox-Q2-2016.pdf; 2Q16- Earnings-Deck.pdf	149:6-149:9			
PX2269	Email from Richard Gillette to Mark Stoll, James Clover, Pierre Jaquet et al re: Second Quarter 2012 Competitor Earnings - Analyst Reports w/ attach	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2272	Intentionally Not Used				
PX2273	Email from Richard Gillette to Ciro Marino, Mark Stoll re: LA Scenarios - base for discussions (focus on MIC-BR)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2276	Cristal Presentation: Pricing Strategy CY2010	149:6-149:9			
PX2277	Email from Ciro Marino to Mark Stoll re: LA Presentation w/Attach: COT -LA Presentation Out 12 HV	149:6-149:9			
PX2278	Email from Fadi Trabzuni to Mark Stoll, Thomas VanValkenburgh re: Discuss Competitors Analysis Report and Findings	149:6-149:9			
PX2279	Email from John Elder to Emad A1 Junaidi re: Completion and Sustainable Operation Readiness Assessment	149:6-149:9			
PX2280	Email from Johannes Nell to Emad A1 Junaidi re: Hatch proposal	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2285	Email from Mutlaq Al-Morished to Dr. Fadi Trabzuni, Dr. Talal Al-Shair, Fawaz A1 Fawaz re: Status Assessment December 2016.docx w/ attach	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2290	Email from Simon Morten to Tony Blanchard re: Yanbu update	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2296 - PX2297	Intentionally Not Used				
PX2298	Email from Dr. Fadi Trabzuni to Abdallah S. Allugmani re: MEFOS report	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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PX2302	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted] t
PX2306	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2308 - PX2309	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2317	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2319- PX2321	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2323 - PX2326	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2327	Email from Mark Stoll to Dr. Talal Al-Shair, Thomas VanValkenburgh, James Koutras re: Follow-up	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2332 - PX2333	Intentionally Not Used				
PX2334	Email from Mark Stoll to Graham Hewson, Scott Strayer, Fahad Nackshabandi, et al. re: Tronox Executive Visit to KSA #2 - Draft Agenda (October 30th - November 2nd) w/Attach: Draft KSA agenda travel week of 30 Oct v3.docx	149:6-149:9			

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PX2335	Email from Mark Stoll to Christian Gunther re: Alembic Global Advisors: TROX VNTR: U.S. Chemicals - Ti02 Deal, With a Remedy, Is Likely; Positive For Both TROX and VNTR	149:6-149:9			
PX2336	Email from Mark Stoll to Dr. Talal Al-Shair, Mutlaq Al-Morished, Christian Gunther, et al. re: Tronox Organizational Announcements & People Retention w/Attach: Draft Ops ●rganization Oct 2017.pdf; Copy of Tronox visit - Trip 1 - Oct 14-20 - Rev A xlsx	149:6-149:9			
PX2337	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2339	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2341 - PX2342	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2344	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2348	Intentionally Not Used				
PX2349	Email from Mark Stoll to AbdulAleem Khokhar, Fawaz A1 Fawaz, Fadi Trabzuni, et al. re: Jizan Slagger re startup plan - status update	149:6-149:9			
PX2350 - PX2351	Intentionally Not Used				
PX2352	Email from Mark Stoll to James Clover, Ciro Marino, Jean-Yves Gigou, et al. re: Price Increase Announcements	149:6-149:9			
PX2353 - PX2354	Intentionally Not Used				
PX2355	Email from Lynn Myers to David Williams, Barry Groot, Christian Gryger, et al. re: Tronox's Q4-14 and CY 2014 Results	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2359	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2361	Email from Chad Verrett to Dennis Lindop re: Ti02 and Ti-Feedstock Business Intel (10/29/16 - 11/04/16)	149:6-149:9			
PX2362	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2374	Email from Christian Gunther to Dr. Talal Al-Sha'ir re: Meeting interview	149:6-149:9			
PX2375	Email from Moazzam Khan to Christian Gunther re: Change Management and Communications for Integration Planning	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
PX2379	Email from Scott Stray er to Christian Gunther re: Yanbu maintenance w/Attach: Yanbu O&M organizational Changes 3Q2017.pptx	149:6-149:9			
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]			[redacted]
PX2384	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2388	Email from Christopher Wiemicki to Scott Strayer and Simon Morten re: SHE Performance	149:6-149:9			
PX2389	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2391	Email from Willem Van Niekerk re: Canceled: Hexagon Post-Closing Strategic Planning - Willem to Host - See enclosed for call-in details	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2395	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2397	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2400	Email from Eyad Planar to Graham Hewson and Scott Strayer re: Tronox Yanbu Visit - October	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted] ment

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[redacted]	[redacted]	[redacted]			[redacted]
PX2403	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2405	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2409	Email from Tony Martin to Graham Hewson, Scott Orris, Dick Dean re: Scott Strayer	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX2414	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2417	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2419	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2421 - PX2422	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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PX2424	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2429	Email from George Lang to Scott Strayer re: Path Forward	149:6-149:9			
PX2430	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2432	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX2434	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2436	Email from Mark Stoll to Richard Gillette and Edward Kossakowski re: Synergies Call with Turquoise - Novemeber 4	149:6-149:9			
PX2437	Email from Scott Orris to Graham Hewson re: WA Chlorine Optimization	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2442	Email from Scott Orris to Machiel Keegel and Dick Dean re: Recover Rail Car Heels	149:6-149:9			
PX2443	Intentionally Not Used				
PX2444	Email from Scott Orris to Machiel Keegel, Andrew Nolan, David Jonas re: Functional Status Report - Synergy workstream - 10092017 Vl.pptx	149:6-149:9			
PX2445	Email from Scott Orris to Machiel Keegel, Andrew Nolan, David Jonas re: SHE workshop outputs	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
PX2448 - PX2450	Intentionally Not Used				
PX2451	Email from Scott Orris to Rolland Neutzling re: TiC14 project update	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
PX2463 - PX2465	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2468	Email from Christian Gunther to Simon Morten and Scott Strayer re: TEP 2.0 for Cristal Manufacturing	149:6-149:9			
PX2469	Email from Amer Albahiti to George Lang and Christian Gunther re: Eyad Haj[jar# 113630 - Resignation	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2473	Email from Christian Gunther to Rolland Neutzling re: Iluka Working meeting	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX2477	Intentionally Not Used				

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2481	Intentionally Not Used				
PX2483	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX2491	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX2494	Intentionally Not Used				
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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX2497	Email from Morris Cole to Lynn Myers, Amy Drusano, Russ Snider et al. re: TDMA Comms Cttee (for info) - Feedback on the CLH proposal ppts w/ Attach 2016-10 FeedbackonPresentationsaboutCLP-Proposal_Ti02.docx; 2016-10-13_ppt to SNEP committeeYD.pptx	149:6-149:9			
PX2498 - PX2499	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX3001 - PX3003	Intentionally Not Used				
PX3004	Higlilights from 2017 CCM reports featuring capacity moderation / issues	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX3007	Kronos Worldwide, Inc. Presentation: Deutsche Bank Leveraged Finance Conference	149:6-149:9			
PX3008	Intentionally Not Used				
PX3009	Venator Presentation: Lender Presentation	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

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PX3011	Kronos Presentation: Public Investor Presentation - €400mm Senior Secured Notes	149:6-149:9	858:3-871:16 (5/25/2018) 1895:21-1899:1 (6/6/2018)		
PX3012 - PX3013	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX3015	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX3017	Chemours Presentation: The Chemours Company Investor Day 2017	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX3021 - PX3022	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX3026	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
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PX3031	Intentionally Not Used				
PX3032	Email from Kurt Ogden to Peter Huntsman, Kimo Esplin, Simon Turner, et al. re: Goldman Sachs Report - Bullish on Ti02 w/Attach: "Golman 6.23.16.pdf	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
PX3034	Email from Mahomed Maiter to Brad Hart, Kurt Ogden, Nooshin Vaughn re: Ti02 prices/Chinese anti-dumping measures taken?	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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PX3039	Kronos Presentation: Ti02 Market Overview Kronos North America Sales Meeting	149:6-149:9			
PX3040	Kronos Presentation: Ampacet/Kronos Meeting Ti02 Market Outlook Q3 2017	149:6-149:9			
PX3041	Kronos Presentation: Ti02 Market Outlook - Q2 2017	149:6-149:9			
PX3042	Kronos Presentation: KRONOS Ti02 Market Outlook - Q2 2016	149:6-149:9			
PX3043	Kronos Presentation: Ampacet/Kronos Meeting	149:6-149:9			
PX3044	Kronos Presentation: Ti02 Market Outlook - Q3 2017	149:6-149:9			
PX3045	Kronos Presentation: Global Ti02 Outlook First Quarter, 2013	149:6-149:9			
PX3046	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX3048	Kronos Presentation: Market update and Kronos 2016.pptx	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX3055	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX3064	Chemours' Co. Responses to Civil Investigative Demand	149:6-149:9			
PX3065	Chemours Q3 2016 Earnings Call	149:6-149:9			
PX3066 - PX3999	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4001 - PX4004	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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PX4009 - PX4015	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4017	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4019	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX4021	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4023 - PX4026	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX4028	Docket No. 9377: Westlake Chemical Corporation's Responses to Subpoena Duces Tecmn	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
PX4030	Letter from James Keller to Kirkland & Ellis LLP Attn: Michael Williams and U.S. Federal Trade Commission re: In the matter of Tronox Limited et al; Docket #D093 77	149:6-149:9			
PX4031	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4033 - PX4078	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX4080 - PX4105	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4107 - PX4112	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4114- PX4119	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4121 - PX4123	Intentionally Not Used				
PX4124	[redacted]	[redacted]			[redacted]

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PX4125 - PX4128	Intentionally Not Used				
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PX4131 - PX4132	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PX4138 - PX4139	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX4143 - PX4145	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4147 - PX4148	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4150 - PX4152	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4154 - PX4179	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX4186	Email from Manoj Shah to manfred Haag re: Monthly report	149:6-149:9			
PX4187	Intentionally Not Used				
PX4188	Email from Jason Guan to Michael Meyer, Manoj Shah, Manfred Haag re: Complaints: LOMON Ti02 DELIVERY TO THE GREENVILLE SITE.	149:6-149:9			
PX4189 - PX4192	Intentionally Not Used				
PX4193	Email from Michael Post to William Harvey re: Q3 Pricing-Cristal	149:6-149:9			

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PX4194	Email from Megan ●'Malley Noe to William Harvey re: Open Order Report w/Attach: Supply plan for pending order from AN USA 160408 xlsx	149:6-149:9			
PX4195	Email from Michael Post to William Harvey re: Please update shipping schedule: it is so serious for stopped AN production...can't accept.	149:6-149:9			
PX4196	Email from William Harvey to Lorry Wang re: AkzoNobel North America	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX4199 - PX4204	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
PX4208	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4210 - PX4215	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
PX4217	Email from Benjamin Nelson to Eric Castorina, Edward Prosapio, Eric Pearson, et al. re: PLEASE READ — Confidential: Moody's Draft Press Release for Tronox w/Attach: Moody's Draft Press Release for Tronox v2.docx	149:6-149:9			
PX4218	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX4220	Moody's Investors Service Press Release: Moody's upgrades Tronox's CFR to B1; rates $2.6 billion in proposed debt	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX4223	Call Notes: Tronox Update Call	149:6-149:9			
PX4224	Email from Robert Gibney to Matthew Blackwell re: Tronox	149:6-149:9			
PX4225	Intentionally Not Used				

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PX4226	Westlake Chemical's Responses to Civil Investigative Demand	149:6-149:9			
PX4232	Deceuninck North America LLC's Responses to Civil Investigative Demand	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
PX4236	Ply Gem Holdings, Inc's Responses to Civil Investigative DemandPly Gem's Responses to Civil Investigative Demand	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
PX4240	Primex Plastics-ICC's Responses to Civil Investigative Demand	149:6-149:9			
PX4241 - PX4999	Intentionally Not Used				
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX5006 - PX5999	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
PX6003	In re Titantium Dioxide Antitrust Litigation (l:10-cv-00318-RDB) Memorandum Opinion	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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PX6009	Email from Gary Cianfichi to Jim Fisher re: Report	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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PX6015	Intentionally Not Used				
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[redacted]	[redacted]	[redacted]			[redacted]
PX6021 - PX6022	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX6024 - PX6025	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX6027	Email from Amy Drusano to James Clover re: Price Increase Press Releases - Drafts	149:6-149:9			
PX6028	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]

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PX6031 - PX6032	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
PX6034	Email from James D Clover to Paul A Rodrigues re: Huntsman	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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PX6041	Intentionally Not Used				
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PX6048	Intentionally Not Used				
PX6051 - PX6999	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
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PX7033	Deposition Transcript: Michael Post	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
PX7053	Deposition Transcript: Bill Bishop	149:6-149:9			
PX7054	RESERVED: Deposition Transcript: Billions America	149:6-149:9			
PX7055	Intentionally Not Used				

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[redacted]	[redacted]	[redacted]			[redacted]
PX7061	RESERVED: Deposition Transcript: Complaint Counsel Expert Rebuttal Witness	149:6-149:9			
PX7062 - PX7999	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
PX8007 - PX8999	Intentionally Not Used				
PX9000	Tronox 4Q2016 Earnings Call Transcript	149:6-149:9			
PX9001	Tronox 3Q2016 Earnings Call Transcript	149:6-149:9	3584:4-3586:5 (6/20/2018)		
PX9002	Tronox 2Q2016 Earnings Call Transcript	149:6-149:9			
PX9003	Tronox 1Q2016 Earnings Call Transcript	149:6-149:9	3541:8-3543:10 (6/20/2018)		
PX9004	Tronox 4Q2015 Earnings Call Transcript	149:6-149:9			
PX9005	Tronox 3Q2015 Earnings Call Transcript	149:6-149:9	3543:11-3545:11 (6/20/2018)		
PX9006	Tronox 2Q2015 Earnings Call Transcript	149:6-149:9	1385:14-1386:17 (5/31/2018)		
PX9007	Tronox 1Q2015 Earnings Call Transcript	149:6-149:9	3539:25-3541:7 (6/20/2018)		

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PX9008	Tronox 4Q2014 Earnings Call Transcript	149:6-149:9	3562:14-3564:4 (6/20/2018)		
PX9009	Tronox 3Q2014 Earnings Call Transcript	149:6-149:9			
PX9010	Tronox 2Q2014 Earnings Call Transcript	149:6-149:9			
PX9011	Tronox 1Q2014 Earnings Call Transcript	149:6-149:9			
PX9012	Tronox 4Q2013 Earnings Call Transcript	149:6-149:9	1685:20-1690:13 (6/1/2018)		
PX9013	Seeking Alpha: Tronox Limited Management Discusses Q3 2013 Results - Earnings Call Transcript	149:6-149:9			
PX9014	Tronox 2Q2013 Earnings Call Transcript	149:6-149:9			
PX9015	Tronox 1Q2013 Earnings Call Transcript	149:6-149:9			
PX9016	Iluka Slide Deck - Pigment Industry Consolidation	149:6-149:9			
PX9017	Cristal Corporate Facts Sheet	149:6-149:9			
PX9018	Letter from Thomas Casey to Stockholders re: Transaction Proposed- Your Vote is Very Important	149:6-149:9			
PX9019	Valspar Corp. v. E.I. du Pont de Nemours & Co., 152 F. Supp. 3d 234	149:6-149:9			
PX9020	Chemical Economics Handbook: Titanium Dioxide	149:6-149:9	3836:20-3838:5 3866:24-3868:14		
PX9021	Tronox Limited SEC Form Preml4A	149:6-149:9			
PX9022	Venator Materials Corporation SEC Fonn 10	149:6-149:9			
PX9023	TZMI Report: Ti02 Pigment Annual Review, A Review of 2014	149:6-149:9			
PX9024	Intentionally Not Used				
PX9025	Chemours Co at Goldman Sachs Basic Materials Conference - Final	149:6-149:9			

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PX9026	Webpage: Insight: Ti02 Consolidation Will Lead to More Price Discipline	149:6-149:9			
PX9027	Intentionally Not Used				
PX9028	Tronox (TROX) Q1 2017 Results - Earnings Call Transcript	149:6-149:9			
PX9029	Webpage: Tasnee announces the Latest Developments on the Ilmenite Smelter Project	149:6-149:9			
PX9030	Tronox 2Q 2011 Earnings Call Transcript	149:6-149:9			
PX9031	Tronox 4Q 2010 and IQ 2011 Earnings Call Transcript	149:6-149:9			
PX9032	Tronox 3 Q 2011 Earnings Call Transcript	149:6-149:9			
PX9033	Tronox 2Q 2012 Earnings Call Transcript	149:6-149:9			
PX9034	Tronox 4Q 2011 Earnings Call Transcript	149:6-149:9			
PX9035	Tronox 4Q 2012 Earnings Call Transcript	149:6-149:9			
PX9036	Tronox 3 Q 2012 Earnings Call Transcript	149:6-149:9			
PX9037	Tronox 2Q 2017 Earnings Call Transcript	149:6-149:9			
PX9038	Chemours Presentation: The Chemours Company Goldman Sachs Basic Materials Conference	149:6-149:9			
PX9039	Tronox Presentation: Third Quarter 2016 Conference Call	149:6-149:9			
PX9040	Tronox Presentation: Tronox Announces Agreement to Acquire Cristal Ti02 and Reports 4Q and FY2016 Results	149:6-149:9			
PX9041	Huntsman Corp at Deutsche Bank Global Industrials and Basic Materials Conference - Final	149:6-149:9			
PX9042	Intentionally Not Used				

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PX9043	Chemours (NYSE-listed; Ticker symbol: CC)	149:6-149:9			
PX9044	Venator (NYSE-listed; Ticker symbol: VNTR)	149:6-149:9			
PX9045	Intentionally Not Used				
PX9046	Rio Tinto (NYSE-listed; Ticker symbol: RIO)	149:6-149:9			
PX9047	Iluka Resources (listed in Australian Stock Exchange (ASX); Ticker symbol: ILU)	149:6-149:9			
PX9048	Chemours Q4 2015 Earnings Call Transcript	149:6-149:9			
PX9049	Tronox Limited 2016 Annual Report	149:6-149:9			
PX9050	Intentionally Not Used				
PX9051	Tronox Press Release: Tronox Signs Definitive Agreement to Sell Alkali Chemicals Business	149:6-149:9			
PX9052	Moody's upgrades Tronox's CFR to Bl; rates $2.6 billion in proposed debt	149:6-149:9			
PX9053	Tronox Ltd SEC Form 8-K	149:6-149:9			
PX9054	Kerr-McGee to Acquire Savannah, Ga., Chemical Plants	149:6-149:9			
PX9055	Q1 2016 Chemours Co Earnings Call - Final	149:6-149:9			
PX9056	Q2 2016 Chemours Co Earnings Call - Final	149:6-149:9			
PX9057	Q3 2016 Chemours Co Earnings Call - Final	149:6-149:9			
PX9058	Q4 2016 Chemours Co Earnings Call - Final	149:6-149:9			
PX9059	Q1 2017 Chemours Co Earnings Call - Final	149:6-149:9			
PX9060	Huntsman Corp. at Goldman Sachs Basic Materials Conference - Final	149:6-149:9			
PX9061	Intentionally Not Used				
PX9062	The Chemours Company 2016 Annual Report	149:6-149:9			

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PX9063 - PX9066	Intentionally Not Used				
PX9067	Webpage: Kronos lockout at Canada Ti02 plant continues for third month	149:6-149:9			
PX9068	Huntsman Corporation 2016 Annual Report	149:6-149:9			
PX9069	Webpage: Kerr-McGee to close Ti02 pigment sulphate plant in Georgia with loss of 100 jobs	149:6-149:9			
PX9070	PRNewswire: Kerr-McGee Completes Acquisition of Kemira's Savannah Plant	149:6-149:9			
PX9071 - PX9074	Intentionally Not Used				
PX9075	Q2 2016 Huntsman Corp Earnings Call - Final	149:6-149:9			
PX9076	Annual Data on Pigments and Preparations Based on Titanium Dioxide: Containing 80 Percent or More by Weight of Titanium Dioxide Calculated on the Dry Matter	149:6-149:9			
PX9077	TZMI Presentation: Ti02 Pigment Supply/Demand Q1 2016	149:6-149:9			
PX9078	TZMI Presentation: Ti02 Pigment Supply/Demand Q1 2016	149:6-149:9			
PX9079	Huntsman Corp at Citi Basic Materials Conference - Final	149:6-149:9			
PX9080	TMZL Inc. Confidentiality and Disclaimer	149:6-149:9			
PX9081	Preliminary 2016 Iluka Resources Ltd. Earnings Call - Final	149:6-149:9			
PX9082	In Re: Titanium Oxide Antitrust Litigation (Case No. 1:10-cv-00318- RDB) Settlement Agreement	149:6-149:9			
PX9083	Tronox Ltd SEC Fonn DEFA Schedule 14A	149:6-149:9			
PX9084	Intentionally Not Used				

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PX9085	US Department of Justice and Federal Trade Commission: Merger Guidelines	149:6-149:9	1922:9-1928:21 (6/6/2018) 3244:10-3255:9 (6/15/2018) 3549:20-3555:6 (6/20/2018)		
PX9086	Tronox Limited SEC Fonn 8-K w/Exhibit 99.1	149:6-149:9			
PX9087	Tronox Ltd to Discuss FTC Complaint Conference Call - Final	149:6-149:9	1888:6-1895:20 (6/6/2018) 2370:10-2380:15 (6/7/2018) 2428:7-2431:23 (6/8/2018)		
PX9088	Tronox CEO discusses Ti02 market softness and new direction	149:6-149:9			
PX9089	Intentionally Not Used				
PX9090	Tasnee: Annual Report 2016	149:6-149:9			
PX9091	Intentionally Not Used				
PX9092	Tronox: Tronox To Vigorously Fight FTC Lawsuit	149:6-149:9			
PX9093	Intentionally Not Used				
PX9094	Tronox: Tronox SEC Fonn 10-Q	149:6-149:9			
PX9095	Tronox: Tronox Files Lawsuit in the U.S. District Court for the Northern District of Mississippi Conference Call Transcript January 24, 2018	149:6-149:9			
PX9096	Tasnee: Tasnee announces the latest developments on the Titanium Sponge Project	149:6-149:9			
PX9097 - PX9098	Intentionally Not Used				
PX9099	Webpage: Tronox's (TROX) CEO Peter Johnston on Q3 2017 Results - Earnings Call Transcript	149:6-149:9			
PX9100	Linkedln Profile: Jeffrey Engle	149:6-149:9			
PX9101	Webpage: Q4 2017 Tronox Ltd Earnings Call - Final	149:6-149:9	1880:16-1887:21 (6/6/2018) 2409:5-2419:19(6/8/2018) 2420:6-2428:2 (6/8/2018)		
PX9102	Tronox Presentation: Tronox Announces Amendment to Cristal Ti02 Agreement and Reports 4Q17 Results	149:6-149:9	2382:1-2383:13 (6/7/2018) 2388:11-2395:17 (6/7/2018)		
PX9103	Intentionally Not Used				

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PX9104	Tronox Limited: SEC Forni 10-K Annual Report	149:6-149:9			
PX9105	Linkedln Profile: Jean-Francois Turgeon, EVP & President, Tronox Ti02	149:6-149:9			
PX9106	Intentionally Not Used				
PX9107	Linkedln Profile: Katherine C. Harper, EVP & CFO - AgroFresh	149:6-149:9			
PX9108	Tronox Announces Agreement to Acquire Alkali Chemicals from FMC Corporation	149:6-149:9	2826:19-2829:11 (6/13/2018)		
PX9109 - PX9110	Intentionally Not Used				
PX9111	Kerr-McGee to close part of Georgia plant	149:6-149:9			
PX9112	Tasnee Global Presentation: Annual Report 2015	149:6-149:9			
PX9113	In Re Titanium Dioxide Antitrust Litigation	149:6-149:9			
PX9114	Paul Richard McGann v. Cinemark USA	149:6-149:9			
PX9115	Illuka Resources Limited Document: Investor Day 2017 Transcript	149:6-149:9			
PX9116	Case Studies of the Price Effects of Horizontal Mergers	149:6-149:9			
PX9117	Horizontal Merger Investigation Data Fiscal Years 1996- 2011	149:6-149:9			
PX9118	Argex: Long-Term Marketing and Supply Agreement Between Argex Titanium Inc. and Helm U.S. Corp	149:6-149:9			
PX9119	Tronox Inc Corporate Presentation To Discuss Strategic and Financial Benefits and Current Market Conditions Conference Call - Final	149:6-149:9	1864:3-1869:5 (6/6/2018)		
PX9120	US Department of Justice and Federal Trade Commission: Commentary on the Horizontal Merger Guidelines	149:6-149:9			
PX9121	The Chemours Company Form 10-K	149:6-149:9			

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RX0001	Email from L. Rudy to R. Santoro re FTC Inquiry re Ti02	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0005	In re Titanium Dioxide Antitrust Litigation, Notice of Prop. Settlement of Class Action and Hearing on Final Settlement, etc.	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0007	Intentionally Not Used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0011	Intentionally Not Used				
RX0012	EMCO Purchase Cost History Ti02 R-2196, 2014 (EMCO Dep. Ex' 7)	149:6-149:9			
RX0013	EMCO Purchase Cost History Ti02 R-2196, 2015 (EMCO Dep. Ex' 8)	149:6-149:9			

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RX0014	EMCO Purchase Cost History Ti02 R-2196, 2016 (EMCO Dep. Ex' 9)	149:6-149:9			
RX0015	EMCO Purcliase Cost History Ti02 R-2196, 2017 (EMCO Dep. Ex' 10)	149:6-149:9			
RX0016	EMCO Purcliase Cost History Ti02 R245, 2016 (EMCO Dep. Ex'. 11)	149:6-149:9			
RX0017	EMCO Purcliase Cost History Ti02 R245, 2017 (EMCO Dep. Ex'. 12)	149:6-149:9			
RX0018	FTC CID to Masco	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0025-RX0027	Intentionally Not Used				
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RX0043	Intentionally Not Used				
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RX0047	Intentionally Not Used				
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RX0065	Kronos International €400,000,000 3.750% Senior Secured Notes Due 2025	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0067	Intentionally not used				

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[redacted]	[redacted]		[redacted]		[redacted]
RX0070	Email from W. Van Niekerk to B. Christian re [X-TRN] RE:	149:6-149:9			
RX0071	Kronos Data Sheets for Grades	149:6-149:9	898:24-908:23 (5/25/2018)		
RX0072	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0078-RX0080	Intentionally not used				
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RX0084	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX0087	Intentionally not used				
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RX0091	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0093	2017.11.10 Ti02 Rises and Shines but Unlikely to Return to Peak, Wells Fargo Securities	149:6-149:9			

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RX0094	Chemours Company, West Coast Investor Meetings (June 9-10, 2016)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0096	Cristal Magazine Special Edition (2014) (Exhibit 18)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0100	Kerr-McGee Corp., 1994 SEC Fonn 10- K (Exhibit 16)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0102	Tronox 2013 Annual Report (Exhibit 9)	149:6-149:9			
RX0103	Tronox Ltd., June 30, 2017, SEC Schedule 14A (Exhibit 17)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0105	TZMI Global Ti02 Pigment Producers: Comparative Cost and Profitability Study	149:6-149:9	3313:16-3316:20 (6/15/2018) 3534:7-3535:6 (6/20/2018)		

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RX0106	TZMI, Titanium Feedstock Price Forecast to 2021 (Exhibit 15)	149:6-149:9			
RX0107	Update on Development of the Feedstock Supply Strategy (Exhibit 14)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0109	Kronos Grades and Applications Worldwide (Maybe duplicate of Ex. G?)	149:6-149:9			
RX0110	Subpoena ad Testificandum to Deceuninck North America	149:6-149:9			
RX0111-RX0163	Intentionally not used				
RX0164	EMCO Construction Products Brochure	149:6-149:9			
RX0165	EMCO Inks & Printing Brochure	149:6-149:9			
RX0166	EMCO Paint & Coatings Brochure	149:6-149:9			
RX0167	EMCO PVC & Plastic Compounding Brochure	149:6-149:9			
RX0168	Tronox Subpoena Ad Testificandum to Ashland	149:6-149:9			
RX0169	Tronox Subpoena Duces Tecum to EMCO	149:6-149:9			

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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
RX0173	Email from B. Griffin to Group re ACCC Review of Tronox's Proposed Acquisition of Cristal Ti02 Business	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0176	Email from B. Griffin to M. O'Malley Noe re US Federal Trade Coimnission	149:6-149:9			
RX0177-RX0184	Intentionally not used				
RX0185	Ishihara Sangyo to Close Singapore Titanium Dioxide Plant	149:6-149:9			
RX0186	Ti02 Pigment Annual Review 2011	149:6-149:9			
RX0187	Intentionally not used				
RX0188	Subpoena ad Testificandum to Kronos from Tronox	149:6-149:9			
RX0189	Tronox Subpoena ad Testificandum to B. Christian	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0192	FTC Subpoena Ad Testificandum to Masco	149:6-149:9			

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RX0193	FTC Subpoena Ad Testificandum to Masco (Pschaidt)	149:6-149:9			
RX0194	FTC Subpoena Duces Tecum to Masco	149:6-149:9			
RX0195	Lomon Billions Invests Millions in Additional Chloride Titanium Dioxide Pigment Production Capacity at its Chloride Production Site in Jiaozuo, Henan Province, China Press Release	149:6-149:9			
RX0196	Tronox Subpoena Ad Testificandum to Masco	149:6-149:9			
RX0197	Tronox Subpoena Duces Tecum to MASCO & Withdrawal Letter	149:6-149:9			
RX0198	Intentionally not used				
RX0199	2010.08.19 FTC Horizontal Merger Guidelines	149:6-149:9		PX9085	
RX0200	2014.09.10 European Coimnission Huntsman Corp Decision	149:6-149:9			
RX0201-RX0202	Intentionally not used				
RX0203	Billions Grade Spreadheet (Ex. I)	149:6-149:9			
RX0204	Chemours Company Investor Presentation. February 2017 (Ex. A)	149:6-149:9			
RX0205	Concord Boat Corp v. Brunswick Corp.	149:6-149:9			
RX0206	Farrell and Shapiro, "Horizontal Mergers: An Equilibrium Analysis," American Economic Review	149:6-149:9			
RX0207	Intentionally not used				
RX0208	FTC Complaint - Superior and Canexus	149:6-149:9			
RX0209	Greenfeld, Simulating a Homogenous Product Merger, Working Paper No. 327	149:6-149:9			
RX0210	Heary Bros. Lighting Protection Co v. Lighting Protection Institute	149:6-149:9			

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RX0211	Helene Erkel-Rousse and Daniel Mirza, Revue Canadienne d'Economique, "Import Price Elasticities: Reconsidering the Evidence"	149:6-149:9			
RX0212	Hosken, O'Brien, Scheffman, & Vita, Demand System Estimation and its Application to Horizontal Merger Analysis	149:6-149:9			
RX0213	Huntsman Press Release re Ti02 Price Increases (Ex. D)	149:6-149:9			
RX0214	In re Southeastern Milk Antitrust Lit., 2012 WL 947106	149:6-149:9			
RX0215	Kronos 2016 Annual Report 10-K	149:6-149:9			
RX0216	Kronos Grades and Applications Worldwide (Ex. G)	149:6-149:9			
RX0217	Kronos Press Release - Ti02 Price Increase (Ex. E)	149:6-149:9			
RX0218	Perry and Porter, American Economic Review, "Oligopoly and the Incentive for Horizontal Merger," 1985	149:6-149:9			
RX0219	Q2 2017 Huntsman Earnings Call (Ex. C)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]		[redacted]	[redacted]
RX0222	Tioxide TR92 Huntsman Presentation (Ex. H)	149:6-149:9			
RX0223	Tronox Grade Sheets, 2015 (Ex. F)	149:6-149:9			
RX0224	Intentionally not used				
RX0225	TZMI Pigment Price Forecast to 2020, Q4 2016 - Tronox	149:6-149:9			

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RX0226	TZMI Ti02 Pigment Supply-Demand - Q4 2016	149:6-149:9			
RX0227	Venator Fonn 10K filed March 2017 (Ex. B)	149:6-149:9			
RX0228	PPG Q2 2016 Earnings Call Transcript	149:6-149:9			
RX0229	PPG Begins Using Chloride-Based Ti02 from Henan Billions in Coatings Production	149:6-149:9			
RX0230	Intentionally not used				
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RX0234	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
RX0237	Email from J. Engle to T. Rachal re RE: Huntsman TR23	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
RX0241	Email from M. Keegel to W. Van Niekerk Attaching TZMIPPF Q1 2014 Tronox Inc	149:6-149:9			
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RX0243	Intentionally not used				
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RX0251	Email from J. Merturi to J. Turgeon, B. Arndt re Re: barclays report on china	149:6-149:9	2698:22-2709:2 (6/13/2018) 2734:3-2737:1 (6/13/2018) 3537:21-3538:13 (6/20/2018) 3674:2-3675:12 (6/21/2018)		
RX0252	Email from J. Turgeon to J. Romano re FW: Huntsman Announces Global Titanium Dioxide Price Increases	149:6-149:9			
RX0253	Email from J. Romano to J. Turgeon re FW: Lomon Billions price increase	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0255	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0257	Email from J. McGuire to Group re: China Trade Report-December 2016	149:6-149:9			
RX0258	Email from J. McGuire to Group re: March 2017 China Trade Report	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0260	Intentionally not used				

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RX0266	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX0276	Intentionally not used				
RX0277	Email from G. Maynard to Group re Tronox Media Update 06.29.2015	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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RX0283	Email from J. Engle to J. Romano re Fwd: Cleveland + ChinaCapacityForecast	149:6-149:9			
RX0284	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
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RX0291	Email from J. Engle to T. Casey, S. Staton re RE: HUN coimnents on Chinese exports	149:6-149:9			
RX0292	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0298	Email from B. Arndt to Group Re: Citi report on Chinese Ti02 ex/im data	149:6-149:9	1388:3-1391:12 (5/31/2018)		
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RX0303	Intentionally not used				
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RX0305	Intentionally not used				
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RX0313	Email from J. Turgeon to R. Mei, J. Romano re RE: China import pricing	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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RX0316	Intentionally not used				
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RX0318	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX0335	Email from J. Romano to L. Bradley re Re: TZMI Study	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0342	Intentionally not used				

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RX0356	Intentionally not used				
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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
RX0371	Email from J. Engle to A. Duvekot, I. Mouland, J. Peters, J. Romano re PPG comments	149:6-149:9			
RX0372	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0376	Intentionally not used				
RX0377	Email from J. Engle to J. Romano, A. Duvekot, I. Mouland, J. Peters re PPG call transcript	149:6-149:9			
RX0378	Email from T. Tan to J. Romano, A. Duvekot re Henan Billion 20% production cut	149:6-149:9			
RX0379	Intentionally not used				
RX0380	Email from J. Romano to Group re RE: Teleconference on China Ti02 with Ed Barlow	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
RX0385	Email from A. Santos to Group re Henan Billions (Chinese) - New CRM Note added	149:6-149:9			
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RX0413	Intentionally not used				
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RX0426	Email from A. Duvekot to J. Romano re Revenue coimnents Sept 2015	149:6-149:9			
RX0427	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX0436	Email from A. Santos to Group re RE: Competitive information - Newman	149:6-149:9			
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RX0440	Intentionally not used				
RX0441	Email from C. Mancini to T. Casey, K. Harper re Chemours notes	149:6-149:9			
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RX0444	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX0455	Email from A. Santos to A. Santos re Competitor News (04/05/17)	149:6-149:9			
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RX0474	Intentionally not used				
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RX0477	Email from J. Silcox to J. Lindsey, F. Badenhorst re FW: Today's Deck	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]		[redacted]	[redacted]
RX0482	Email from K. Crosswell to P. Morrison re Mineral Sands Report Issue - Issue 256: February 2017	149:6-149:9			
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RX0509	Email from J. McGuire to Group re May 2017 China Trade Report	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
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RX0529	Email from J. Turgeon to R. Mei, J. McGuire re FW: China Trade Data Report - Feb 2017	149:6-149:9			
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RX0536	Email from R. Mei to D. Shelden re integration tool pack	149:6-149:9			
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RX0547	Intentionally not used				
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RX0549	Intentionally not used				
RX0550- RX0551	Intentionally not used				
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RX0557	Intentionally not used				

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RX0559	Intentionally not used				
RX0560	Email from T. Carlson to D. Stith, J. Quinn re RE: VNTR Case Study - Tronox	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
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RX0565	Intentionally not used				
RX0566	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0568	Email from W. Himnan t J. Quinn re Fwd: FTC	149:6-149:9			
RX0569-RX0571	Intentionally not used				
RX0572	Email from B. Grebey to J. Quinn re For Review: DRAFT JQ Dec town hall script, docx	149:6-149:9			

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RX0573- RX0574	Intentionally not used				
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RX0576	Email from J. Quinn to T. Carlson re Re: Tomorrow	149:6-149:9			
RX0577	Intentionally not used				
RX0578	Email from J. Quinn to D. Srivisal re MSR Dec 2017.pdf	149:6-149:9			
RX0579- RX0580	Intentionally not used				
RX0581	Email from J. Romano to J. Quinn re FW: +++ Are there too few titanium dioxide suppliers? +++ 7 steps to higher sales prices +++ Oleander plant as antifoulant +++	149:6-149:9			
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RX0593	Intentionally not used				

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RX0598	Email from R. Bordeleau to W. Harvey re RE: Offset requests	149:6-149:9			
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RX0610	Intentionally not used				
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RX0613	TZMI Feedstock Price Forecast Q4 2016 (Exhibit 29)	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0626	Email from J. Clover to W. Kirwan, L. Myers re Order Pattern Changes over the next several weeks	149:6-149:9			
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RX0629	Intentionally not used				
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RX0633	Email from L. Ness to J. Clover re North America Weekly 2012 08 31.doc	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
RX0639	The Valspar Corporation FQ2 2014 Earnings Call Transcript	149:6-149:9			
RX0640	The Valspar Corporation FQ3 2012 Earnings Call Transcript	149:6-149:9			
RX0641	Intentionally not used				

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RX0642	Email from T. Wu to W. Harvey re RE: samples-Billions- WFA-Salem	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0657	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]				[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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RX0662	Email from G. Hewson to S. Stray er RE re Ash 1 Update	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0664	Email from G. Hewson to Group re Manufacturing Monthly report	149:6-149:9			
RX0665	Meeting Invitation (Organizer Jenny Donoghue to Group) re Coimnercial Paint Marketing Study - 2014 Results Attaching Presentation	149:6-149:9			
RX0666	Email from S. Livingston to R. Rowe, M. Goodman, M. Stolle re FW: Update	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0669	Email from B. Iovene to Group re April 2013 Ti02 Manufacturing Results - (CG) MSA's Included	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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RX0673	Cristal Overview Business Update	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0677	Intentionally not used				
RX0678	Response Care - Om Commitment to Sustainability (EBITDA Margins Q3 2014	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0682	Email from R. Snider to M. Johnson re RE: RKB-2 into NA	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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RX0687	SB Bus Brief Q1 Apr 2009 FINAL	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0689	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0691	China Imports 2005-Present Graphs	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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RX0696	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0700	Email from B. Pickett to Group re Not Good....PPG and Henan Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]				[redacted]
RX0719	Intentionally not used				
RX0720	Ardagh Complaint for Preliminary Injunction Pursuant to Section 13(b) of the Federal Trade Commission Act	149:6-149:9			
RX0721	CSL Talecris Complaint for Temporary Restraining Order and Prelimianry Injunction Pursuant to Section 13(b) of the Federal Trade Commission Act	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0723	Email from M. Stoll to W. Van Niekerk; C. Mancini; M. Keegel re Public Information - Lomon Billions	149:6-149:9			
RX0724	Superior Plus Corp. Complaint	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
RX0727	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0729- RX0744	Intentionally not used				
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RX0749	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0753	The Sherwin-Williams Company FQ2 2015 Earnings Call Transcript	149:6-149:9	722:6-734:19 (5/24/2018)		
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0756-RX0579	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0761	Email from M. Levert to wvigdor@velaw.com re Venator attaching Mahomed Maiter declaration	149:6-149:9			
RX0762	Email from W. Vigdor to M. Levert re RE: Venator	149:6-149:9			
RX0763	Ti02 Market Overview	149:6-149:9			
RX0764	MM - China Capacity Estimates (TZML Jun *'11)*	149:6-149:9			
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RX0768	Email from M. Maiter to S. Turner re Fw help - BREXIT Impact - Revised & Corrected Version	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0770	Email from G. Jones to J. Lee re RE [EXT] RE Courtesy Copy of Discovery to Westlake Chemical	149:6-149:9			
RX0771	Westlake Chemical's Responses to Civil Investigative Demand	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]				[redacted]
RX0774	Email from J. Clover to M. Stoll re Re: RPM/Rust Oleum	149:6-149:9			
RX0775	Email from M. Alkadi to Dr. G. von Ilsemann; C. Gunther re READING: Large Saudi gas price rises would damage chemicals industry - Tasnee	149:6-149:9			
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[redacted]	[redacted]	[redacted]			[redacted]
RX0778	Email from B. Pickett to J. Rowan re FW: PPG information	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0782	Intentionally not used				
RX0783	Email from B. Pickett to J. Rowan re FW: Notes from PPG Global Call	149:6-149:9			
RX0784	Email from D. Murrer to Group re Valspar Meeting Summary: BRC: August 28th - 29th	149:6-149:9			
RX0785	Email from B. Pickett to J. Rowan re FW: PPG information	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0787	Email from D. Murrer to Group re Valspar Meeting Summary: BRC: August 28th - 29th	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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Exhibit Number	Exhibit Title/Description	Admission Citation	Pages Discussed	Cross Reference	In Camera Treatment & Ruling
RX0789	Email from Jean-Yves Gigou to R. Snider re Re: Competitor activity	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0793	Email from Jean-Yves Gigou to J. Soenen re Re: Outlook call today	149:6-149:9			
RX0794	Email from Jean-Yves Gigou to G. Parks; R. Snider re RE: RPM New Business — RKB-2	149:6-149:9			
RX0795	Email from Jean-Yves Gigou to R. Snider re Re: ENC: New order for Pringles - Argentina	149:6-149:9			
RX0796	Email from Jean-Yves Gigou to G. Parks re RE: Pro tech Price Change	149:6-149:9			
RX0797	Email from Jean-Yves Gigou to Group re RE: Rustolemn Request RKB-2	149:6-149:9			
RX0798	Email from Jean-Yves Gigou to M. Johnson; F. Thibaut; R. Snider re RE: Malaysian T595 shipments	149:6-149:9			
RX0799	Email from Jean-Yves Gigiou to R. Snider re Re: New order for Tuboforte - Argentina	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
RX0803	Email from G. Parks to P. Facchine; D. Murrer; M. Florville re RE: Benjamin Moore	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0810	Email from M. Stoll to Group re RE: Chinese Pigment Performance Review 2012	149:6-149:9			

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RX0811	Email from A. Drusano to M. Stoll re Re: Power Point Slide - Cristal Historical Timeline	149:6-149:9			
RX0812	Email from J. Nahas to M. Stoll re RE: Cristal Board / Shareholders Meeting May 8th 2013	149:6-149:9			
RX0813	Email from M. Stoll to D. Herrmann re RE: China Quality Article	149:6-149:9			
RX0814	Email from M. Stoll to F. Tedeschi re RE: Chinese Pigment Performance Review 2012	149:6-149:9			
RX0815	Email from M. Stoll to F. Tedeschi re RE: Chinese Pigment Performance Review 2012	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0821	Email from Dr. F. Trabzuni to M. Almorished re Fwd: Enc: Henan/Lomon	149:6-149:9			

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RX0823	Cristal - Management Discussion Items, April 23, 2014	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0826	Email from S. Livingston to M. Goodman re Technology Assessment of the Outotec Technology provided to Jizan	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0830	Email from Dr. F. Trabzuni to E. AlJunaidi re Re: SMT Visit to Jazan on the 4th of Jan	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
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RX0843	Email from M. Stoll to Group re Henan Billions and Sichuan Lomon	149:6-149:9			
RX0844	Email from C. Gunter to M. Stoll re RE: Draft document for the Cristal Board	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0846	Email from G. Hewson to C. GUnter re RE: Yanbu shutdown	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0850	Email from Dr. F. Trabzuni re FW: Not Good....PPG and Henan Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]

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RX0852	Email from R. Gillette to Dr. F. Trabzuni re RE: Not Good....PPG and Henan Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0855	Email from Dr. F. Trabzuni to S. Mufied re RE: MOP Updated Recovery Plan (Letter 23DEC 2015)	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0859	Email from G. Hewson to Dr. T. Al- Shair; M. Stoll re Yanbu Traingle visit	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
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RX0866	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX0868	Email from R. Snider to K. Zhang; Jean-Yves Gigou re RE: Thank You	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0871	Email from M. O'Malley to B. Griffin re Biggest Hurdle For Tronox Acquisition of Cristal? Chinese Regulators	149:6-149:9			

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[redacted]	[redacted]	[redacted]			[redacted]
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[redacted]	[redacted]	[redacted]			[redacted]
RX0880	Email from B. Griffin to J. Reid re RE: ACCC approves Tronox/Cristal	149:6-149:9			

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RX0882	Email from B. Griffin to tanriquing@lomonbillions.com re Tronox Cristal - Cleared in the US	149:6-149:9			
RX0883	Email from B. Griffin to tanmiqing@lomonbillions.com re Update: Tronox Cristal - Cleared in US	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0885	Email from B. Griffin to E. Elmore re RE: FTC Challenges Proposed Merger of Tronox and Cristal	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0888	Chemours Fonn 10K Annual Report, 2016	149:6-149:9			
RX0889	Letter from W. Trapp to Z. Avallone; L. Ruby re Tronox/Mississippi Polymers	149:6-149:9			
RX0890	Lomon Billions Invests $285M in Additional Chloride Titanium Dioxide Pigment Production Capacity 2.20.18	149:6-149:9			
RX0891	Lomon Billions Presentation	149:6-149:9			
RX0892	PCB Pollution Suits Have Day in Court in Alabama - The New York Times, Jan. 27, 2002	149:6-149:9			

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RX0893	Redacted Amended Answer and Counterclaims of Defendant Cristal USA Inc., Valspar, Docket No. 159 (Apr. 10, 2015)	149:6-149:9			
RX0894	Declaration of Markham Sherwood Re Dissemination of Class Notice and Opt Outs Received (March 18, 2013)	149:6-149:9			
RX0895	Declaration of Solomon B. Cera in Support of Plaintiffs' Motion For Preliminary Approval of Class Action Settlements With Defendants Cristal USA Inc. and Kronos Worldwide, Inc.	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0898	Email from Jean-Francois Turgeon to T. Casey re Extra Information for Your Investors' Meetings Next Week	149:6-149:9			
RX0899	Email from J. Romano to T. Casey re RE: Trade stats	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]

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[redacted]	[redacted]	[redacted]			[redacted]
RX0904	Email from S. Narcisse, to Group re Rising Star Communication - DRAFT 7- 17 clean version	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0908	Intentionally not used				
RX0909	Email from W. Van Niekerk to Group re RE: Public Information - Lomon Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
RX0912	Email from R. Brown to J. Lee re Response to CID (FTC File No. 171- 0083)	149:6-149:9	357:17-368:14 (5/23/2018)		

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RX0913	Presentations re Ti02	149:6-149:9			
RX0914	2013.09.18 Article 7 Reasons This Company May Have Made A Grave Mistake	149:6-149:9			
RX0915	2014.10.21 Article PPG Marks Completion of Henan Billions Chloride- Based Titanium Dioxide Plant in China	149:6-149:9	417:14-418:21 (5/23/2018)		
RX0916	2015.12.15 Article PPG Begins Using Chloride-Based Ti02 from Henan Billions in Coatings Production	149:6-149:9	418:23-421:20 (5/23/2018)		
RX0917	2017 PPG Annual Report	149:6-149:9			
RX0918	2016.08.24 Ti02 - Enabling Supply/Expansion (X-SBU/Corporate)	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
RX0920-RX0921	Intentionally not used				
RX0922	Emails from T. Knavish to P. Malichky re FWD: November 7 Lomon-Billons Dinner Meet Update	149:6-149:9			
RX0923	Intentionally not used				
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
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RX0928	Intentionally not used				
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[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
RX0933	Email from P. Malichky to K. Cook re FW: P&L topics from earnings call	149:6-149:9	421:23-426:3 (5/23/2018)		
[redacted]	[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]	[redacted]			[redacted]
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RX0937	Intentionally not used				
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RX0946	Email from L. Joonsuk to bbrown@ppg.com re <EXT> Courtesy Copy of Discovery to PPG	149:6-149:9			
RX0947	Intentionally not used				
RX0948	Email from J. Lee to R. Brown re RE: <EXT>Courtesy Copy of Discovery to PPG	149:6-149:9			
RX0949	Email from J. Lee to R. Brown re RE: <EXT>RE: Response to CID (FTC File No. 171-0083	149:6-149:9			
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RX0951	Email from P. Cooper to M. Zalich re Henan Billions	149:6-149:9			
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
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RX0955	Memo - Participants P. Serret-Salvat, C. Camsuzo, Mineshkumar, T. Braun re Teleconference with PG	149:6-149:9			
RX0956	Ti02 Rises and Shines but Unlikely to Return to Peak	149:6-149:9			
RX0957	TROX: Catalysts Include Cristal, Pricing, Inttegration	149:6-149:9			
RX0958	2016.02.04 Bloomberg Article "Stealing White: How a corporate spy swiped plans for DuPont's billion dollar color formnula"	149:6-149:9			
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RX0970	Chemours Investor Presentation, August 2015	149:6-149:9			
RX0971	Chemours 10-K2017	149:6-149:9			
RX0972	Declaration of Peter O'Sullivan The Chemours Company	149:6-149:9		PX8004	

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RX0973	Peter O'Sullivan - Chemours Organizaitonal Health Executive	149:6-149:9			
RX0974	Chemours Consolidates and Strengthens Ti02 Business as Part of Five-Point Transformation Plan	149:6-149:9			
RX0975	Intentionally not used				
RX0976	Subpoena Ad Testificandum Depostion re Tronox to Chemours	149:6-149:9			
RX0977	Subpoena Ad Testificandum Deposition re Tronox to P. O'Sullivan	149:6-149:9			
RX0978	Email from M. Vergnano to T. Casey re DuPont Performance Chemicals	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
RX0980	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
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RX0984	Goldman Sachs Metals & Mining Conference, November 29, 2017	149:6-149:9			
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RX0987	Intentionally not used				
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RX0991	Intentionally not used				
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RX0995	Email from S. Newman to J. Engle re FW: Meeting follow-up with Attached Lomon Billions Presentation, "Consolidation and Growth"	149:6-149:9			

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RX1002	Email from K. Crosswell to D. Dean re Ti02 Pigment Price Forecast: August 2017 with Attaclunent	149:6-149:9			
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RX1005	Email from P. Maharaj to E. Capendale and G. Grobler re FW: Marketing Presentation to customers with Attachment	149:6-149:9			
[redacted]	[redacted]	[redacted]			[redacted]
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RX1009	Intentionally not used				
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RX1013	2015 Fiscal Year - Tronox, Fonn 10-K	149:6-149:9			
RX1014	2016 Fiscal Year - Tronox, Fonn 10-K	149:6-149:9			
RX1015	Intentionally not used				

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RX1020	Intentionally not used				
RX1021	2015.04.10 Cristal's Redacted Amended Answer and Counterclaims, *Valspar Corp.* v. *Millennium Inorganic Chemicals Inc.,* No. 13-CV-3214-RHK-LIB (D. Minn.)	149:6-149:9			
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RX1045	2017.10.10-2017.10.12 Dubai Yanbu Workshop Agenda	149:6-149:9			
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RX1063-RX1064	Intentionally not used				
RX1065	1993 - A.E. Rodriguez, M. Williams - Is the World Oil Market One Great Pool	149:6-149:9	3234:14-3238:14 (6/15/2018)		
RX1066	2018.02.20 - Lomon Annoucement - Lomon Billions invests millions in additional chloride	149:6-149:9			
RX1067	1991 - B. Harris, J. Simons - Focusing Market Definition How Much Substitution is Necessary	149:6-149:9			
RX1068	2008 - C. Broda N. Limao and D. Weinstein - Optimal Tariffs and Market Power	149:6-149:9	1795:1-1798:8 (6/1/2018)		

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RX1069	2006 - C. Broda, D. Weinstein - Globalization and the Gains from Variety	149:6-149:9	1789:24-1794:25 (6/1/2018)		
RX1070	2004 - C. Broda, D. Weinstein - Globalization and the Gains from Variety	149:6-149:9			
RX1071	2017 Fiscal Year - Chemours Company, SEC Fonn 10-K	149:6-149:9			
RX1072	2015 - D. Greenfield et al. - Simulating Homogeneous Product Merger	149:6-149:9			
RX1073	Intentionally not used				
RX1074	2004 - G. Werden, L. Froeb, D. Scheffman - Daubert Discipline for Merger Simulation	149:6-149:9			
RX1075	H14834-0251-020308 (Excel Sheet)	149:6-149:9			
RX1076	Tronox Analysis of Preliminary Yanbu Improvement Plan (Excel Sheet)	149:6-149:9			
RX1077	2000.10.11 - ISIS Article - Kerr-McGee sells 25% share in Saudi Ti02 plant for $43m	149:6-149:9			
RX1078	1973 - reprinted 1998 - K. Elzinga T. Hogarty - Problem of Geo Market Delineation in Antimerger Suits	149:6-149:9			
RX1079	2016 Kronos - 10-K	149:6-149:9			
RX1080	2017 Kronos - 10-K	149:6-149:9			
RX1081	2015 Kronos News Release - Kronos Announces Price Increase for all Titanium Dioxide Products	149:6-149:9			
RX1082	2005 IBC Conference - L. Froeb - Use of Economics in Merger Analysis	149:6-149:9			
RX1083	2008 EAG Discussion - N. Hill - Analyzing Mergers Using Capacity Closures	149:6-149:9			
RX1084	1986.10.16 NEWSOK Article - Kerr-McGee Joins Saudi Venture	149:6-149:9			

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RX1085	2017.05.08 PRNEWSWIRE Article - Huntsman Announces Global Titanimn Dioxide Price Increases	149:6-149:9			
RX1086-RX1088	Intentionally not used				
[redacted]	[redacted]	[redacted]			[redacted]
RX1090	Intentionally not used				
RX1091	1990 Oxford Bulletin - S. Johansen, K. Juselius - Maximum Likelihood Estimattion Inference Cointegration w App to Demand $	149:6-149:9			
RX1092	2017.02 The Chemours Company - Investor Presenation	149:6-149:9			
RX1093	2016.06.09-10 The Chemours Company - West Coast Investor Meetings	149:6-149:9			
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RX1098	2012 M. Coate J. Simon - In Defense of Market Definition	149:6-149:9			
RX1099	2018.01.26 Industrial Mineral Article - Podium Lomon Billions	149:6-149:9			

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RX1100	1985, G. Stigler, R. Sherwin "The Extent of the Market," Journal of Law and Economics	149:6-149:9			
RX1101	2015.12.15 PPG Article re Chloride- based Ti02 from Henan Billions	149:6-149:9			
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RX1103	Hexagon Synergy Summary - 2017.11.20	149:6-149:9			
RX1104	Brace Griffin Profile, Senior Vice President, Strategic Development at Lomon Billions	149:6-149:9			
RX1105	Exhibit 10-6 Refresh - 2017 LA Sales Data with Manufacturing Site	149:6-149:9			
RX1106	Exhibit 10-7 Refresh - 2017 Tikon Sales Data with Tikon sku numbers	149:6-149:9			
RX1107	Freight Cost Report 2015 though Jan 2017	149:6-149:9			
RX1108	TZMI Feedstock Supply/Demand Q4 2016	149:6-149:9			
RX1109	2018.02.20 Project Hexagon Synergy Summary	149:6-149:9			
RX1110	TZMI Pigment Producers Cost Study, A STudyof2016 Costs (2017)	149:6-149:9			
RX1111	TZMI Pigment Price Forecast to 2020 (Q4 16)	149:6-149:9			
RX1112	TZMI, "Global Ti02 Pigment Producers Comparative Cost & Profitability Study, A Study of 2015 Costs"	149:6-149:9			
RX1113	TZMI Pigment Supply/Demand, February 2018	149:6-149:9			
RX1114	Tronox Response to Specification 26	149:6-149:9			

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RX1133	Tronox Presentation, "Ti02 Safety Update - To Be Updated by Fletcher, Improvement Activities & Initiatives"	149:6-149:9			
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RX1137	Intentionally not used				
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RX1139	Intentionally not used				
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RX1141	Intentionally not used				
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RX1150- RX1156	Intentionally not used				
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RX1160	Intentionally not used				

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RX1165	Intentionally not used				
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[redacted]	[redacted]	[redacted]			[redacted]
RX1168- RX1170	Intentionally not used				
RX1171	2017.11.13 Presentation to FTC Front Office	149:6-149:9			
RX1172	2018.01.23 Emergency Compl for Declaratory Judgment and Injunctive Relief	149:6-149:9			
RX1173	2018.02.05 Cristal Responses and Objections to CCs First Irogs	149:6-149:9			10 year *in camera* treatment granted per 5/15/18 Order on Respondent Cristal's Motion for In Camera Treatment
RX1174	Intentionally not used				

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RX1175	2018.03.21 C. Boswell ChemCycle Article, "Chemical Upcycle to Continue Through 2022"	149:6-149:9			
RX1176	2016.11.29 CAMEO MFA Boston, "Titanium Dioxide"	149:6-149:9			
RX1177	2011.05.16 Chemical Daily, DuPont to Expand Titanium Dioxide Capacity	149:6-149:9			
RX1178	Chemicals Technology - DuPont Titanium Dioxide Production Facility	149:6-149:9			
RX1179	Chemours Manufacturing Sites	149:6-149:9			
RX1180	Chemours Fonn 10K, FY 2017	149:6-149:9			
RX1181	2015.02.06 E. Barlow, Paint and Coatings Industry mag, "Review of Global Supply and Demand for Ti02"	149:6-149:9	3842:2-3842:25		
RX1182	2016.07.05 E. Bender, Paint and Coatings Industry mag, "Bouncing off the Bottom of the Ti02 Market"	149:6-149:9			
RX1183	2002.01.01 E. Wolan Sosna, European Coatings, "Chloride Ti02 Better than Sulfate" 3	149:6-149:9			
RX1184	2017.01, G. Bedinger "Titanium and Titanium Dioxide"	149:6-149:9			
RX1185	Kronos, Varennes Canada Facility	149:6-149:9			
RX1186	Tronox's 2017.11.28 Presentation to Chainnan Ohlhausen	149:6-149:9			
RX1187	Tronox's 2017.11.28 Presentation to Commissioner McSweeny	149:6-149:9			
RX1188	Intentionally not used				
RX1189	Exhibit 7 to Tronox's Responses and Objections to Complaint Counsel's 1st Interrogatories	149:6-149:9			
RX1190	Exhibit 8 to Tronox's Responses and Objections to Complaint Counsel's 1st Interrogatories	149:6-149:9			
RX1191	Exhibit 9 to Tronox's Responses and Objections to Complaint Counsel's 1st Interrogatories	149:6-149:9			

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RX1193	Exliibit 12-2 to Tronox's Responses and Objections to Complaint Counsel's 1st Interrogatories	149:6-149:9			
RX1194	Exliibit 17 to Tronox's Responses and Objections to Complaint Counsel's 1st Interrogatories	149:6-149:9			
RX1195	TZMI Feedstock Supply/Demand, Feb. 2018	149:6-149:9			
RX1196	TZMI Feedstock Supply/Demand, Q3 2016	149:6-149:9			
RX1197	TZMI Pigment Price Forecast, Feb. 2018	149:6-149:9			
RX1198	TZMI Pigment Supply/Demand, Nov. 2017	149:6-149:9			
RX1199	TZMI Ti02 Feestock Annual Report, 2013	149:6-149:9			
RX1200	Duties Faced in Export Markets PDF, Australia 2012-2017	149:6-149:9			
RX1201	Duties Faced in Export Markets PDF, Australia 2012-2017	149:6-149:9			
RX1202	Bender, Eric. “Ti02 Landscape Changing Rapidly.” *Paint & Coatings Industry* 1 May 2011	149:6-149:9			
RX1203	2011.09.26 Tronox Presentation re Exxaro Mineral Sands Acquisition	149:6-149:9			
RX1204	2012.01.26 Letter to M. Foster, Tronox Gen. Counsel from US SEC	149:6-149:9			
RX1205	2013.03.27 BCG, How Successful M&A Deals Split the Synergies	149:6-149:9			
RX1206	2013 Tronox Annual Report	149:6-149:9			
RX1207	2014 Tronox Annual Report	149:6-149:9			
RX1208	2015 Tronox Annual Report	149:6-149:9			
RX1209	Intentionally not used				
RX1210	Cristal, "About Us"	149:6-149:9			
RX1211	Cristal Corporation Fact Sheet	149:6-149:9			

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RX1213	Tronox, "Our Company"	149:6-149:9			
RX1214	KPMG Overview	149:6-149:9			
RX1215	PWC, "Chemical Compounds"	149:6-149:9			
RX1216-RX1221	Intentionally not used				
RX1222	KPMG, "Services"	149:6-149:9			
RX1223	2011.09.26 Tronox Press Release, "Tronox to Acquire Exxaro's Mineral Sands Operations"	149:6-149:9			
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RX1232	Intentionally not used				
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RX1327	2008, K. Kulm, "The Coordinated Effects of Mergers"	149:6-149:9			
RX1328	1978, K. Elzinga, T. Hogarty, "The Problem of Geographic Market Delineation Revisited: The Case of Coal"	149:6-149:9			
RX1329	2003, M. Coleman, D. Meyer, D. Scheffman, "Empirical Analyses of Potential Competitive Effects of a Horizontal Merger"	149:6-149:9			
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RX1335	International Financial Statistics (IFS) Nominal Exchange Rates, Selected Indicators	149:6-149:9			
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RX1342	Intentionally not used				
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RX1473	Tronox Presentation, "Finance and IT Transformation ("FITT") Program Update"	149:6-149:9			
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RX1493	Intentionally not used				
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RX1511	TZMI, “Global Ti02 Pigment Producers Cost & Profitability Study: A study of 2010 costs.” 2011.	149:6-149:9			
RX1512	TZMI, “Global Ti02 Pigment Producers Comparative Cost & Profitability Study: A study of 2011 costs." 2012.	149:6-149:9			
RX1513	TZMI, “Global Ti02 Pigment Producers Comparative Cost & Profitability Study: A study of 2012 costs and profitability: forecasts costs to 2017." 2013.	149:6-149:9			
RX1514	TZMI, “TI02 Pigment Producers Comparative Cost & Profitability Study: A study of 2016 costs." 2017.	149:6-149:9			
RX1515	TZMI, “Pigment Cost Study.” 2010. Excel data file.	149:6-149:9			
RX1516	TZMI, “Tai Bai Fen III - Multiclient Market Study.” April 2015.	149:6-149:9			
RX1517	TZMI, “Ti02 Market Insight, Data and Analysis of the Global Ti02 Pigment Industry.” December 2016.	149:6-149:9			
RX1518	TZMI, “Ti02 Market Insight, Data and Analysis of the Global Ti02 Pigment Industry.” January 2017.	149:6-149:9			
RX1519	TZMI, “Titanium Feedstock Annual Review.” 2012.	149:6-149:9			
RX1520	TZMI, “Titanium Feedstock Annual Review.” 2013.	149:6-149:9			
RX1521	TZMI, “Ti02 Pigment Price Forecast to 2021 with Quarterly Price Forecasts for 2017 & 2018.” November 2017.	149:6-149:9			
RX1522	TZMI, “Ti02 Pigment Price Forecast to 2021 with Quarterly Price Forecasts for 2017 & 2018.” Q12017.	149:6-149:9			
RX1523	TZMI, “Titanium Feedstock Supply/Demand.” November 2017.	149:6-149:9			

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RX1524	"A Brief History of Huntsman." Huntsman, Huntsman International LLC., 2018	149:6-149:9			
RX1525	L. Alexander, J. Schnell, D. Rizzo, "Chemours A Severe Case of Asterism. Initiate with Buy."	149:6-149:9			
RX1526	L. Alexander, J. Schnell, D. Rizzo, "Ti02! The Sequel: Not Quite the Last Light of the Sun"	149:6-149:9			
RX1527	L. Alexander, J. Schnell, D. Rizzo, "Chemicals: Ti02: A Better Cycle. 1st New Plant Clips P/E; Takes 4-5 to Impair Margins"	149:6-149:9			
RX1528	E. Barlow, "Paint Pigments and the Global Economy," Paint & Coatings Industry	149:6-149:9			
RX1529	D. Begaleiter, K. Griffin, D. Huang, "US Ethylene 2018 Outlook: Shallow and Short Cycle Trough," DeutscheBank Markets Research	149:6-149:9	3876:17-3879:3		
RX1530	D. Begaleiter, K. Griffin, D. Huang "Growth and Stability in Ti02: Initiating with a Buy"	149:6-149:9			
RX1531	A. Bellezza, "The Chemours Company: Investor Day 2017"	149:6-149:9			
RX1532	E. Bender, "Ti02 Optimization," Paint & Coatings Industry	149:6-149:9			
RX1533	I. Bennett, S. Byrne, B. Gottesdiener, "Slowing Growth After 5-Year Bull Run - Coatings Industry/End Market Overview," Merril Lynch	149:6-149:9			
RX1534	Bloomberg, "BI Global Ti02 Competitive Peers (BIBDTIO) - Profitability"	149:6-149:9			
RX1535	"British Titan Products," Wikipedia	149:6-149:9			
RX1536	C. Challener, "All Signs Point to More M&A in Paints & Coatings," Coatings Tech	149:6-149:9			

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RX1538	A. Drunsano, "Millennium Inorganic Chemicals Announces Project to Close its Le Havre, France Plant"	149:6-149:9			
RX1539	B. DuBose, "US Moody's cuts credit ratings for Cristal on Ti02 Weakness," ICIS	149:6-149:9			
RX1540	"DuPont's Titanium Dioxide Production Facility, Altamira," Chemicals Technology	149:6-149:9			
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RX1544	J. Gambogi, "Titanium and Titanium Dioxide," USGS	149:6-149:9			
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RX1546	B. Griffin "Lomon Billions" Presentation at Citi Basic Materials Conference 2017	149:6-149:9			
RX1547	Kronos, "Hauge I Dalane, Norway"	149:6-149:9			
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RX1549	ICIS News, "Huntsman's Closure of UK Ti02 Plants Prompts Concerns"	149:6-149:9			
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RX1551	ICIS, "Huntsman Launches European Ti02 Expansion in Global Growth Plan"	149:6-149:9			
RX1552	Iluka 2017 Investor Day Presentation	149:6-149:9			
RX1553	Kemira, "Kemira and Rockwood to fonn leading Ti02 joint Venture"	149:6-149:9			
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RX1558	"Lomon Billions acquires Panzhihua Ruierzxinto ensure ilmenite supply," *CCM Data and Business Intelligence*	149:6-149:9			
RX1559	"Lomon Billions: Merger of Henan Billions and Lomon is Complete, Creating Fourth Largest Ti02 Company Globally"	149:6-149:9			
RX1560	ICIS News, "MIC's Ti02 Plant inLe Havre Shuttered"	149:6-149:9			
RX1561	Moody's Investor Service, "Moody's Downgrades Tronox one notch to B2; Outlook Negative"	149:6-149:9	3752:7-3758:13 3760:19-3760:12		
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RX1565	"Our Titanium Dioxide Pigment Experts at Lomon Billions are Excited About Chinacoat 2017," *Lomon Billions"*	149:6-149:9			
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RX1567	K. Pianoforte, "Consolidation in the Coatings Industry," *Coatings World*	149:6-149:9			
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RX1570	"Rockwood and Kemira Close Ti02 Joint Venture," *Business Wire*	149:6-149:9			
RX1571	N. Sinclair, "Huntsman to expand Teesside Ti02 plant by 50%," *ICIS*	149:6-149:9			
RX1572	L. Terry, "INSIGHT: US Ti02 tightness recalls 2011-12 constraints," ICIS News	149:6-149:9			
RX1573	L. Terry, "Outlook '17: US Ti02 anticipating a sellers' market," *ICIS News*	149:6-149:9			
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RX1576	"The Chernours Company Investor Presentation," The Zen of Investing (June 2015)	149:6-149:9			
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RX1578	US Department of Commerce, "The Effect of Imports of Steel on National Security: An Investigation Conducted Under Section 232 of the Trade Expansion Act of 1962, as Amended"	149:6-149:9			
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RX1580	"TiO China: New Enviromnental inspections announced", *CCMData & Business Intelligence*	149:6-149:9			
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RX1589	Venator Materials' CEO Simon Turner on Q4 2017 Results- Earnings Call Transcript, Seeking Alpha	149:6-149:9			
RX1590	Venator Prospectus, Filed Pursuant to Rule 424(b)(4)	149:6-149:9			
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RX1592	Presentation by B. Wells, "Sherwin-Williams: Industry Overview"	149:6-149:9			
RX1593	D. Wu "A New Dominant Force in China's Ti02 Market?", *Paint and Coatings Industry*	149:6-149:9			
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RX1595	E. Linak, Y. Inoguchi, "CEH Marketing Research Report: Titanium Dioxide"	149:6-149:9			
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RX1637	Press Release, "Lomon Billions Will Exhibit at ACS 2018 in Indianapolis, USA 10-12 April 2018" (Billions Dep Ex. 4)	149:6-149:9			
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RX1641	Press Release, "Brace Griffin Presents at Wells Fargo Securities Industrials Conference in New York" (Billions Dep. Ex. 11)	149:6-149:9			
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RX1645	Email from J. Nathan to M. Williams, K. DeSantis, M. Reilly, T. Langenkamp, J. Cooper, S. Weiner, C. Mata, Z. Avallone re Dr. Hill's Report (Hill Ex. 2)	149:6-149:9			
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EXHIBIT B

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Name of Witness	Title and Company	Transcript Pages	In Camera Pages
John Romano	Senior Vice President and Chief Commercial Officer, Tronox	2135 - 2291	2145 - 2211 2255 - 2283 2290 - 2291
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Jeffrey Austin Engle	Vice President of Marketing and Product Development, Tronox	2433 - 2575	2502 - 2515 2520 - 2522 2553 - 2575
Jean-Francois Turgeon	Executive Vice President and Chief Operating Officer, Tronox	2578 - 2733	2675 - 2677
Raoul Charles Mancini	Senior Vice President of Organizational Effectiveness and Chief of Staff, Tronox	2678 - 2910	2806 - 2817 2831 - 2866 2886 - 2906
Richard Ralph Dean	Vice President of Global Operations Integration, Tronox	2911 - 3132	2996 - 3016 3019 - 3063 3091 - 3126
Rose Mei	Director of Sales and Operation Planning and Global Logistics, Tronox	3139 - 3194	3174 - 3194
Ramsey Shehadeh	Respondent's Expert	3194 - 3691	3447 - 3522 3613 - 3668 3683 - 3691
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Willem H. Van Niekerk	Tronox, Senior Vice President of Strategy	3899 - 4014	3963 - 3994 4010 - 4014

Notice of Electronic Service

I hereby certify that on August 08, 2018, I filed an electronic copy of the foregoing Respondents Proposed Findings of Fact and Conclusions of Law, with:

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