

Anticipated acquisition by Tronox Holdings plc of TiZir Titanium & Iron A.S.

Decision on relevant merger situation and substantial lessening of competition

ME/6905/20

The CMA's decision on reference under section 33(1) of the Enterprise Act 2002 given on 4 January 2021. Full text of the decision published on 26 February 2021.

Please note that [X] indicates figures or text which have been deleted or replaced in ranges at the request of the parties or third parties for reasons of commercial confidentiality.

SUMMARY

1. Tronox Holdings plc (**Tronox**), through a wholly owned subsidiary, has agreed to acquire 100% of the shares in Tizir Titanium & Iron A.S. (**TTI**) (the **Merger**). Tronox and TTI are together referred to as the **Parties** and, for statements relating to the future, the **Merged Entity**.
2. The Competition and Markets Authority (**CMA**) believes that it is or may be the case that each of Tronox and TTI is an enterprise; that these enterprises will cease to be distinct as a result of the Merger; and that the share of supply test is met on the basis of an overlap between the Parties in the supply of chloride feedstock (as defined below) in the UK by volume including captive supply. Accordingly, the CMA believes that it is or may be the case that arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation.
3. The Parties overlap in the production of titanium feedstocks, specifically chloride slag, used in the production of titanium dioxide (**TiO₂**) pigment. Tronox, but not TTI, is also active in the downstream production of TiO₂ pigment. Tronox uses a blend of different feedstocks, including chloride slag, in the production of TiO₂ pigment.

Titanium feedstocks

4. Titanium feedstocks are titanium rich minerals extracted from mineral sands, and are used as inputs in the production of TiO₂. TiO₂ is primarily used in the production of pigments for coatings and plastics, as well as paper laminate, for a wide range of consumer products.
5. TiO₂ pigment can be produced by either a chloride or a sulphate-based production process. Chloride slag is one of the main titanium feedstocks used in the chloride-based production process, alongside natural rutile, synthetic rutile, leucoxene, upgraded slag (**UGS**) and chloride ilmenite (**chloride feedstocks**).
6. The CMA assessed the extent to which other feedstocks are substitutable for chloride slag. Taking into account a range of evidence, the CMA found that other feedstocks are a weak substitute for chloride slag, although the CMA found that there is some limited substitutability between chloride slag and natural rutile, synthetic rutile and UGS (but not other feedstocks).
7. The CMA therefore assessed the impact of the Merger in the supply of chloride slag, but took into account constraints from natural rutile, synthetic rutile and UGS in its competitive assessment.
8. The CMA found that the geographic frame of reference is global, but excludes supply from China due to the substantial obstacles that feedstock customers face in sourcing chloride feedstocks (including chloride slag) from Chinese suppliers.
9. The CMA therefore assessed the impact of the Merger in the supply of chloride slag globally, including supply in the UK, but excluding supply from China.

TiO₂ pigment

10. The CMA assessed the impact of the Merger in the supply of TiO₂ pigment (including both chloride- and sulphate-based TiO₂ pigment) for plastics and coatings end-applications (**pigment for mass applications**) in a geographic frame of reference encompassing the UK and the EEA (**Europe**), including supply through imports. There are no customers that use TiO₂ pigment for paper laminate in the UK. The CMA therefore did not consider the impact of the Merger in the supply of TiO₂ pigment for paper laminate in its assessment.

11. There is some evidence that the extent of substitutability between chloride- and sulphate-based TiO₂ pigment for mass applications is limited, and may vary depending on the quality or specific use of the end product in question. The CMA took account of this in its competitive assessment.
12. The CMA also considered the potentially weaker constraint provided by Chinese imports as part of its competitive assessment, given evidence indicating possible concerns regarding the quality and consistency of Chinese imports, lead times, the breadth of product portfolio, transport costs and import duties.

Unilateral effects in the supply of chloride slag

13. Tronox stated that, from the beginning of 2021, it would cease to be active in the merchant supply of chloride feedstocks globally (and that this decision was independent of the Merger) as part of its strategy to achieve greater vertical integration.
14. The CMA therefore found that the Parties would not compete with each other to supply chloride slag on the merchant market absent the Merger.
15. Tronox also stated that following the Merger it intends to use all of TTI's production of chloride slag internally for Tronox's production of TiO₂ pigment. The CMA therefore considered whether the Merger may give rise to horizontal unilateral effects in the supply of chloride slag globally (excluding China) including in the UK by eliminating the constraint that TTI exerts on other suppliers of chloride slag.
16. The CMA found that the removal of TTI's supply from the merchant market would result in a significant degree of concentration in the merchant supply of chloride slag globally (excluding China) including in the UK, leaving Rio Tinto with a near monopoly position. Even if natural rutile, synthetic rutile and UGS are included in the assessment, the removal of TTI would still result in a significant concentration of supply, and leave Rio Tinto with the largest share of supply.
17. In light of a range of evidence, the CMA also considered that TTI is likely to represent an important competitive constraint on Rio Tinto. In particular, absent the Merger, TTI would be the only other significant supplier of chloride slag on the merchant market, with a share of supply of [10-20]%. All other suppliers of chloride slag outside of China cumulatively account for less than [0-5]% of supply. The CMA therefore considers that the removal of TTI from the merchant market may enable Rio Tinto profitably to restrict the volume of chloride slag that it supplies to the market and/or raise prices.

18. For these reasons, the CMA believes that the Merger gives rise to a realistic prospect of a substantial lessening of competition (**SLC**) as a result of horizontal unilateral effects in the supply of chloride slag globally (excluding China), including in the UK.

Vertical effects arising through foreclosure of Tronox's rivals in the downstream supply of TiO₂ pigment for mass applications

19. The CMA assessed whether, as a result of the Merger, Tronox would have the ability and incentive to foreclose rival TiO₂ pigment producers in the downstream supply of TiO₂ pigment for mass applications in Europe (including supply in the UK) and whether this would affect competition downstream.
20. The CMA found that Tronox may have both the ability and incentive to do so.
21. In relation to incentive, Tronox has a clear publicly stated business strategy to remove TTI's capacity from the upstream merchant market for chloride slag.
22. In relation to ability, further to the CMA's assessment of horizontal unilateral effects, the removal of TTI from the merchant market may enable Rio Tinto to restrict chloride slag supply and/or raise prices for chloride slag. The CMA found that chloride slag is an important input in the production of TiO₂ pigment, and that customers have limited ability to switch away from chloride slag to other chloride feedstocks. The CMA also found that chloride feedstock is a large component of the cost of TiO₂ pigment.
23. In terms of effects, the CMA found that a substantial proportion of the TiO₂ pigment market for mass applications in Europe (including supply in the UK) may be affected by any input foreclosure. The CMA therefore considered that foreclosure could lead to an increase in the price of TiO₂ pigment for mass applications in Europe (including supply in the UK).
24. For these reasons, the CMA believes that the Merger gives rise to a realistic prospect of an SLC as a result of vertical effects between the supply of chloride slag globally (excluding China) including supply in the UK and the downstream supply of TiO₂ pigment for mass applications in Europe (including supply in the UK).

Countervailing buyer power and barriers to entry and expansion

25. The CMA considered whether countervailing buyer power, and entry or the expansion of existing firms, could mitigate the effect of the Merger on competition. However, the CMA did not receive any compelling evidence to

suggest that countervailing buyer power or competitor entry or expansion would offset the SLCs identified.

Efficiencies

26. The CMA did not receive compelling evidence that the efficiencies submitted by the Parties as arising from the Merger would be timely, likely or sufficient to prevent the SLCs identified, or sufficiently merger-specific.

Conclusion

27. The CMA therefore believes that the Merger gives rise to a realistic prospect of an SLC as a result of horizontal unilateral effects in the supply of chloride slag globally (excluding China) including supply in the UK and vertical effects between that market and the downstream supply of TiO₂ pigment for mass applications in Europe (including supply in the UK).
28. The CMA is therefore considering whether to accept undertakings under section 73 of the Enterprise Act 2002 (**the Act**). The Parties have until 11 January 2021 to offer an undertaking to the CMA that might be accepted by the CMA. If no such undertaking is offered, the CMA will refer the Merger pursuant to sections 33(1) and 34ZA(2) of the Act.

ASSESSMENT

Parties

29. Tronox is a global producer of titanium products, including TiO₂ pigment, specialty-grade TiO₂ products and high-purity titanium chemicals, as well as zircon and pig iron. Tronox is headquartered in Connecticut, USA, and listed on the New York Stock Exchange. Tronox's activities in the UK include the operation of a TiO₂ pigment facility at Stallingborough in Lincolnshire. Tronox's turnover in the financial year ending 31 December 2019 was £2,071 million worldwide and [REDACTED] in the UK.
30. TTI is part of the wider TiZir business owned by Eramet, a global mining and metallurgical group, listed on the Euronext Paris Stock Exchange. TTI owns and operates a titanium feedstock smelter and a titanium and iron ilmenite upgrading and feedstock production facility at Tyssedal in Norway. The facility produces chloride feedstock (chloride slag), as well as sulphate feedstock (chloride fines), primarily sold to pigment producers, and pig iron which is sold to ductile iron foundries. TTI's turnover in the financial year ending 31 December 2019 was [REDACTED] worldwide and [REDACTED] in the UK.

Transaction

31. Through a sale and purchase agreement dated 14 May 2020, Tronox, through its wholly owned subsidiary, Tronox Titanium Holdings A.S., has agreed to acquire TTI from Eramet for USD 300.4 million.
32. In connection with the Merger, Tronox will also enter into a 10-year supply agreement with Grande Côte Operations (**GCO**), a mineral sands mine in Senegal owned by Eramet, for the supply of ilmenite to TTI.¹ The supply agreement provides that, for an initial two-year period, GCO will supply substantially all of TTI's ilmenite requirements. After the initial two-year period, the volumes sold to Tronox will reduce progressively until the annual volume commitment is [✂].

Procedure

33. The CMA's mergers intelligence function identified this transaction as warranting an investigation.²
34. The Merger was considered at a Case Review Meeting.³

Jurisdiction

35. The initial period for consideration of the Merger under section 34ZA(3) of the Act started on 5 November 2020 and the statutory 40 working day deadline for a decision is therefore 4 January 2021.
36. The Act requires the CMA to assess whether arrangements are in progress or in contemplation which, if carried into effect, will result in enterprises ceasing to be distinct and whether either the turnover of the target in the UK exceeds £70 million (the **turnover test**) or the merger results in a combined share of supply or acquisition of goods or services of any description of 25% or more (the **share of supply test**).⁴
37. As explained below, the CMA believes that the share of supply test set out in section 23 of the Act is met. The Parties overlap in the supply of chloride feedstock in the UK, including captive supply, with a combined share of

¹ GCO currently provides all of the ilmenite consumed by TTI to produce chloride slag (including coarse slag), chloride fines and pig iron.

² See [Mergers: Guidance on the CMA's jurisdiction and procedure](#) (CMA2), January 2014 (**Mergers: Guidance on the CMA's jurisdiction and procedure**), paragraphs 6.9-6.19 and 6.59-6.60.

³ See [Mergers: Guidance on the CMA's jurisdiction and procedure](#), from paragraph 7.34.

⁴ Section 33(1)(a) of the Act and Section 23 of the Act.

supply (by volume) of [40-50]% in 2019 (with an increment from TTI of [20-30]%).⁵

38. The CMA therefore believes that it is or may be the case that arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation.

Enterprises ceasing to be distinct

39. The CMA believes that the Merger (as described in paragraph 31) is sufficient to constitute arrangements in progress or contemplation for the purposes of the Act.⁶
40. Each of Tronox and TTI is an enterprise. As a result of the Merger, Tronox will acquire 100% of the shares in TTI and, accordingly, Tronox and TTI will cease to be distinct.

The turnover test

41. TTI's UK revenue in the year to 31 December 2019 was [REDACTED].⁷ Therefore, the turnover test set out in section 23(1)(b) of the Act is not met.

The share of supply test

Legal framework for the share of supply test

42. The share of supply test is satisfied if the merging enterprises both either supply or acquire goods or services of a particular description, and will, as a result of the merger, supply or acquire 25% or more of those goods or services in the UK as a whole or in a substantial part of it.⁸
43. The share of supply test therefore contains the following three key elements:
- (a) a product element (ie the supply or acquisition of goods or services of a particular description);

⁵ Data submitted by the Parties, calculated based on TZ Minerals International (**TZMI**) Chloride Sales Data converted to TiO₂ units.

⁶ Section 33(1)(a) of the Act.

⁷ While TTI's business year preceding the date when the CMA's decision in relation to a possible reference is made is the year to 31 December 2020, the CMA has not been provided with TTI's UK revenue for that year, and therefore is exercising its discretion to refer to the earlier business year under article 11(2)(b) of the Enterprise Act 2002 (Merger Fees and Determination of Turnover) Order 2003.

⁸ Section 23 of the Act and [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.53. The word 'supply' is defined broadly for these purposes (section 129 of the Act).

(b) a geographical element (ie the UK or a substantial part of it); and

(c) a quantitative element (ie the 25% threshold).

44. **Product element:** With regard to the product element, the Act confers on the CMA a broad discretion to choose a specific category of goods or services supplied or acquired by the merging parties.⁹ The CMA's guidance on its jurisdiction and procedure (the **Guidance**) provides that the share of supply test is not an economic assessment of the type used in the CMA's substantive assessment and the description of goods or services need not amount to a relevant economic market. In addition, the Guidance explains that the group of goods or services to which the jurisdictional test is applied can aggregate, for example, intra-group and third-party sales even if these might be treated differently in the substantive assessment.¹⁰ In general, the CMA will have regard to any reasonable description of a set of goods or services to determine whether the share of supply test is met.¹¹
45. **Geographic element:** With regard to the geographic element, the Act does not provide specific rules on how to determine whether, and to what extent, an enterprise's activities should be deemed to be in the UK for the purposes of the share of supply test. The Guidance provides that goods or services are generally supplied in the UK where they are provided to customers located in the UK.¹² The Guidance also states that the CMA will apply this general rule in a flexible and purposive way, with regard to all relevant factors, including where relevant procurement decisions are likely to be taken and where, in turn, any competition between suppliers takes place,¹³ although the CMA is not restricted to considering only these factors in its assessment. Further, in relation to multi-national companies, the Guidance cross-refers to the principle that where individual orders are placed via a central purchasing organisation, but products are directly delivered to subsidiaries, turnover will be allocated to the countries in which the delivery takes place, because 'competition with

⁹ Section 23 of the Act. In particular, sections 23(6) and (7) of the Act provide that, where goods or services of any description are the subject of different forms of supply (ie where in the CMA's opinion, transactions concerned differ materially as to their nature, their parties, their terms or their surrounding circumstances), the CMA may consider the supply of such goods or services to be of those forms taken separately, together or in groups. Moreover, section 23(8) of the Act states that '[t]he criteria for deciding when goods or services can be treated, for the purposes of this section, as goods or services of a separate description shall be such as in any particular case the decision making authority considers appropriate in the circumstances of that case'.

¹⁰ *Mergers: Guidance on the CMA's jurisdiction and procedure*, paragraph 4.56, citing *anticipated acquisition by Montauban S.A. of Simon Group plc* (ME/2500/06), OFT decision of 21 August 2006.

¹¹ *Mergers: Guidance on the CMA's jurisdiction and procedure*, paragraph 4.56.

¹² *Mergers: Guidance on the CMA's jurisdiction and procedure*, paragraph 4.58.

¹³ *Mergers: Guidance on the CMA's jurisdiction and procedure*, paragraph 4.58.

alternative suppliers takes place for the delivery of products to the different subsidiaries even though the contract is concluded centrally'.¹⁴

46. **Quantitative element:** With regard to the quantitative element, the Act gives a wide discretion to the CMA to apply whatever measure it considers appropriate to calculate the merging parties' share of supply or procurement and to determine whether the 25% threshold is satisfied.¹⁵

The Parties' submissions

47. The Parties submitted that the CMA does not have jurisdiction to review the Merger as the Parties' activities do not overlap in the UK and the share of supply test is therefore not met. In particular, they submitted that:
- (a) The Merger is vertical and vertical transactions cannot satisfy the share of supply test.¹⁶ Tronox does not sell chloride feedstock (or any other feedstock) in the UK to any third parties and Tronox's internal supply of chloride feedstock in the UK should not be aggregated with TTI's merchant supply for the purposes of the share of supply test. In this regard, the Parties pointed to the CMA's assessment of the relevant counterfactual, namely that Tronox will have ceased supplying chloride feedstock to the merchant market.¹⁷
 - (b) Tronox's internal supply does not take place on any 'market' and so is not subject to competition. The Parties cite the CMA's decision in *Barry Callebaut AG/Burton's Foods* in support of this submission.¹⁸
 - (c) The CMA's published Merger Assessment Guidelines explain that self-supply is not relevant to the assessment of mergers if there is no prospect of volumes being diverted to the merchant market in response to a small but significant and non-transitory increase in price.¹⁹ Tronox said there is no realistic prospect that it would begin supplying the merchant market in

¹⁴ Commission Consolidated Jurisdictional Notice under Council Regulation (EC) No 139/2004 on the control of concentrations between undertakings, (2008/C 95/01), paragraph 198. The Guidance explains that the CMA will generally follow the Commission's Jurisdictional Notice in its approach to the geographic allocation of turnover.

¹⁵ Section 23(5) of the Act.

¹⁶ The Parties cited [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.56 and also referred to The House of Commons Research Paper published at the time of the Enterprise Bill to note that purely vertical mergers were not intended by Parliament to be caught by the share of supply test (Enterprise Bill, Research Paper 02/21 (4 April 2002)).

¹⁷ See the Counterfactual section below.

¹⁸ [Anticipated acquisition by a subsidiary of Barry Callebaut AG of certain business assets of Burton's Foods Limited](#), CMA decision of 8 November 2018 (*Barry Callebaut/Burton's Foods*).

¹⁹ [Merger Assessment Guidelines](#) (OFT1254/CC2), September 2010 (*Merger Assessment Guidelines*), paragraph 5.2.20.

the UK, as its demand for feedstock exceeds its own internal production and is expected to continue to do so post-Merger.

(d) Finally, even if internal supply is considered relevant for the share of supply test, Tronox's supply to its Stallingborough plant is not supply 'in the UK', as decisions on the allocation of Tronox's internal production of feedstock (including to the Stallingborough plant) are taken [✂].

48. Each of these points was considered by the CMA as part of its assessment of the share of supply test, which is set out below.

The product element

49. The CMA believes that the supply of chloride feedstock falls within a reasonable description of goods given that this is consistent with: (i) the Parties' own submissions that there are separate markets for chloride and sulphate feedstocks; and (ii) the European Commission (**Commission**)'s finding when it previously considered feedstock markets as part of its in-depth review of Tronox's acquisition of Cristal in 2018 (**Tronox/Cristal**) that chloride and sulphate feedstocks are generally quite distinct.²⁰ The Parties have not disputed that the supply of chloride feedstocks in the UK is a reasonable description of goods for the purposes of the share of supply test; rather, the Parties dispute that Tronox can be said to supply chloride feedstocks in the UK.

50. TTI owns and operates a titanium feedstock smelter and feedstock production plant at Tyssedal in Norway which produces chloride feedstock. TTI supplies some of this chloride feedstock to customers in the UK, including to Tronox's TiO₂ pigment plant at Stallingborough. Tronox also supplies its Stallingborough plant with chloride feedstock that Tronox imports into the UK from its own plants elsewhere in the world, ie Tronox self-supplies its Stallingborough plant with chloride feedstock in addition to acquiring feedstock from third parties for this plant.

51. The CMA believes that both Tronox and TTI can be considered to supply chloride feedstock in the UK for the purposes of calculating the share of supply test. The CMA does not consider it accurate to describe the Merger as being purely vertical as the Parties are both engaged in the supply of chloride

²⁰ Case M.8451 – *Tronox / Cristal*, Commission decision of 4 July 2018 (**Tronox/Cristal**), paragraph 474.

feedstock in the UK, and therefore do both supply goods of a particular description.²¹

52. Further, as noted above, the Guidance explains that the share of supply test is not an economic assessment of the type used in the CMA's substantive assessment, need not amount to a relevant economic market, and that the group of goods to which the jurisdictional test is applied 'can aggregate... intra-group and third-party sales even if these might be treated differently in the substantive assessment'.²² As such:

- (a) The CMA disagrees that Tronox's internal supply of chloride feedstock should not be aggregated with TTI's merchant supply of chloride feedstock for the purposes of the share of supply test. The CMA notes that it has applied the share of supply test in a similar manner in other cases, aggregating internal and external supply for this purpose as appropriate, as envisaged by the Guidance.²³ This includes the situation where one party to the transaction only supplied the relevant product internally while the other party supplied that product to third parties.²⁴
- (b) The CMA considers the Parties' submissions which cite *Barry Callebaut AG/Burton's Foods* and the CMA's Merger Assessment Guidelines (as summarised at paragraph 47) to be misplaced, as they relate to the CMA's substantive assessment on frame of reference and competition concerns, not its jurisdictional assessment.²⁵ The same is true of the Parties' reference to the CMA's counterfactual assessment, the purpose of which is to determine the competitive conditions against which to assess the impact of the Merger.²⁶ That the questions of jurisdiction and substance are separate flows directly from section 33 of the Act, which requires the CMA to answer two separate questions, namely whether it is

²¹ In [Completed acquisition by Google LLC of Looker Data Sciences, Inc.](#) (ME/6839/19), CMA decision of 13 February 2020, the share of supply test was applicable where the parties were active at the same level of the supply chain, in addition to being vertically related (see paragraph 63).

²² [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.56.

²³ See for example [Anticipated acquisition by Montauban S.A. of Simon Group plc](#) (ME/2500/06), OFT decision of 21 August 2006 (as cited in the Guidance), [Completed acquisition by NBTY Europe Limited of Julian Graves Limited](#) (ME/3887/08), OFT decision of 24 March 2009, and [Completed acquisition by Danish Crown A/S \(via its subsidiary Tulip Limited\) of Easey Holdings Limited](#) (ME/670917), CMA decision of 14 December 2017 (*Tulip/Easey*).

²⁴ *Tulip/Easey*, paragraph 72. In that case, the share of supply threshold was calculated on the basis of the parties' supply of outdoor bred pigs to abattoirs for slaughter in the UK, and this calculation expressly included Tulip's captive farming production. The CMA explained that 'Tulip is not currently active in the supply of pigs for slaughter to third parties in the UK (and the CMA does not believe that it will enter the merchant market within the foreseeable future)'.

²⁵ While in *Barry Callebaut AG/Burton's Foods* the CMA focused on shares of supply on the merchant market, finding that there was no substantive overlap between the parties' activities in chocolate compound when determining the appropriate frames of reference and finding that the transaction did not give rise to competition concerns (see paragraph 30), this goes to the question of the substantive competition assessment.

²⁶ As explained in the Merger Assessment Guidelines, the counterfactual is part of the application of the SLC test (paragraph 4.3.1).

or may be the case that the transaction will result in a relevant merger situation, and whether the creation of that situation may be expected to result in an SLC.

53. The CMA believes that including captive supply within the description of goods for the purposes of the share of supply test in the circumstances of this case is reasonable. The CMA also notes that there is a competitive interaction between internal and external supply, with the quantity of chloride feedstock for a particular plant purchased from the merchant market being influenced by the amount that is supplied internally. Tronox explained that it sources material from external suppliers to supplement its internally produced feedstock at Stallingborough as and when cost-related factors make it beneficial to do so.
54. The CMA therefore believes the supply of chloride feedstock in the UK, aggregating internal and external supply, is a reasonable description of goods for the purposes of the share of supply test in the circumstances of this case.

The geographic element

55. Tronox supplies chloride feedstock to its Stallingborough plant in the UK. Regardless of whether the chloride feedstock supplied to Tronox's Stallingborough plant is supplied internally by Tronox or externally by a third party, the product is physically delivered to the plant in the UK for use at that plant. The CMA disagrees with the Parties' submission that it is irrelevant whether the product is physically shipped to the UK. Rather, on the basis of the general approach set out above, the CMA believes that physical delivery of chloride feedstock to the Stallingborough plant in the UK for use at that plant – be that internal or merchant supply – is *prima facie* supply of goods in the UK.
56. Nonetheless, the CMA applies this general rule in a flexible and purposive way, having regard to all relevant factors.²⁷ One such factor, as submitted by the Parties, is where procurement decisions are taken. In relation to procurement decisions, the Guidance explains that, in the case of sales to multinational companies, the 'general question is the presumptive location of the procurement decision' and that '[i]t would generally be a UK supply if the procurement decision is made by a business unit located in the UK and it will be non-UK supply if such a decision is made outside the UK. Certain strategic decisions may on the facts be made at a multinational's headquarters, even if

²⁷ [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.58.

the goods are delivered, title passes, or the services are supplied outside the jurisdiction of the headquarters (for example, secondary stock exchange listings).²⁸ Where procurement decisions are taken is a relevant factor; however, the guidance is clear that this is only a 'general' indication, and the CMA will look at all relevant factors. In particular, it is important to consider the context in which such procurement decisions are taken, and what factors influence them.

57. The CMA has considered the involvement of Tronox staff located in the UK at its Stallingborough plant in Tronox's feedstock planning process as well as the factors that influence how Tronox allocates its feedstock. The CMA considers these are relevant factors, as they go to the question of how procurement decisions are made and where in turn competition with alternative suppliers for the delivery of products to the Stallingborough plant takes place.
58. Tronox has explained that decisions on the allocation of its internal production of feedstock (including to the Stallingborough plant) are taken [REDACTED]. The CMA notes that Tronox's internal documents also demonstrate that [REDACTED].²⁹ As such the CMA believes that Tronox's characterisation of the situation – [REDACTED] – appears to be an over-simplification, and that staff at the Stallingborough plant do have some influence in [REDACTED] in addition to their role in day-to-day adjustments at plant level.
59. Furthermore, it is clear that, within the centralised feedstock planning process, local and geographic factors have a material impact on the procurement decisions which are made.³⁰ For example, Tronox explained that [REDACTED]. However, the CMA believes that the involvement of the local plant combined with the local factors taken into account by Tronox's centralised feedstock planning process suggests a clear UK nexus of the supply, consistent with where physical delivery of the goods takes place.
60. In addition, as noted above, Tronox explained that it sources material from external suppliers to supplement its internally produced feedstock at Stallingborough as and when transport costs and other cost-related factors make it beneficial to do so, and the CMA considers that this further suggests that competition with alternative suppliers takes place for delivery to the

²⁸ [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.59.

²⁹ See, for example, Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10066094, 'First IBP April 2019 v8', at page 14 where the 'IBP Regional Feedstock & Co-Product Monthly Process' is described, including 'Monthly Review of Internal Feedstock Requirements' with IBP responsible in consultation with plants.

³⁰ See, for example, Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10066094, 'First IBP April 2019 v8', at page 16 discussing [REDACTED].

Stallingborough plant in the UK³¹ and takes account of geographic considerations.

61. As such, overall, the CMA believes that, while Tronox's procurement decisions are made at least to some extent centrally and outside the UK, this process also involves local input, and all other relevant factors considered point towards Tronox's supply of chloride feedstocks to its Stallingborough plant taking place in the UK. Such factors include: (i) that physical delivery of the goods takes place in the UK; (ii) the relevance of local and geographic factors such as shipping costs and local waste constraints when making procurement decisions (over which the Stallingborough plant itself has at least some influence); and (iii) the interplay between Tronox's internal supply and availability of external supply from third parties.

The quantitative element

62. Based on data submitted to the CMA by the Parties, the Parties have a combined share of supply in the UK of chloride feedstock by volume including captive supply of [40-50]% in 2019 (with an increment from TTI of [20-30]%).³²
63. As such, the CMA believes that it is or may be the case that arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation.

Counterfactual

64. The CMA assesses a merger's impact relative to the situation that would prevail absent the merger (ie the counterfactual). For anticipated mergers the CMA generally adopts the prevailing conditions of competition as the counterfactual against which to assess the impact of the merger. However, the CMA will assess a merger against an alternative counterfactual where, based on the evidence available to it, it believes that in the absence of the merger the prospect of these conditions continuing is not realistic or there is a realistic prospect of a counterfactual that is more competitive than these conditions.³³
65. The Parties have not submitted an alternative counterfactual to the prevailing conditions of competition.

³¹ [Mergers: Guidance on the CMA's jurisdiction and procedure](#), paragraph 4.58.

³² Data submitted by the Parties, calculated based on TZMI Chloride Sales Data converted to TiO₂ units.

³³ [Merger Assessment Guidelines](#), paragraph 4.3.5.

66. The CMA considered whether it is necessary to depart from the prevailing conditions of competition in two respects, considered below.
67. **Alternative purchasers for TTI.** The CMA considered whether there is a realistic prospect that absent the Merger, TTI would have been acquired by an alternative purchaser, and whether there is a realistic prospect that any such acquisition would have created a more competitive situation than the prevailing conditions of competition. The CMA notes that [REDACTED].³⁴ The CMA does not therefore believe that there is a realistic prospect of an acquisition by an alternative purchaser that would have resulted in a more competitive counterfactual than the prevailing conditions of competition.
68. **Tronox's supply of chloride feedstock on the merchant market.** The CMA considered whether there is a realistic prospect that Tronox would supply chloride slag on the merchant market absent the Merger, and provide a source of competitive constraint on that market.
69. Tronox submitted that it is withdrawing from the merchant market globally (and had decided to do so independently of the Merger) as part of its strategy to achieve greater vertical integration. Tronox pointed to its 2019 Annual Report, which states:
- ‘It is our long-term strategic goal to be fully vertically integrated and consume all our feedstock materials in our 9 TiO₂ pigment facilities [...]. We believe that full vertical integration is the best way to achieve our ultimate goal of delivering low cost, high-quality pigment to our approximately 1,200 TiO₂ customers throughout the world.’³⁵
70. Whilst as at the beginning of the CMA's merger investigation Tronox had [REDACTED].³⁶
71. Tronox informed the CMA that in 2018 it entered into an option agreement with Advanced Metal Industries Cluster Company Limited (**AMIC**) to purchase 90% ownership of the Jazan chloride slag smelter in Saudi Arabia from AMIC. The Jazan smelter is not yet operational and Tronox submitted that [REDACTED].³⁷
72. The CMA has therefore considered whether the successful commissioning of the Jazan smelter might affect Tronox's stated intention not to supply the merchant market. Tronox has confirmed in public statements that even if the

³⁴ [REDACTED].

³⁵ Tronox 2019 Annual Report, page 1.

³⁶ The contracts concern [REDACTED] and limited sales of chloride slag to INEOS as a result of a US Federal Trade Commission (**FTC**) consent decree entered into in 2019.

³⁷ Nameplate capacity refers to the nominal capacity of a smelter.

Jazan smelter resulted in Tronox being net long, Tronox has no intention of supplying the merchant market. In particular, Tronox's Chairman, President and CEO noted on an earnings conference call/presentation on 29 October 2020, that if Tronox 'end[s] up in a situation where Jazan comes on and we are structurally long in high-grade feedstock [...] it's not our intention to enter the commercial market and be a merchant seller of high-grade feedstock. But what we will look for are opportunities to put that asset to work to create value for our shareholders.'³⁸ Tronox's Executive VP and COO also noted that when Tronox commissions the Jazan smelter 'the intention is to ramp up Jazan with the need of the increase of our pigment production.'

73. Overall, therefore, the CMA considers that, absent the Merger, Tronox would cease to supply chloride feedstock on the merchant market. Aside from this, the CMA considers the prevailing conditions of competition to be the relevant counterfactual (including TTI continuing to supply the merchant market).

Background on the titanium dioxide industry

Titanium feedstocks and TiO₂ pigment

74. Tronox and TTI are both active in the production of titanium feedstocks. Titanium feedstocks are titanium rich minerals extracted from mineral sands and are used as inputs in the production of TiO₂ pigment (and to a lesser extent titanium metal and other applications (mostly welding electrodes)).
75. TiO₂ is an organic chemical used to opacify, brighten and whiten various industrial and consumer products. TiO₂ is primarily used in the production of pigments for coatings and plastics, as well as for the manufacture of paper laminate.³⁹
76. TiO₂ can be produced by one of two processes: the chloride-based process, or the sulphate-based process.⁴⁰ Titanium feedstocks with lower TiO₂ content are typically used in the sulphate-based process, whereas feedstocks with higher TiO₂ content are typically used in the chloride-based process.
77. TiO₂ can have one of two different crystalline forms: rutile and anatase. Anatase TiO₂ can be produced only via the sulphate-based process, whereas rutile TiO₂ can be produced via both processes. Anatase TiO₂ refracts light

³⁸ [Edited Transcript of TROX.N earnings conference call or presentation 29-Oct-20 1:00pm GMT](#) (yahoo.com).

³⁹ *Tronox/Cristal*, paragraphs 28-29 and 467; Final Merger Notice (**FMN**), paragraph 12.2.

⁴⁰ As the Commission set out in *Tronox/Cristal*, paragraph 30, '[i]n the sulphate-based process, titanium feedstocks are treated with sulphuric acid to form an intermediate product that is then calcined to form titanium dioxide crystals. In the chloride-based process, titanium feedstocks are reacted with chlorine and carbon to form titanium tetrachloride (TiCl₄) in a continuous fluid bed reactor. The titanium tetrachloride is then purified by distillation before being oxidised to produce raw titanium dioxide crystals and chlorine gas.'

less effectively, and as a result does not offer the same level of opacity, whiteness and coverage, and only accounts for a minor proportion of all sales of TiO₂ in Europe.

78. Titanium feedstocks are primarily differentiated by their TiO₂ content and impurities. Other differences in chemical composition and in physical characteristics (eg particle size, particle size distribution, specific gravity, density and moisture content) also arise between feedstock types, and among feedstocks of the same type (depending on where and how the raw material was mined).⁴¹
79. There are three main types of naturally occurring titanium feedstock:⁴²
- (a) **Natural rutile.** Natural rutile mainly consists of crystalline TiO₂ with minor impurities. It has the highest TiO₂ purity, of between approximately 94% and 96%, and is generally used in the chloride-process.
 - (b) **Ilmenite.** Ilmenite is the most abundant titanium feedstock, with between approximately 45% and 64% TiO₂ content. Depending on the quality of the ilmenite,⁴³ it can be used directly as a feedstock, either in the chloride or sulphate process. Ilmenite with a TiO₂ content below 56% is used in sulphate-based production, and is known as **sulphate ilmenite**, whereas ilmenite with a TiO₂ content above 55% is used in chloride-based production, and is known as **chloride ilmenite**.
 - (c) **Leucoxene.** Leucoxene is an intermediate natural alteration of ilmenite, with approximately 66% to 87% TiO₂ content, and is generally used in the chloride process. Unlike rutile and ilmenite, it is not a distinct type of mineral but is the result of the natural weathering of ilmenite.
80. Ilmenite can also be upgraded by industrial means ('beneficiated') to produce a number of synthetic titanium feedstocks with improved TiO₂ content. These include the following:⁴⁴
- (a) **Titanium slag.** Titanium slag is produced by smelting ilmenite in a furnace, creating high purity pig iron as a by-product. Depending on the volume of impurities after smelting, it can be used in the sulphate process (**sulphate slag**) or the chloride process (**chloride slag**). Titanium slag's TiO₂ purity ranges from approximately 75% to 91%, with sulphate slag at

⁴¹ FMN, paragraphs 12.4 and 15.18.

⁴² *Tronox/Cristal*, paragraph 468 and FMN, paragraph 12.4.

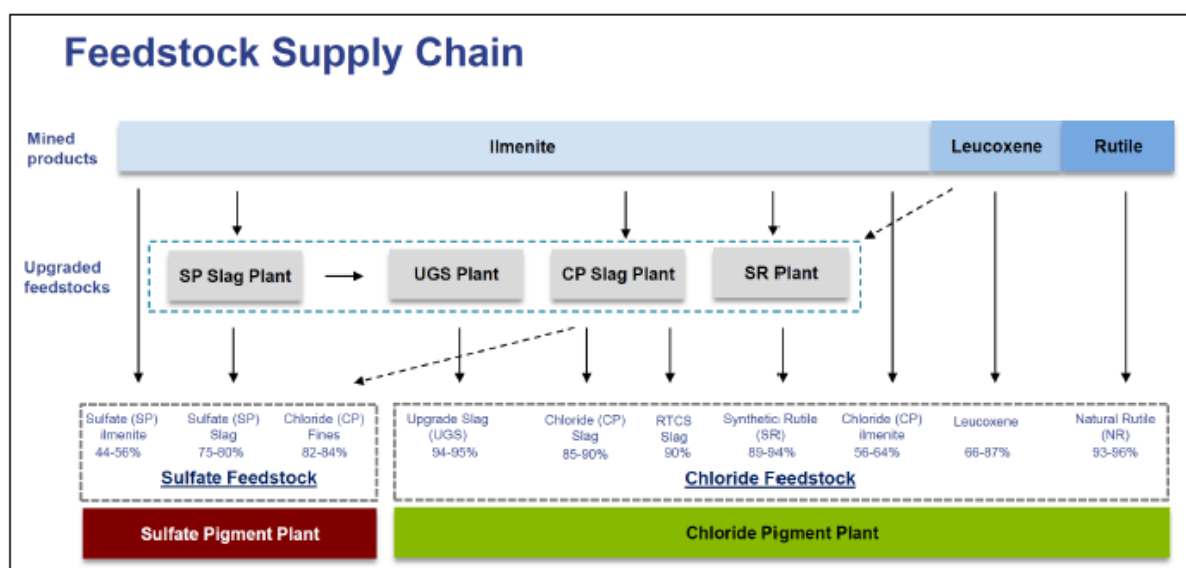
⁴³ Factors affecting the quality of the ilmenite include the TiO₂ content, the types of impurities, and the size of the particles.

⁴⁴ *Tronox/Cristal*, paragraph 468 and FMN, paragraph 12.4.

the lower end of this range (approximately 75% to 84%), and chloride slag at the higher end (approximately 85% to 91%). In order to be suitable for the chloride process, the titanium slag must be milled into smaller particle sizes (which creates 'chloride fines' as a by-product, which is sold as a low quality feedstock for the sulphate process).⁴⁵

- (b) **Synthetic rutile.** Synthetic rutile is produced by reducing ilmenite in a rotary kiln, followed by leaching to remove iron. Synthetic rutile has a TiO₂ purity of approximately 89% to 94% and is only used in the chloride process.
- (c) **UGS.** UGS is produced by leaching a sulphate slag product. It has approximately 95% purity, and is used in the chloride-process. UGS is only produced by Rio Tinto.

81. The diagram below shows which feedstocks are used in the chloride and sulphate TiO₂ pigment production processes. It also shows which feedstocks can be beneficiated to produce other feedstocks.



Source: Parties' submission

Sale of chloride feedstocks

82. The Parties submitted that most chloride feedstocks are supplied under long term bilaterally negotiated contracts, with prices renegotiated several times

⁴⁵ Rio Tinto is active in the production of chloride slag, producing a product known as Rio Tinto Chloride Slag (**RTCS**) which is a trademark product.

per year. For example, TTI has long term supply agreements with [X].⁴⁶ Tronox has long term supply agreements with [X].

83. Customers told the CMA that, as chloride feedstocks are undifferentiated, prices are influenced by overall supply and demand (if supply is tight prices will increase and *vice versa*), although individually negotiated prices do vary.
84. The Parties submitted that long term contracts typically contemplate flexibility for shifting volumes between periods or reducing volumes within pre-agreed limits, giving producers flexibility to alter their feedstock procurement strategies based on both their own individual situation and market dynamics.
85. Suppliers may also make spot sales under one off supply contracts. The CMA understands however that these account for a small percentage of overall sales.

Frame of reference

86. Market definition provides a framework for assessing the competitive effects of a merger and involves an element of judgement. The boundaries of the market do not determine the outcome of the analysis of the competitive effects of the merger, as it is recognised that there can be constraints on merging parties from outside the relevant market, segmentation within the relevant market, or other ways in which some constraints are more important than others. The CMA will take these factors into account in its competitive assessment.⁴⁷
87. For the purposes of its assessment, the CMA has considered the appropriate frame of reference in relation to the following:
 - (a) The upstream supply of titanium feedstocks; and
 - (b) The downstream supply of TiO₂ pigment.

Titanium feedstocks

Product scope

88. Tronox produces chloride slag as well as a range of other chloride feedstocks, including chloride ilmenite, leucoxene, natural rutile and synthetic rutile.⁴⁸

⁴⁶ FMN, Table 7.

⁴⁷ [Merger Assessment Guidelines](#), paragraph 5.2.2.

⁴⁸ Annex RFI 1 Q10.4.

Tronox uses most of the chloride feedstock it produces for its own TiO₂ pigment production.⁴⁹ TTI primarily produces chloride slag, which it sells on the merchant market.⁵⁰

89. In determining the appropriate product frame of reference for the competitive assessment, the CMA considered:
- (a) the Parties' submissions;
 - (b) case precedent;
 - (c) substitutability between chloride feedstocks and sulphate feedstocks;
 - (d) substitutability between low-grade chloride feedstocks (chloride ilmenite) and high-grade chloride feedstocks; and
 - (e) substitutability between different types of high-grade chloride feedstocks and chloride slag.

Parties' submissions

90. The Parties submitted that the appropriate product frame of reference is the supply of all types of chloride feedstock on the basis that chloride TiO₂ pigment producers have the flexibility to use a blend of feedstocks interchangeably, and do so as a matter of practice.
91. To support this view, the Parties relied on data regarding Tronox and third party pigment plants' historic feedstock usage, ordinary course documents, and a range of economic analyses (including a hypothetical monopolist test, and a price correlation analysis) as discussed further below.
92. The Parties further submitted that the narrowest plausible product frame of reference would be a market for high-grade chloride feedstocks (feedstocks with a TiO₂ content of typically at least 80% to 85%).⁵¹ This would include natural rutile, synthetic rutile, chloride slag, UGS and leucoxene, but exclude chloride ilmenite.
93. The Parties also submitted that there is substitution between chloride and sulphate feedstocks, both on the demand-side and the supply-side, although

⁴⁹ As discussed above regarding the counterfactual, for the purposes of its assessment the CMA has treated Tronox as not being active in the merchant supply of chloride slag.

⁵⁰ The Parties also overlap in the supply of pig iron and sulphate feedstocks (which are both by-products in the production of chloride slag). However, given the limited nature of the Parties' overlaps the CMA has not considered these overlaps further.

⁵¹ The CMA notes that the Commission in *Tronox/Cristal* (paragraph 474) said that chloride-based plants typically need around 85% TiO₂ content.

they submitted that the CMA could ultimately leave open whether sulphate feedstocks are in the relevant frame of reference.

Case precedent

94. The CMA had regard to the Commission's recent decision in *Tronox/Cristal*, given that the markets in question are wider than national (as discussed further below), and given that *Tronox/Cristal* concerned one of the same parties as the Merger.
95. In that case, the Commission considered the following market segmentations for titanium feedstocks:
- (a) *Segmenting between chloride and sulphate titanium feedstocks.* The Commission noted that feedstocks used in chloride- and sulphate-based TiO₂ pigment production processes are generally quite distinct, and that chloride-based TiO₂ pigment plants typically use only feedstocks with a minimum TiO₂ content of around 85%.⁵²
 - (b) *Segmenting by individual titanium feedstock types.* The Commission noted that there was a degree of demand-side substitutability between individual feedstocks, but this varied between plants.⁵³ Some plants had more flexibility than others (eg those with waste disposal systems that could handle the higher volumes of impurities from lower grade feedstocks). The Commission noted that switching to lower grade feedstocks generally created additional costs (higher volumes of waste, lower output rates and possible reductions to a particular plant's capacity). Supply-side substitutability was also considered to be 'very limited', as it was not easy for suppliers to upgrade or change the types of titanium feedstock they supply.⁵⁴
96. Ultimately the Commission left the product market definition open because it considered that the transaction would not give rise to competition concerns in relation to the supply of titanium feedstocks under any plausible product market definition.

Substitutability between chloride feedstocks and sulphate feedstocks

97. The Parties submitted that on the demand side, pigment producers view chloride and sulphate feedstocks as substitutes. For example, they referred to

⁵² *Tronox/Cristal*, paragraph 474.

⁵³ *Tronox/Cristal*, paragraphs 473-475.

⁵⁴ *Tronox/Cristal*, paragraphs 473-478.

Venator which has stated that '[b]y operating both sulfate and chloride processes, we also have the ability to use a wide range of titanium feedstocks.'⁵⁵

98. The Parties also submitted that there is supply-side substitutability and referred to TTI's experience switching from sulphate slag production in the 1980s, to both chloride and sulphate slag production in 1997, to sulphate slag production in 2001 and finally to chloride slag production in 2015.
99. The CMA does not consider that the relevant product frame of reference includes sulphate feedstocks.
100. On the demand side, as explained above, TiO₂ can be produced by one of two processes: the chloride-based process, or the sulphate-based process, and as the Commission in *Tronox/Cristal* noted, the feedstocks used in either process are quite distinct. According to the Parties' own submissions, sulphate pigment plants use sulphate feedstocks and chloride pigment plants use chloride feedstocks. None of the customers that responded to the CMA's merger investigation used sulphate feedstocks in their chloride pigment plants, and none said that they would use sulphate feedstocks as an alternative to chloride slag if the price of chloride slag increased by 5%.
101. The CMA does not consider that the fact that some customers (such as Venator) operate both chloride and sulphate pigment plants suggests that chloride feedstocks and sulphate feedstocks are substitutable and should be considered in the same product frame of reference.
102. In relation to supply-side substitution, the CMA notes that the Merger Assessment Guidelines state that the CMA will consider supply-side substitution where firms have the ability and incentive to quickly shift capacity between products.⁵⁶ The Parties submitted that it cost approximately [X] to convert TTI's facility from producing sulphate slag to chloride slag [X]. The CMA also notes that [X].⁵⁷ This suggests that the process of conversion, from the initial decision to commencing production, took over a year.⁵⁸ The CMA therefore considers it inappropriate to widen the product frame of reference on the basis of supply-side substitution.

⁵⁵ Venator, Registration Statement Under the Securities Act of 1933 (Form S-1) at 3 (May 5, 2017).

⁵⁶ [Merger Assessment Guidelines](#), paragraph 5.2.17.

⁵⁷ Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-00000027; see also Bates White Memorandum re Natural Experiment Robustness Checks (October 16, 2020), Annex Issues Paper Response 001.

⁵⁸ See [Merger Assessment Guidelines](#), paragraph 5.2.17, which states that firms will generally need to be able to shift capacity within a year for supply-side substitution to be taken into account.

103. In view of the available evidence, the CMA does not consider that sulphate feedstocks should be included in the relevant product frame of reference. However, the CMA considers the potential to convert existing sulphate pigment plants into chloride pigment plants in its assessment of barriers to entry and expansion.

Substitutability between low-grade chloride feedstocks (chloride ilmenite) and high-grade chloride feedstocks

104. The Parties submitted that there are no barriers to using chloride ilmenite in the production of TiO₂ pigment in Europe (including the UK), and therefore that it should be included in the frame of reference.

105. However:

(a) The Parties accepted that chloride ilmenite is not a high-grade chloride feedstock, having a TiO₂ content of only 55% to 64%.

(b) Tronox [REDACTED] and the Parties noted that, as far as they are aware, no other chloride TiO₂ pigment plant in Europe (including the UK) currently uses chloride ilmenite in its feedstock blend.

(c) No feedstock customers that responded to the CMA's merger investigation said that they would use chloride ilmenite as an alternative to chloride slag if the price of chloride slag increased by 5%.⁵⁹ Some feedstock customers said that high impurity levels made it difficult to process chloride ilmenite without major capital investment. Others said that they are already very close to maximising their use of chloride ilmenite or cannot use it at all.

106. The Parties also submitted that Tronox's ordinary course documents refer to [REDACTED].⁶⁰

107. In view of the available evidence, the CMA does not consider that chloride ilmenite should be included in the relevant product frame of reference.

⁵⁹ Responses to customer questionnaire, Q4.

⁶⁰ The Parties also presented data showing that ilmenite accounts for approximately 15-25% of blend mix across all pigment plants based on TZMI data (Figure 9 to the Parties' response to the Issues Letter). Whilst this indicates that some plants are able to use ilmenite in their overall blends, it does not demonstrate that plants are able to substitute their existing consumption of chloride slag for ilmenite. In light of all the other evidence considered by the CMA in paragraphs 105-106 the CMA believes that chloride ilmenite should not be included in the frame of reference.

Substitutability between high-grade chloride feedstocks and chloride slag

108. The CMA's competitive assessment concerns the potential impact of the Merger on competition in the supply of chloride slag (the only chloride feedstock supplied by TTI) (see paragraph 196). Therefore, the CMA has focused its assessment on whether the relevant frame of reference should be widened to include high-grade chloride feedstocks other than chloride slag. The characteristics of each type of high-grade chloride feedstock are discussed in more detail in paragraphs 78 to 81 above.
109. Chloride TiO₂ pigment producers typically use a blend of different chloride feedstocks in their TiO₂ pigment production processes, choosing the blend that maximises the efficiency and economic returns of their individual plants. The overall TiO₂ content of the blend of chloride feedstocks used is commonly referred to as the 'head grade'. Lower grade chloride feedstocks, and a lower overall head grade, will increase the volume of impurities that need to be removed (eg an 86% head grade means that 14% of the volume of the chloride feedstock blend must be removed as impurities).
110. Feedstock customers told the CMA that there are limits to their ability to substitute between feedstocks, which can be plant-specific. Key factors that affect the substitutability of chloride feedstocks include the cost of handling and disposing of waste by-products,⁶¹ technological constraints due to production methods, regulatory constraints such as environmental regulations, and the availability of certain types of chloride feedstock (which is limited in some cases).
111. Feedstock customers told the CMA that it was difficult to upgrade their plants to use different chloride feedstocks. For example, one feedstock customer said that it would be expensive for it to convert its plants to use lower-grade chloride feedstocks. Another feedstock customer said that it has not been able to solve the 'technical complexities' required for it to approve a different chloride feedstock type for use in its plants. Therefore the CMA has assessed the substitutability of chloride feedstock types taking as given customers' existing technology.
112. The remainder of this section first discusses the substitutability of chloride slag in general (ie, without reference to substitution to any particular alternative high-grade feedstock type). Second, it considers the substitutability

⁶¹ Whilst the Parties submitted that substituting between feedstocks does not lead to higher costs, at the same time they acknowledged that different pigment plants have different waste disposal methods available to them, which impacts their waste disposal costs. [REDACTED].

of each individual alternative high-grade chloride feedstock for chloride slag, considering UGS, synthetic rutile, natural rutile and leucoxene in turn.

113. In the sub-sections that follow, the CMA has generally placed more weight on the views of customers than those of competitors, given that customers have direct knowledge as to which feedstocks can be substituted in their specific plants. In addition, the CMA has considered the relative size of each customer's chloride slag consumption when considering their views. This is because larger customers' switching behaviour is more likely to affect feedstock producers' incentives than that of smaller customers. The CMA received responses to its merger investigation from customers representing a large majority of chloride slag consumption globally (excluding China). Given that Rio Tinto is likely to be a significant beneficiary of any reduction in competition resulting from the Merger (see paragraph 196), the CMA has placed less weight on its views compared to those of other feedstock competitors.

- *Chloride slag*

114. This section considers the importance of chloride slag to chloride pigment producers and whether it is substitutable for other high-grade chloride feedstocks in general.

115. **Overall consumption of chloride slag:** TZ Minerals International (TZMI)⁶² data provided by the Parties concerning the total available capacity of different types of chloride feedstock (in terms of supplier capacity) showed that chloride slag is the most abundant high-grade chloride feedstock available for supply by some margin. In particular, chloride slag comprised 47% of global high-grade chloride feedstock available for supply in 2019 and is expected to comprise an even larger proportion over the next five years, reaching 62% in 2024.⁶³ This suggests it is likely to be an important input for chloride-based pigment producers (the vast majority of high-grade chloride feedstock is used in the production of TiO₂ pigment).

116. **Variation in feedstock blend over time:** To support their view that chloride pigment producers use a blend of different feedstocks interchangeably, the Parties provided TZMI data on the blend of chloride feedstocks used at Tronox's plants in Yanbu, Stallingborough and Botlek, as well as plants

⁶² TZMI is a consulting and publishing company which specialises in mineral sands, titanium dioxide and coatings industry.

⁶³ Annex RFI 1 Q8.2.

operated by rivals, including [REDACTED].⁶⁴ This data showed significant fluctuations in the proportion of chloride slag used in the feedstock blend over time at seven of the eight plants. However, the data did show that the proportion of chloride slag consumed at [REDACTED] was relatively stable.

117. The TZMI data used by the Parties to estimate plant-level feedstock consumption is primarily based on annual purchase data from 2012 to 2018, which is estimated using inferences from shipment and import statistics. Actual consumption data that the CMA obtained directly from third party pigment producers, and for a more recent period (2016 to 2020), was not consistent with the data provided by the Parties. In particular, this data showed that the proportion of the total feedstock blend accounted for by chloride slag at their plants has been relatively stable. This is also the case when the data submitted by the Parties and actual data are compared over the same time period, between 2016 and 2018.
118. Tronox presented actual feedstock consumption data using internal data for its Botlek plant. This showed [REDACTED]. [REDACTED]. The CMA considers that the Parties' data from Botlek does show it is technically possible to substitute some volumes of chloride slag for other feedstocks. However, the CMA also notes that the extent to which different feedstocks are substitutable is likely to be plant specific (see paragraph 110). [REDACTED].
119. As a general matter, the CMA also notes that historic fluctuations in the relative proportion of chloride slag and other feedstocks in the overall feedstock blend at a plant do not necessarily imply that these feedstocks are substitutable for each other in response to small changes in relative price.⁶⁵ Underlying changes in technology may cause suppliers to migrate to a new blend and, in such a scenario, it would not necessarily follow that suppliers would substitute away from that blend in response to relative changes in prices between feedstock types. Similarly, some variation in feedstock blend may reflect changes due to more extreme events – such as *force majeure* affecting the availability of feedstocks. Again, this does not necessarily imply

⁶⁴ FMN, Figures 3 – 7, and Annex RF13 Q07. In response to the CMA's Issues Letter, the Parties also presented data regarding fluctuations in chloride slag consumption at plant level for plants supplying pigment to the EEA for 2012 to 2018. This included data for 19 plants in total, including the 8 referred to above. Regarding the 11 additional plants, 5 showed significant fluctuations in chloride slag consumption during the relevant period. The CMA did not have actual data for each of these plants against which it could compare the data provided by the Parties. Moreover, the CMA notes that the data was aggregated over a period of 7 years, making it difficult for the CMA to analyse and reliably draw conclusions from it. For example, it is not possible to ascertain from the data as presented how often chloride slag consumption fluctuated at each plant during the relevant period, or when the fluctuations in consumption occurred.

⁶⁵ The Parties submitted that TiO₂ pigment producers regularly varying the feedstock blend shows that doing so does not result in meaningful cost increases.

that, when those events pass, it would be profitable to substitute away from chloride slag in response to small changes in relative prices.

120. The CMA also notes that the feedstock blend data submitted by the Parties, which showed that in many cases chloride slag consumption has *decreased* relative to other high-grade feedstocks, is not consistent with the data used by the Parties in their price correlation analysis, which shows that chloride slag consumption has *increased* relative to other high-grade feedstocks (see paragraphs 122 to 123).
121. Overall, the CMA has attached limited weight to the data submitted by the Parties on feedstock fluctuations for third party plants, as it is inconsistent with data obtained directly from feedstock customers. To the extent that the data shows fluctuations in chloride slag consumption (eg for Tronox's Botlek plant), the CMA considers that this shows that it is technically possible to substitute chloride slag with other feedstocks, but the CMA notes that this of itself does not show whether customers would switch in response to a small but significant price increase, because the data alone does not explain the reason for the change in blend. It has not been possible within the time constraints of the Phase 1 investigation to investigate the underlying reasons for fluctuations in detail.
122. **Price correlation analysis:** To support their view that there is substitution between chloride slag and other high-grade chloride feedstocks (specifically natural rutile and synthetic rutile),⁶⁶ the Parties submitted an analysis that they said showed that as the price of chloride slag and UGS increased relative to the other feedstocks, their consumption fell as a proportion of the overall mix of feedstocks consumed. The Parties submitted that this was consistent with customers substituting between high-grade chloride feedstocks in response to changes in price.
123. The CMA considers that the evidence from the Parties' price correlation analysis is inconclusive. Correlation between two data series does not necessarily show causality between the two, and the analysis does not control for any factors that may be affecting both series. For example, feedstock blends or relative prices may change over time reflecting changes in technology, regulation, customer requirements (eg relating to lightfastness⁶⁷), the target head grade, exchange rates, declining supply, changes in capacity, supply interruptions or other factors that may lead to migration towards chloride slag, but would not necessarily imply substitution between the two. In

⁶⁶ The data used by the Parties for this analysis did not enable them to separate the prices and volumes of chloride slag from those of UGS.

⁶⁷ That is, how resistant a pigment is to fading when exposed to light.

addition, the analysis includes UGS as well as chloride slag and therefore to the extent any substitution were identified, it may result from substitution between UGS and other feedstocks, rather than between chloride slag and other feedstocks. For these reasons the CMA has placed limited weight on this analysis.

124. **Customer views:** Some customers provided qualitative views on their ability to substitute away from chloride slag. Customers generally indicated that it would be difficult. For example, one feedstock customer said that chloride slag is its ‘most critical’ feedstock and it will ‘always’ use ‘a lot of’ chloride slag ([X]). Another feedstock customer said that chloride slag is the ‘main raw material used by chloride TiO₂ producers’ and that it requires chloride slag to meet its high-grade feedstock needs. Another feedstock customer said that it is fairly unlikely to stop using chloride slag altogether, as it is part of its current blend. These customers represent a significant proportion of chloride slag used by the customers that responded to the merger investigation.
125. The CMA asked chloride slag customers what they would do if the price of chloride slag increased by 5%, but the prices of all other titanium feedstocks stayed the same. This therefore captured customers’ switching to all other titanium feedstocks in aggregate. All but one respondent said they would continue to use a significant proportion (at least 75% of their current consumption) of chloride slag in their TiO₂ pigment production.⁶⁸ Furthermore, customers representing more than 75% of chloride slag used by the customers that responded to the merger investigation stated that they would continue to use almost all (at least 90%) of their current chloride slag consumption. The CMA considers that this shows that switching away from chloride slag to all other feedstock types in aggregate is likely to be limited.
126. **Competitor views:** The CMA also asked producers of feedstocks how they thought customers would respond if chloride slag became relatively more expensive than other feedstocks.⁶⁹ These producers suggested that a greater degree of switching would occur compared to the views of customers but, nonetheless, most indicated that customers would continue to use a significant proportion of chloride slag.⁷⁰
127. **Ordinary course documents:** The Parties submitted that public statements and security filings of Tronox, and other feedstock producers and customers, demonstrate the substitutability between individual chloride feedstocks. The CMA considers, however, that the statements referred to by the Parties do not

⁶⁸ Responses to customer questionnaire, Q4.

⁶⁹ A price increase of 5%, while the prices of all other titanium feedstocks stayed the same.

⁷⁰ Responses to competitor questionnaire, Q4.

show that customers can substitute chloride slag with other high-grade feedstocks (or, specifically, that they would do so in response to a price increase):

- (a) Chemours has referred, in a Titanium Technologies Presentation from September 2018, to its ‘feedstock flexibility’ without providing further explanation as to what this means.⁷¹
- (b) Venator has referred, in a security filing from May 2017, to its ‘ability to use a wide range of titanium feedstocks’.⁷² However, this statement was made in relation to the fact that Venator ‘operat[es] both sulphate and chloride processes’. Venator was not therefore making any claim about its ability to use a wide range of feedstocks in its chloride process.
- (c) Kronos has referred, in its 2019 Annual Report, to purchasing chloride feedstocks ‘from a limited but increasing number of suppliers’.⁷³ However, the document does not refer to flexibility in Kronos’ choice of feedstocks.
- (d) Iluka has noted, in an investor briefing, that ‘chloride pigment plants typically run on blends’. However, the investor briefing does not discuss the extent or ease to which pigment plants can alter the relative proportions of different feedstocks in those blends.⁷⁴
- (e) Tronox has noted, in its 2019 Annual Report, the ‘high degree of substitutability between and among titanium feedstocks’.⁷⁵ But this contrasts with [REDACTED] which suggest [REDACTED].

128. Tronox also submitted that its ordinary course internal documents [REDACTED].

129. **Hypothetical monopolist test:** The Parties submitted an estimate of the volume of chloride slag sales which a hypothetical monopolist in chloride slag could lose before a small price increase (2.5%, 5% or 10%) would be unprofitable – the critical loss.⁷⁶ Using TTI’s margin as a proxy for the margin of a hypothetical monopolist in chloride slag,⁷⁷ the Parties estimated that if a

⁷¹ Chemours, Titanium Technologies Presentation 3, 21 (Sept. 21, 2018), page 3.

⁷² Venator, Registration Statement Under the Securities Act of 1933 (Form S-1) at 3 (May 5, 2017).

⁷³ Kronos, Annual Report (Form 10-K) 8 (Mar. 11, 2020).

⁷⁴ Iluka, Investor Briefing 25 (Oct. 31, 2019).

⁷⁵ Tronox, Annual Report (Form 10-K) 5-6 (Mar. 16, 2020).

⁷⁶ A critical loss analysis estimates the maximum volume that a hypothetical monopolist in a market could lose before a given increase in price would be unprofitable. For a small but significant increase in price (typically 5-10%), it tests whether a particular product or set of products is a market or if the market should be defined more widely.

⁷⁷ The CMA notes that it does not have data on the margins of the other main supplier of chloride slag (Rio Tinto) and therefore cannot test whether this assumption is valid.

hypothetical monopolist in chloride slag lost approximately 10% of its volumes, a price rise of 5% would be unprofitable.

130. The Parties estimated the losses a hypothetical monopolist in chloride slag would incur following a price rise using two methods. The Parties submitted that these showed that the market was wider than chloride slag, as they both suggest that the hypothetical monopolist would lose more than 10% of sales volumes:
- (a) In the first method the Parties used plant level feedstock blend data for 2012 to 2018 (described in paragraph 117 above) and assumed that customers would switch away the difference between the 2018 proportion and the minimum proportion of chloride slag used by that plant in its feedstock blend during that period to a different feedstock in response to a price increase. The CMA considers this to be an extreme assumption as it measures technical substitutability (assuming no technological changes in the plant over the period), rather than actual switching in response to price changes. Furthermore, for the reasons discussed in paragraphs 116 to 121, the CMA does not consider the feedstock blend data submitted by the Parties (and therefore the Parties' estimates of losses using that data) to be reliable.
 - (b) The second method used the ranges from customer responses to the CMA's question in its merger investigation asking what they would do if the price of chloride slag increased by 5%, but the prices of all other titanium feedstocks stayed the same (paragraph 125). While the Parties relied on redacted non-confidential ranges to conduct this analysis, the CMA has used the actual responses and the volume of chloride slag used by customers to estimate the expected volume loss following a price increase. Using this method, the CMA estimates that the actual volume of chloride slag purchases that would be lost following a 5% price increase would be 8% - below the Parties' estimate of the critical loss of 10%.^{78, 79}
131. The Parties also submitted an alternative methodology assessing whether a hypothetical monopolist supplying chloride slag could profitably increase its prices. This estimated the elasticity of demand⁸⁰ at which a small but significant price rise would be profit maximising for a hypothetical monopolist in chloride slag (the critical elasticity). It then compared this with the 'actual'

⁷⁸ One customer said that it could switch between 0 and 100% of its chloride slag usage. The CMA has assumed that this customer would switch 25% of its chloride slag usage to another feedstock type. The CMA considers this to be a conservative assumption because (1) it is above the highest switching rates submitted by other respondents and (2) it is substantially bigger than any historic fluctuation in chloride slag usage seen in the data provided by this customer.

⁷⁹ Bates White Critical Loss Analysis, Annex Issues Paper Response 001.

⁸⁰ This measures the responsiveness of demand to a change in price.

elasticity which was estimated using the event analysis discussed in paragraphs 234 to 237 and found that it would not be profitable for a hypothetical monopolist to raise prices by a small but significant amount. For the reasons given in paragraphs 234 to 237, the CMA believes that the Parties' event analysis suffers from significant limitations which materially undermine the evidentiary weight that can be placed on any analysis that relies on the outputs from the event analysis in a major way which is the case with the Parties' elasticities comparison. Consequently, the CMA considers the results of its own hypothetical monopolist test analysis (described at paragraph 130(b) above), which uses customers' own estimates of the expected volume loss following a price increase, to be more reliable.⁸¹

132. The CMA does not therefore consider that the Parties have demonstrated that a 5% price rise for chloride slag would be unprofitable for a hypothetical chloride slag monopolist to implement.
133. **Conclusion:** Overall, the CMA believes the evidence above indicates that the substitutability of chloride slag with all other high-grade chloride feedstocks in aggregate is likely to be limited, with customers unlikely to switch substantial volumes of current chloride slag demand to alternative feedstock in the event of a 5% price increase. Furthermore, the critical loss analysis conducted by the CMA suggests that a hypothetical monopolist in the supply of chloride slag could profitably increase the price of chloride slag by 5%, which may indicate a frame of reference that only includes chloride slag. It is with this context in mind that the CMA now considers further evidence regarding the substitutability between chloride slag and each alternative high-grade chloride feedstock in the sub-sections below.

- *UGS*

134. As noted in paragraph 80, UGS is produced only by Rio Tinto.
135. **Customer views:** There was mixed evidence from customers about the ease of using UGS as a substitute for chloride slag. One feedstock customer said that it was 'extremely limited' in its flexibility to use UGS as an alternative to chloride slag.
136. Other feedstocks customers (accounting for nearly half of chloride slag used by customers that responded to the CMA's merger investigation) thought they could use UGS as a replacement for chloride slag, but several of these

⁸¹ Memorandum from Bates White to FTC Staff, The hypothetical monopolist test rejects a chloride slag market (3 September 2020), Annex Issues Paper Response 001.

customers referred to its higher relative cost, including on a relative economic value (**REV**⁸²) basis. The CMA notes that the Parties submitted that reoptimizing feedstocks would not result in meaningful cost increases, and that feedstocks do not need to have a better REV than chloride slag to be a substitute. The CMA considers that third party responses and internal documents (see paragraph 139 below) suggest that the REVs of feedstocks are important when choosing feedstock blends, and that changing blend can cause higher input costs.

137. As to whether feedstock customers would switch to UGS in the event that the price of chloride slag rose by 5% relative to the price of other titanium feedstocks, [REDACTED] feedstock customers who responded, accounting for over [REDACTED] of chloride slag used by respondents to the CMA's merger investigation, said that they would not do so. Overall only around [REDACTED] of chloride slag consumption would switch to UGS.⁸³
138. **Competitors:** Responses from feedstock competitors to the same question were mixed, although the majority of competitors who responded thought that only limited volumes of chloride slag consumption would switch to UGS.
139. **Internal documents:** [REDACTED].⁸⁴ The CMA considers that this may mean substitutability between chloride slag and UGS is limited.
140. **Capacity:** Evidence suggests that Rio Tinto, the only supplier of UGS, [REDACTED] thus could supply new customers or higher volumes ([REDACTED]).
141. **Conclusion:** Based on the evidence above, the CMA considers that there is limited substitutability between chloride slag and UGS for most customers, even for the proportion of chloride slag which may be substitutable. Therefore, the CMA does not consider it appropriate to include UGS in the product frame of reference, although the CMA considered shares of supply (and other measures of concentration) on a wider basis including UGS in the competitive assessment.

⁸² REV takes into account certain factors that impact the overall economics of an ore, such as material landed costs, including shipping and transportation costs; TiO₂ content; and the technical and operational efficiency of the ore based on criteria such as product sizing and impurity levels, which impact chlorine usage (dependent on iron content), plant yield, waste treatment and landfill costs (also dependent on iron content), and operating rate.

⁸³ One customer said that it could switch between 0 and 100% of its chloride slag usage to UGS. The CMA has assumed that this customer would switch at most 25% of its chloride slag usage to UGS. For the reasons discussed in footnote 78, the CMA considers this to be a conservative assumption.

⁸⁴ Tronox response to s.109 notice of 7 October 2020, TRONOX-TTI-10896179.

- *Synthetic rutile*

142. There are limited suppliers of synthetic rutile globally, primarily Iluka, but also CMRL, DCW and some Chinese producers.⁸⁵ One feedstock customer said that the only supplier is Iluka. This is supported by a Tronox internal document which shows that [REDACTED]. The CMA has estimated that Iluka's global share of supply (excluding China) was [70-80]% for synthetic rutile in 2019 (Table 3, Appendix A).
143. **Customer views:** Feedstock customers accounting for a large proportion of chloride slag used by customers responding to the CMA's merger investigation said that they would find it technically difficult to use synthetic rutile as an alternative to chloride slag. Some feedstock customers also said that synthetic rutile is more expensive than chloride slag (even on a REV basis⁸⁶).
144. In the event that the price of chloride slag rose by 5% relative to the price of other titanium feedstocks: [REDACTED] feedstock customers (accounting for [REDACTED] of chloride slag used by customers responding to the merger investigation) said that they would not switch from chloride slag to synthetic rutile. Overall only around [REDACTED] of chloride slag consumption would switch to synthetic rutile in response to a price increase based on the responses to the CMA's merger investigation.⁸⁷
145. **Competitor views:** One feedstock competitor provided an example of a customer referring to the price of chloride slag to negotiate a lower synthetic rutile price. In particular, it submitted that [REDACTED]. This suggests that chloride slag could be substitutable for synthetic rutile, but not necessarily *vice-versa*.
146. In the event that the price of chloride slag rose by 5% relative to the price of other titanium feedstocks, feedstock competitors said that some chloride slag consumption would switch to synthetic rutile, with one competitor specifying 15% would switch.
147. **Capacity:** The CMA understands that Iluka, the main producer of synthetic rutile, may have excess capacity. However, the CMA understands that a number of factors may affect whether and how quickly additional supply can be brought to market. In particular, Iluka submitted that it has [REDACTED] TiO₂ units of spare capacity per year. However, it submitted that there are [REDACTED]. These

⁸⁵ Annex RFI 1 Q10.4, 'CMA RFI 1 question 10(d)'.

⁸⁶ As discussed in paragraph 136, the CMA considers that REVs of feedstocks are important when deciding feedstock blends.

⁸⁷ One customer said that it could switch between 0 and 100% of its chloride slag usage to synthetic rutile. The CMA has assumed that this customer would switch at most 25% of its chloride slag usage to synthetic rutile. For the reasons discussed in footnote 78, the CMA considers this to be a conservative assumption.

include [REDACTED] and a lack of demand for TiO₂ pigment following COVID-19. Iluka did not otherwise indicate that suppliers of synthetic rutile, in aggregate, are capacity constrained.

148. The Parties' internal documents suggest synthetic rutile is capacity constrained and therefore a limited substitute for chloride slag. A Tronox board presentation from March 2020 states that [REDACTED].⁸⁸
149. **Conclusion:** Based on the evidence above, the CMA considers that there is limited substitutability between chloride slag and synthetic rutile for most customers, even for the proportion of chloride slag which may be substitutable. The CMA further notes that it is not clear whether Iluka, the main supplier of synthetic rutile, would be able to bring sufficient synthetic rutile to market to replace chloride slag volumes in the event of a price increase. Therefore, the CMA does not consider it appropriate to include synthetic rutile in the product frame of reference, although the CMA considered shares of supply (and other measures of concentration) on a wider basis including UGS and synthetic rutile in the competitive assessment.
- *Natural rutile*
150. Natural rutile is supplied by the following feedstock suppliers: Iluka, Base Resources, UMCC Vilnohirsk, Rio Tinto and several other suppliers. The largest supplier of natural rutile is Iluka followed by Base Resources. The CMA has estimated that Iluka's and Base Resources' global shares of supply (excluding China) were [40-50]% and [20-30]% respectively for natural rutile, in 2019 (Table 3, Appendix A).
151. **Customer views:** Most feedstock customers said that whilst they could use natural rutile as an alternative to chloride slag in certain circumstances, its substitutability was limited due to its higher cost relative to chloride slag, with one customer noting that this was the case even on a REV basis.⁸⁹
152. In the event that the price of chloride slag rose by 5% relative to the price of other titanium feedstocks, [REDACTED] customers that responded to the CMA's merger investigation accounting for [REDACTED] of chloride slag used by respondents said that they would not switch any of their chloride slag consumption to natural rutile. Of the remaining feedstock customer respondents, one said

⁸⁸ Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10167628, page 131. Ilmenite is needed to produce synthetic rutile. For feedstock competitors who depend on high-grade ilmenite to produce synthetic rutile, there is a capacity constraint on how much synthetic rutile they can produce.

⁸⁹ As discussed in paragraph 136, the CMA considers that REVs of feedstocks are important when deciding feedstock blends.

that, for one of its plants, it would switch a very small proportion of its chloride slag consumption to natural rutile; and another said that it would switch 'less than 100%' of its chloride slag consumption to natural rutile (with the exact proportion depending on natural rutile's availability and relative pricing). Overall the CMA has assumed that only around [REDACTED] of chloride slag consumption would switch to natural rutile in the event of a price increase.⁹⁰

153. **Competitor views:** A document submitted by one feedstock competitor, stated that natural rutile can often be substituted for chloride slag, UGS or synthetic rutile.
154. In the event that the price of chloride slag rose by 5% relative to the price of other titanium feedstocks, most feedstock competitors said that some chloride slag consumption would switch to natural rutile, with one competitor specifying 0-15%, and another [5-10%].
155. **Capacity:** A number of third parties said that the supply of natural rutile is capacity constrained, which may therefore limit its substitutability for chloride slag. However, one feedstock competitor said that Iluka has [REDACTED] TiO₂ units of spare capacity of natural rutile.
156. Internal documents and industry reports also indicated that the supply of natural rutile is capacity constrained. For example:
- (a) An internal document produced by Tronox notes that [REDACTED].⁹¹
 - (b) A Tronox internal document for a board presentation in March 2020 states that [REDACTED].⁹²
 - (c) A TZMI industry report states that 'declining global rutile remains a key concern for existing rutile customers.'⁹³
157. Iluka has also noted in its public statements that natural rutile is in 'tight supply'.⁹⁴
158. **Conclusion:** Based on the evidence above, the CMA considers that there is limited substitutability between chloride slag and natural rutile, even for the proportion of chloride slag which may be substitutable. The CMA notes that [REDACTED] third parties said that chloride TiO₂ pigment producers would not switch

⁹⁰ As noted above, one customer said that it could switch between 0 and 100% of its chloride slag usage to natural rutile. The CMA has assumed that this customer would switch at most 25% of its chloride slag usage to natural rutile. For the reasons discussed in footnote 78, the CMA considers this to be a conservative assumption.

⁹¹ Annex 166 of Tronox's index to the FMN, page 6.

⁹² Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10167628, page 130.

⁹³ Annex 051 of Tronox's index to the FMN, page 39.

⁹⁴ Iluka, Investor Briefing 25 (Oct. 31, 2019), page 25.

or would only switch a small proportion of their chloride slag consumption to natural rutile. Furthermore, there is strong evidence of capacity constraints for natural rutile which may mean some suppliers would stop supplying in the future. Therefore, the CMA does not consider it appropriate to include natural rutile in the product frame of reference, although the CMA considered shares of supply (and other measures of concentration) on a wider basis including UGS, synthetic rutile and natural rutile in the competitive assessment.

- *Leucoxene*

159. Leucoxene is supplied by the following suppliers: Doral, Iluka, Chemours, TiZir GCO and by feedstock producers in Thailand, Vietnam, Indonesia and China. Doral and Iluka are the largest suppliers of leucoxene and the CMA has estimated that their global shares of supply (excluding China) were [40-50]% and [30-40]% respectively, for leucoxene in 2019 (Table 3, Appendix A).
160. **Third party views:** Feedstock customers accounting for a large proportion of chloride slag used by respondents to the CMA's merger investigation told the CMA that it is difficult to use leucoxene as a substitute for chloride slag. For example:
- (a) One feedstock customer said that leucoxene is a high cost alternative to chloride slag and therefore not attractive.
 - (b) Three feedstock customers said that they could not use leucoxene due to its high level of impurities.
161. There is weak evidence of substitutability from chloride slag to leucoxene in the event of a 5% increase in the price of chloride slag relative to the price of other titanium feedstocks. Only [redacted] feedstock competitor said that 'some' chloride slag consumption would switch to leucoxene. [redacted] said that they would expect any chloride slag consumption to switch to leucoxene.
162. **Leucoxene consumption data:** The data on feedstock consumption submitted by the Parties for eight plants⁹⁵ [redacted]. [redacted]. However, the CMA understands that [redacted].
163. **Conclusion:** Based on the evidence above, the CMA considers that leucoxene is a very weak substitute for chloride slag, even for the proportion of chloride slag which may be substitutable. Therefore, the CMA does not

⁹⁵ [redacted].

consider it appropriate to include leucoxene within the product frame of reference.

Conclusion on product scope

164. On the basis of its assessment above, the CMA believes the appropriate product frame of reference is the supply of chloride slag.⁹⁶
165. Nonetheless, in order to take into account any potential constraint from UGS, synthetic rutile and natural rutile (**high-grade chloride feedstocks excluding leucoxene**), the CMA has considered shares of supply (and other measures of concentration) for high-grade chloride feedstocks excluding leucoxene, incrementally in order of the CMA's assessment of their likely strength of potential constraint on suppliers of chloride slag.

Geographic scope

166. In assessing the geographic frame of reference for chloride slag, the CMA has considered:
 - (a) the Parties' submissions;
 - (b) case precedent;
 - (c) current import patterns by European chloride feedstock customers;
 - (d) third party views; and
 - (e) internal documents and industry reports.

Parties' submissions

167. The Parties submitted that the market for chloride feedstocks (including chloride slag) is global.
168. In relation to supply from China specifically, they submitted that there is no chemical or qualitative difference in the chloride feedstocks produced in China

⁹⁶ The above analysis by the CMA is focused on demand-side substitution as per the CMA's guidance ([Merger Assessment Guidelines](#), paragraph 5.2.17). In this case, supply-side substitutability is extremely unlikely as production/extraction facilities, especially mines, cannot be easily switched between producing/extracting different types of feedstock. The CMA also specifically found this to be the case regarding substitutability between sulphate and chloride feedstocks, as discussed at paragraph 102 above. Therefore, the CMA considers it is inappropriate to widen the market on the basis of supply-side substitution.

from those produced elsewhere. They also submitted that transport costs are not prohibitive.

Case precedent

169. In *Tronox/Cristal*, the Commission considered whether the geographic market for titanium feedstocks was wider than EEA.⁹⁷ It found that most suppliers served customers worldwide or at least over a wide geographic area, that import duties and regulations did not pose barriers to importing into the EEA, and that prices were fairly similar worldwide.
170. However, the Commission noted some differences between China and the rest of the world. In particular:⁹⁸
- (a) there was often a difference between prices in China and the rest of the world; and
 - (b) sales of feedstocks in China were almost exclusively made on a spot basis, whereas elsewhere prices were fixed for at least six-month periods.
171. Ultimately, the Commission left open whether the geographic market was EEA-wide or wider than EEA, as the transaction did not give rise to competition concerns in the markets for titanium feedstocks under any plausible geographic market definition.⁹⁹

Current import patterns by European chloride feedstock customers

172. Data provided by the Parties on imports into Europe¹⁰⁰ showed that the majority of chloride feedstock came from outside Europe. In particular, [70-80]% of UK purchases came from outside Europe and [80-90]% of EEA purchases came from outside Europe in 2019.¹⁰¹ The CMA considers that this suggests that the geographic frame of reference is wider than Europe.
173. However, data provided by the Parties also showed that only around [0-5]% of chloride feedstocks produced in China in 2019 were exported outside China, suggesting that supply from China may not fall within the geographic frame of reference.¹⁰²

⁹⁷ *Tronox/Cristal*, paragraphs 483-487.

⁹⁸ *Tronox/Cristal*, paragraph 483.

⁹⁹ *Tronox/Cristal*, paragraph 487.

¹⁰⁰ For the purposes of this Decision, all references to Europe refer to the EEA and the UK.

¹⁰¹ TZMI data. Annex RF11 Q40. Tronox purchased [X%] of its feedstock from outside the Europe in 2019.

¹⁰² The Parties stated that this may be an underestimate as there is a further c.10% of Chinese feedstocks which has an unknown country destination.

Third party views

174. Third parties submitted that the feedstocks used in Europe (including in the UK) were often sourced from outside Europe. For example:
- (a) One feedstock customer said that its feedstocks come from all over the world. Its closest suppliers are in Canada; its furthest in Australia. Some come from Norway and South Africa.
 - (b) Another feedstock customer said that because chloride feedstock is only mined/produced in certain countries, while TiO₂ pigment is produced globally, chloride feedstocks historically have been transported all over the world with relative ease and reasonable cost.
 - (c) One feedstock producer said it thought that all the major high-grade feedstock suppliers, apart from those in China, have recently sold to Europe (including the UK).
175. On the supply-side, when asked as part of the CMA's merger investigation how easy it is for suppliers not currently supplying the EEA to start supplying the EEA:
- (a) The majority of feedstock customer respondents did not identify any specific entry barriers, and one customer considered that entry should be very easy for suppliers into the EEA. However one feedstock customer suggested that it would not be easy for suppliers to start supplying the EEA due to capacity constraints.
 - (b) The majority of feedstock producer respondents said that suppliers outside the EEA would be likely to start supplying into the EEA if the price that customers of titanium feedstocks in the EEA were willing to pay rose by 5%.
176. As discussed in paragraph 170, the Commission considered that conditions of competition could be different for China compared to the rest of the world. This is also supported by the import figures noted in paragraph 173. The CMA therefore focused its assessment on whether supply from China should be included in the geographic frame of reference.
177. Although the Parties submitted that Chinese producers should be included in the frame of reference, [REDACTED]. Tronox explained that, because suppliers in China primarily manufacture feedstock for their own consumption, they are less able (or willing) to guarantee supply on a long-term basis.

178. All customers responding to the CMA's merger investigation considered that sourcing titanium feedstocks, and chloride feedstocks in particular, from China is not a viable option. Reasons provided for this included that the majority of Chinese feedstock production is for the sulphate, not chloride, production process; due to vertical integration, most titanium feedstocks are consumed internally rather than exported, and this is not expected to change in the near to mid-term; the quality of Chinese feedstocks is lower; and Chinese chloride slag, where available, is typically priced unattractively and subject to elevated freight costs due to the small volumes produced.
179. All feedstock producers that responded to the CMA's merger investigation confirmed that Chinese producers supplied either zero or very limited volumes of chloride feedstock to customers in Europe, for the same reasons as those given by feedstock customers as set out above.
180. The large majority of feedstock producers said that Chinese suppliers would not start supplying chloride feedstocks into Europe, primarily because:
- (a) China currently imports feedstocks and Chinese feedstock consumption is expected to increase, using any additional feedstock capacity created in China.
 - (b) Chinese producers are largely vertically integrated. There is a Chinese producer (Maoming Ubridge) that is increasing production at a plant in southern China which may supply outside of China, but it is most likely to target customers in China and Japan first.
 - (c) There is limited capacity in Chinese mines.

Internal documents and industry reports

181. Internal documents and industry reports also support that China is not part of the geographic frame of reference for chloride feedstock. For example:
- (a) A Tronox internal document shows that, in 2019, [redacted].¹⁰³
 - (b) A TZMI industry report, from 2019, states that Western feedstock suppliers 'produce higher quality [feedstock] products'. This is because suppliers in China invest less in the manufacturing process required to produce higher quality products.¹⁰⁴

¹⁰³ Annex RFI 1 Q8.1.

¹⁰⁴ Annex 103 of Tronox's index to the FMN, 'TiO₂ Pigment Producers Comparative Cost & Profitability Study'.

- (c) An internal TTI document, from February 2019, explains that [REDACTED].¹⁰⁵
- (d) A Ruidow Titanium Monthly industry report, from August 2018, states that both demand and supply for ‘titanium slag is also declining’ due to the ‘environmental inspection[s]’ in China. The report states that regulation in China has also left ‘idle capacity further increased’.¹⁰⁶ These regulatory requirements may make it difficult for Chinese suppliers to produce chloride slag in the future.

Conclusion on geographic scope

182. For the reasons discussed above, the CMA believes that the appropriate geographic frame of reference is global, including supply in the UK, but excluding supply from China.

TiO₂ pigment

Product scope

183. Tronox produces TiO₂ pigment using the chloride process. TTI does not produce TiO₂ pigment.
184. The Parties submitted that the product frame of reference for TiO₂ pigment should follow the approach set out by the Commission in its *Tronox/Cristal* decision.
185. In that case, the Commission distinguished between rutile and anatase TiO₂ pigment.¹⁰⁷ Within rutile TiO₂ pigment:
- (a) The Commission found a separate market for chloride-based TiO₂ pigment for paper laminate end-applications.¹⁰⁸
- (b) The Commission considered that chloride-based and sulphate-based TiO₂ pigment for customers that manufacture plastics and coatings (**pigment for mass applications**) belong to the same product market. However, that conclusion rested on mixed evidence as to the degree of substitutability between chloride- and sulphate-based TiO₂ pigment. The Commission found that the majority of customers could switch ‘at least some’ but not necessarily all of their purchases between chloride- and

¹⁰⁵ [REDACTED].

¹⁰⁶ Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-00001616, page 7-8.

¹⁰⁷ *Tronox/Cristal*, paragraphs 45-47.

¹⁰⁸ *Tronox/Cristal*, paragraphs 57-74 and 80-104.

sulphate-based TiO₂ pigments, and that the extent of switching ‘may depend on the quality or specific use of the end product’.¹⁰⁹

- (c) The Commission also considered but left open whether the market could be segmented further between plastic and coating applications, and by different end-uses within those applications.¹¹⁰ In turn, this meant that the Commission also left open whether chloride- and sulphate- based TiO₂ pigment were substitutable within these possible narrower end-use segments.

Conclusion on product scope

186. The CMA considers that the Commission’s approach to the downstream product market definition in *Tronox/Cristal* is generally appropriate.
187. Regarding the supply of TiO₂ pigment for mass applications, the CMA has therefore carried out its assessment using a product frame of reference incorporating pigment produced using the chloride- and sulphate-based processes. However, the CMA has also taken account of the possible different strength of constraint from chloride- and sulphate-based pigments for these applications in the competitive assessment.
188. Regarding the supply of pigment for paper laminate, Tronox submitted that it does not sell pigment for paper laminate in the UK and [✂]. The Parties also submitted that to the best of their knowledge there are no paper laminate customers in the UK at all. Third parties also confirmed that they do not supply paper laminate customers in the UK and were not aware of other suppliers doing so either. In view of this, the CMA has not considered the supply of TiO₂ pigment for paper laminate further as part of its assessment.

Geographic scope

189. The Parties submitted that the geographic frame of reference for TiO₂ pigment should follow the approach determined by the Commission in *Tronox/Cristal*.

¹⁰⁹ *Tronox/Cristal*, paragraphs 116-117; see also footnotes 383 and 384.

¹¹⁰ *Tronox/Cristal*, paragraphs 109-113. Within plastics, the Commission noted possible sub-segments for polyolefin, engineering plastics and PVC, and within coatings, for architectural, industrial, and thin-film coatings.

190. In that case, the Commission considered the geographic market for TiO₂ pigment for mass applications (and its various possible sub-segments) to be EEA-wide (including the UK).¹¹¹
191. The Commission's market definition included imports into the EEA from Chemours in Mexico, and from Chinese suppliers. However, the Commission noted that most imports into the EEA were from Chemours, which, in contrast to all other importers, benefited from 0% import duties.¹¹² Whilst Chinese suppliers had recently increased their sales into the EEA, the Commission found evidence to suggest that such imports had not been sufficient to offset an upward pressure on prices following the closure of Venator's Pori plant in Finland in 2017. Other evidence also cast doubt on whether EEA customers would be willing to source significant volumes from Chinese suppliers due to possible concerns about quality and consistency, lead times, breadth of product portfolio, higher transport costs, and import duties.¹¹³
192. The CMA considers that it is appropriate to also adopt a Europe wide (ie the EEA and the UK) geographic frame of reference for TiO₂ pigment for mass applications for the purposes of its assessment (including imports from Mexico and China). However, the CMA has also taken account of the potentially weaker constraint provided by Chinese imports as part of this assessment.

Conclusion on frame of reference

193. For the reasons set out above, the CMA has considered the impact of the Merger in the following frames of reference:
- (a) The supply of chloride slag globally, including supply in the UK, but excluding supply from China.
 - (b) The supply of TiO₂ pigment for mass applications in Europe (ie the EEA and the UK).

Competitive assessment

194. The CMA has assessed two theories of harm in relation to the Merger:

¹¹¹ *Tronox/Cristal*, paragraphs 120-136 and 138-143. At the time of the Commission's decision, the UK was part of the EEA.

¹¹² *Tronox/Cristal*, paragraph 140.

¹¹³ *Tronox/Cristal*, paragraphs 139 and 375.

- (a) horizontal unilateral effects in the supply of chloride slag globally (excluding China) including supply in the UK; and
- (b) vertical effects in relation to the supply of chloride slag globally (excluding China) including supply in the UK, and the downstream supply of TiO₂ pigment for mass applications in Europe (ie the EEA and the UK).

Horizontal unilateral effects

General framework

195. The CMA often considers horizontal unilateral effects where a merger eliminates competition between two merging firms, reducing the competitive constraints exerted on each merging firm and potentially allowing the merged firm profitably to raise prices on its own and without needing to coordinate with its rivals. Nonetheless, the CMA is not limited to doing so. Theories of harm are developed by the CMA to provide the framework for assessing the effects of a merger and whether or not it could lead to an SLC. They describe possible changes arising from a merger, any impact on rivalry and the expected harm to customers as compared with the counterfactual.¹¹⁴ A merger gives rise to an SLC when it has a significant effect on rivalry over time, and therefore on the competitive pressure on firms to improve their offer to customers or to become more efficient or innovative.¹¹⁵
196. As explained above (see paragraph 73), the CMA considers that, absent the Merger, Tronox would cease to supply chloride feedstock on the merchant market. In the counterfactual, the Parties would not therefore compete with each other to supply chloride slag to TiO₂ pigment producers. Nonetheless, the CMA believes that there is a realistic prospect that the Merger will have a significant effect on rivalry and competition. This is because evidence shows that the Merger may lead to TTI ceasing to supply chloride slag to rival TiO₂ pigment producers of Tronox, which would eliminate existing competition between TTI and the only significant remaining supplier of chloride slag globally excluding China, namely Rio Tinto. The CMA has therefore considered whether the removal of the competitive constraint currently posed by TTI might allow Rio Tinto profitably to restrict the volume of chloride slag that it supplies to the market and/or raise prices, such that the Merger may be expected to result in an SLC.
197. The CMA acknowledges that because Tronox does not intend to supply chloride feedstocks to the merchant market post-Merger, it will not directly

¹¹⁴ [Merger Assessment Guidelines](#), paragraph 4.2.1.

¹¹⁵ [Merger Assessment Guidelines](#), paragraph 4.1.3.

benefit from TTI customers switching to purchase from the Merged Entity (as typically would be the case in a horizontal merger). Nonetheless, the CMA considers that it is not necessary to demonstrate that merging parties would profit from an SLC for one to occur. Even if it were necessary to demonstrate this, the vertical theory of harm suggests that this is the case: that is, the CMA believes that there is a realistic prospect that the Parties would benefit from the loss of competition in the upstream market through higher prices in the downstream TiO₂ pigment market post-Merger (see paragraphs 270 to 296 below).

Parties' over-arching submissions on the horizontal theory of harm

198. The Parties submitted that the CMA should not assess the competitive impact of the Merger in terms of horizontal unilateral effects. In particular, the Parties submitted:
- (a) The CMA's horizontal theory of harm is not distinct from its vertical theory of harm. The Parties submitted that the central thesis of both theories of harm is the same – that Rio Tinto will gain market power. Under the horizontal theory of harm, Rio Tinto would gain market power on a global market for chloride slag (excluding China). Under the vertical theory of harm, if Rio Tinto gains market power in this way, there could be a foreclosing effect on TiO₂ producers selling in or into Europe (including the UK).
 - (b) The Parties submitted that the only customers that could possibly be impacted under both theories of harm are also the same, namely downstream TiO₂ pigment producers and their customers (because the only customers for chloride slag are TiO₂ pigment producers).
 - (c) In order to understand the effect of any gain in Rio Tinto's market power upstream, the CMA must consider all constraints that affect Rio Tinto's ability and incentive to raise its chloride slag prices. This includes the role of indirect constraints arising from competition in the downstream TiO₂ pigment market.
 - (d) The question that the CMA must ultimately ask itself is whether the transaction will result in an SLC in the market for TiO₂ pigment that will have a detrimental effect on pigment end-users (eg paint, plastics and coatings manufacturers). If there is no effect on pigment end-users or ultimate consumers, then the CMA's intervention would only serve to protect a handful of TiO₂ pigment producers in Europe who are customers of Rio Tinto.

- (e) In view of the above, the Parties submitted that the only appropriate analytical framework for assessing the impact of the Merger is a vertical theory of harm that assesses whether Rio Tinto has the ability and incentive to foreclose downstream TiO₂ producers, and whether any attempt to do so would harm TiO₂ pigment suppliers' customers and their onwards consumers.

199. The CMA considers that the vertical and horizontal theories of harm are distinct. The CMA recognises that the impact of the Merger on the competitive constraints faced by Rio Tinto in the supply of chloride slag globally (excluding China) is relevant to the assessment of both theories of harm. However, and further to the discussion above:

- (a) The relevant legal test is whether the Merger may be expected to result in an SLC within any market or markets in the UK.¹¹⁶ The horizontal theory of harm assesses whether the Merger may be expected to result in an SLC in the supply of chloride slag globally (excluding China), including the supply of chloride slag in the UK, by eliminating the constraint that TTI exerts on Rio Tinto and other suppliers of chloride slag. The vertical theory of harm assesses whether the Merger may be expected to result in an SLC in the supply of TiO₂ pigment for mass applications in Europe (ie the EEA and the UK) through the input foreclosure of TiO₂ pigment producers as a result of the withdrawal of TTI's chloride slag from the merchant market. The two theories of harm are therefore distinct.
- (b) The CMA does not consider that the only relevant question it must ask itself is whether the Merger may be expected to result in an SLC in the market for TiO₂ pigment that will have a detrimental effect on TiO₂ pigment end-users. The merger control regime under the Act is designed to capture structural changes that have a significant effect on rivalry in a market over time (and therefore competitive pressure on suppliers to improve their offer to customers, for example through lower prices) (see paragraph 195). A merger that gives rise to an SLC will be expected to lead to an adverse effect for customers, and therefore evidence on likely adverse effects will often be key, but it is not necessary for the CMA to demonstrate actual adverse effects.¹¹⁷ It is also not necessary for the CMA to demonstrate that customers that purchase products on markets downstream of the market where the SLC arises will suffer adverse effects.

¹¹⁶ Specifically, whether the CMA believes that it is or may be the case that the Merger may be expected to result in an SLC within any market or markets in the UK for goods and services. See Section 33(1) of the Act.

¹¹⁷ [Merger Assessment Guidelines](#), paragraphs 4.1.3 and 4.2.3.

(c) In any event, the CMA has separately considered the impact of the Merger in the downstream supply of TiO₂ pigment for mass applications in Europe (ie the EEA and UK), and believes that the Merger gives rise to a realistic prospect of an SLC in that market as well (as considered from paragraph 270 onwards below). For the reasons set out below, the CMA also believes that the Merger may give rise to adverse effects on customers (in the form of price increases) at both levels of the supply chain.

200. The CMA has taken into account, in the remainder of this section, the Parties' arguments regarding Rio Tinto's ability and incentive to raise chloride slag prices, including the role of possible indirect constraints from competition in the downstream market.

The CMA's assessment of the horizontal unilateral effects theory of harm

201. In order to assess whether the Merger would give rise to horizontal unilateral effects, the CMA considered:

- (a) Tronox's plans to remove TTI's supply of chloride slag from the merchant market post-Merger;
- (b) Shares of supply and other measures of concentration;
- (c) Evidence regarding TTI's competitive constraint on Rio Tinto; and
- (d) Rio Tinto's ability and incentive to raise prices/reduce supply of chloride slag.

Tronox's plans to remove TTI's supply from the merchant market

202. As discussed in paragraphs 68 to 73 above, absent the Merger, Tronox is expected to withdraw from the merchant market.

203. Tronox has also stated that, following the Merger, it intends to use all of TTI's production of chloride slag internally. As noted in Tronox's press release concerning the Merger: '[t]his highly strategic acquisition represents the next step in advancing our vertical integration strategy, providing Tronox with increased titanium feedstock capacity to better fulfil our internal requirements.'¹¹⁸ Tronox submitted that it intends to do so because it expects to continue to be net-short in chloride feedstocks (that is, it expects to

¹¹⁸ www.tronox.com/tronox-to-acquire-norwegian-titanium-smelting-facility.

consume more chloride feedstock than it produces). Tronox explained that producing chloride feedstock internally is less costly than buying it.

204. Third parties confirmed that they believe that Tronox will use all of TTI's production of chloride slag internally post-Merger. For example, one feedstock customer said that Tronox has announced publicly its strategy of advancing its vertical integration, and so would stop supplying feedstock externally. [REDACTED]. Another feedstock customer noted Tronox's public statements and said that it believes these to be accurate on the basis of what Tronox has done in the past following other acquisitions.
205. The CMA therefore believes that there is a realistic prospect that, following the Merger, the Merged Entity would remove all of TTI's production of chloride slag from the merchant market and use it internally.

Shares of supply and Herfindahl-Hirschman Indexes (HHIs)

206. The CMA has considered shares of supply and HHIs to assess the likelihood of unilateral effects arising. As explained in the Merger Assessment Guidelines, where products are undifferentiated, as is the case here, unilateral effects are more likely where the market is concentrated, there are few firms in the affected market post-merger, the merger results in a firm with a large market share and there is no strong competitive fringe of firms.¹¹⁹
207. In light of the CMA's view on the frame of reference, the CMA places the greatest weight on shares of supply for chloride slag. To account for the weaker constraint from other types of high-grade chloride feedstocks excluding leucoxene, the CMA has also considered shares of supply including those feedstocks, in order of the CMA's assessment of their likely strength of potential constraint on suppliers of chloride slag.
208. **Data sources:** The CMA calculated share of supply estimates using data provided by the Parties and TZMI. The Parties used TZMI estimates of high-grade chloride feedstock production volumes, and their own estimated TiO₂ conversion factors,¹²⁰ to calculate the volume of TiO₂ units produced by feedstock competitors in 2019. TZMI data is used extensively in the market and has been referenced by a range of feedstock competitors and customers. Internal documentary evidence shows that the Parties often use this data for their own internal analysis.

¹¹⁹ [Merger Assessment Guidelines](#), paragraph 5.4.4.

¹²⁰ The Parties used the following conversion factors based on the TiO₂ content of the feedstock: chloride slag, 86%; natural rutile, 95%; synthetic rutile, 92%; and UGS, 94%.

209. In the absence of complete data on actual consumption, as far as the CMA is aware, TZMI is the only data source available to produce shares of supply. TZMI data provided by the Parties has some data limitations¹²¹ but provides an indication of concentration in the market.
210. **Approach to assessing impact on concentration:** In order to assess the impact of the Merger on the relative position of suppliers that would remain after TTI's supply is removed from the merchant market, the CMA took the following steps:
- (a) First, the CMA took pre-Merger shares of supply based on TZMI data and adjusted them by removing Tronox's current supply.¹²² The resulting shares of supply reflect the relative position of suppliers absent the Merger, taking into account Tronox's intention to cease supplying to the merchant market.
 - (b) Second, the CMA adjusted this share of supply by removing TTI's supply from the merchant market. The resulting shares of supply reflect the relative position of remaining suppliers post-Merger.¹²³
211. This approach effectively reallocates the Parties' shares of supply to competitors in proportion to their pre-Merger shares of supply. The CMA does not consider that these shares of supply represent a projection of the actual shares of supply that would prevail post-Merger.¹²⁴ Rather, the CMA considers that these adjusted shares of supply serve as an indicator of the relative importance of the suppliers that would remain post-Merger. By reallocating shares of supply according to the pre-Merger share, this may understate the level of concentration that would arise post-Merger, to the extent that smaller suppliers are capacity constrained, or larger suppliers – and particularly Rio Tinto – may have significant spare capacity. Suppliers' capacity constraints are discussed in paragraphs 134 to 163.

¹²¹ For example, TZMI uses import statistics and producer shipment figures to estimate the TiO₂ consumption units of downstream competitors. Some estimates are at country-level, rather than producer-level, eg those for Indonesia, China, Thailand, Malaysia and Vietnam. Country-level data may lead to an overestimation of the HHI and the market concentration. However, the CMA believes this will have a limited impact on its HHI calculations as the shares of supply for countries (Vietnam) within the geographic frame of reference (worldwide, excluding China), are very small (less than [0-5]%) as shown in Table 4 of Appendix A.

¹²² In particular, the CMA removed the volumes supplied by Tronox to third parties from both the numerator and the denominator. This reflects Tronox's intention to cease supplying the merchant market.

¹²³ Again, the CMA removed the volumes supplied by TTI to Tronox and to third parties from the numerator and the denominator.

¹²⁴ The Parties submitted that the CMA's market share estimates overstate Rio Tinto's position because they exclude internal production and supply. The CMA considers that these concentration measures are intended to assess the significance of the options available to customers purchasing from the merchant market and, as such, has excluded internal production and supply.

212. Using these adjusted shares of supply, the CMA has calculated three main indicators: the share of the largest supplier (in each case, this is Rio Tinto); the share of the top 3 firms, and the level of the HHI.¹²⁵
213. **Shares of supply and HHI estimates:** Shares of supply and HHIs on the bases set out above are presented in Table 1. A breakdown of the share of supply estimates by feedstock competitor is set out in Table 3 and Table 4 in Appendix A.
214. The CMA estimates that TTI had an [10-20]% share of supply in 2019 for the provision of chloride slag globally (excluding China).¹²⁶ When including all high-grade chloride feedstocks excluding leucoxene, TTI had a share of supply of [5-10]%.

Table 1: The CMA’s share of supply and HHI estimates for the global supply (excluding China) of high-grade chloride feedstocks excluding leucoxene (excluding captive supply)

	Absent the Merger	Post-Merger	Change
Chloride slag			
Share of largest firm	[70-80]%	[90-100]%	+[10-20]%
Shares of Top 3 firms*	[90-100]%	[90-100]%	Up to +[0-5]%
HHI	>6,000	>9,000	>+2,000
Chloride slag and UGS			
Share of largest firm	[80-90]%	[90-100]%	+[10-20]%
Shares of Top 3 firms*	[90-100]%	[90-100]%	Up to +[0-5]%
HHI	>7,000	>9,000	>+2,000
Chloride slag, UGS and synthetic rutile			
Share of largest firm	[60-70]%	[70-80]%	+[5-10]%
Shares of Top 3 firms	[90-100]%	[90-100]%	+[0-5]%
HHI	>4,000	>5,000	>+1,000
Chloride slag, UGS, synthetic rutile and natural rutile			
Share of largest firm	[50-60]%	[50-60]%	+[5-10]%
Shares of Top 3 firms	[80-90]%	[80-90]%	+[0-5]%
HHI	>3,000	>4,000	>+500

Source: CMA estimates using TZMI data provided by the Parties in RFI 1 Annex Q10(d).

Notes:

- * The change in the shares of the top 3 firms post-Merger is between [0-5]% and [0-5]%. Post-Merger figures included ‘Vietnam’ which represents all competitors in that country and not an individual feedstock competitor. The post-Merger increment will depend on the number of feedstock

¹²⁵ HHI is a measure of market concentration that considers not only the size of market shares but differences of these sizes between participants. It is calculated by adding together the squared values of the market shares of all firms in the market. This method gives greater weight to market participants with the largest market shares. By doing so, this method considers both the relative size and distribution of market shares within a market. The HHI value can be between 0 and 10,000, where the higher the value, the more concentrated the market.

¹²⁶ The CMA has excluded Tronox’s supply from the share of supply calculations as, in the counterfactual, it would not be supplying the merchant market (see paragraphs 68 to 73). Captive supply from other competitors has also been excluded from these calculations.

competitors in Vietnam; concentration for these figures will increase by up to [0-5]% with the exit of TTI.

- The CMA has excluded Tronox's supply from the share of supply calculations as the CMA considers that in the counterfactual, it would not be supplying the merchant market (see paragraphs 68 to 73).
- In the post-Merger shares of supply estimates, the CMA has removed the volumes supplied by TTI to the merchant market from the numerator and the denominator. The shares of supply are then reallocated to the remaining suppliers in proportion to their pre-Merger shares of supply.
- Sibelco has been excluded from these shares of supply as it left the market in 2019.

215. Table 1 shows that the removal of TTI's supply would leave Rio Tinto with very little competition in the supply of chloride slag to the merchant market globally (excluding China). Rio Tinto's post-Merger share would be [90-100]%, reflecting a substantial increase of [10-20] percentage points on its already high share of supply absent the Merger. With the exit of TTI from the merchant market, the top three suppliers would have a combined share of supply of at least [90-100]%. Absent the Merger the HHI is >6,000, indicating that the supply of chloride slag globally (excluding China) is currently highly concentrated. Post-Merger, the HHI would be extremely high (at >9,000), incorporating a very substantial change arising from the Merger (or 'delta') of >2,000.

216. The Merger Assessment Guidelines state that any market with a post-merger HHI exceeding 2,000 can be regarded as highly concentrated. They also state that, in a highly concentrated market, a horizontal merger generating a delta of less than 150 is not likely to give cause for concern.¹²⁷ In this case, however, the post-Merger HHI exceeds 9,000 and the delta is more than [X] the size of that which would not likely give cause for concern. The Merger Assessment Guidelines also explain that these thresholds may be most informative for markets where the product is undifferentiated,¹²⁸ as is the case here.

217. The CMA has also assessed the degree of concentration, and the impact of the Merger on concentration, when high-grade chloride feedstocks other than leucoxene are included in the shares of supply in addition to chloride slag. In relation to this, Table 1 above shows:

- (a) When UGS is also included, Rio Tinto's share of supply absent the Merger is very high ([80-90]%) and the Merger would give rise to a significant increment ([10-20] percentage points), leading to an extremely high share of supply of [90-100]%. The HHI indicates that supply would be highly concentrated absent the Merger (>7,000), and even more highly

¹²⁷ [Merger Assessment Guidelines](#), paragraph 5.3.5.

¹²⁸ [Merger Assessment Guidelines](#), paragraph 5.3.5.

concentrated post-Merger (>9,000), incorporating a very significant change arising from the Merger (>2,000).

- (b) When both UGS and synthetic rutile are also included, Rio Tinto's share of supply absent the Merger is high ([60-70]%). The Merger would give rise to a material increment ([5-10] percentage points) to this already high share, leading to a very high share of supply ([70-80]%). The HHI indicates that supply would be highly concentrated (>4,000) absent the Merger, and even more highly concentrated post-Merger (>5,000), incorporating a significant change arising from the Merger (>1,000).
- (c) When UGS, synthetic rutile and natural rutile are also included, Rio Tinto's share of supply absent the Merger is high ([50-60]%). The Merger would give rise to a material increment ([5-10]percentage points) to this already high share of supply, leading to a share of supply of [50-60]%. The HHI indicates that supply would be highly concentrated (>3,000) absent the Merger, and even more highly concentrated post-Merger (>4,000), incorporating a significant change arising from the Merger (>500). The top 3 firms would account for [80-90]% of supply absent the Merger and [80-90]% of supply with the exit of TTI. The top 3 firms with the exit of TTI are Rio Tinto ([50-60]%), Iluka ([20-30]%) and Base Resources ([5-10]%) (Appendix A, Table 4). This indicates that, even in the widest possible product frame of reference, supply is highly concentrated and even more highly concentrated post-Merger.

218. Overall, the CMA notes that:

- (a) all scenarios considered by the CMA indicate a high degree of concentration absent the Merger;
- (b) the increase in concentration from the Merger is generally material, and is especially significant when excluding natural rutile; and
- (c) as set out above, the CMA attaches the greatest weight to the shares of supply for chloride slag only.

219. The Parties submitted that the current pivotality or importance of the largest supplier in the market (ie Rio Tinto) was demonstrated by estimates of the residual supply index (RSI) submitted by the Parties.¹²⁹ As these calculations were done purely using share of supply data and did not include any estimate of spare capacity, the CMA considers that these do not add additional

¹²⁹ Bates White Pivotality Analysis, Annex Issues Paper Response 001.

information to the share of supply data already considered in this section and, as such, has not attached separate weight to them.

220. As noted above, where products are undifferentiated, unilateral effects are more likely where the market is concentrated, there are few firms in the affected market post-merger, the merger results in a firm with a large market share and there is no strong competitive fringe of firms. The CMA considers these facts are present here. The exit of TTI from this market would leave Rio Tinto as the only significant supplier of chloride slag globally (excluding China), including in the UK. Even if limited substitutes such as UGS, synthetic rutile and natural rutile are included, Rio Tinto has the largest share of supply. Calculated on this basis, Rio Tinto's share of supply ([50-60]%) is more than twice the size of the share of supply of the second largest feedstock competitor, Iluka ([20-30]%) (Table 4, Appendix A), which offers feedstocks that are limited substitutes for chloride slag.

TTI's competitive constraint on Rio Tinto

221. As noted in paragraph 212, the largest supplier of high-grade chloride feedstocks excluding leucoxene, on any of the bases considered, is Rio Tinto. The CMA considers that TTI is likely to be the most significant competitor to Rio Tinto on the merchant market as it is the other main supplier of chloride slag globally outside China, including in the UK, with an [10-20]% share of supply absent the Merger globally (excluding China). Other suppliers of chloride slag cumulatively account for less than [5-10]% of global supply (excluding China). Therefore, the CMA's assessment, as set out below, focused on TTI's constraint on Rio Tinto.
222. As part of its assessment of the competitive constraint exerted by TTI on Rio Tinto, the CMA considered:
- (a) third party views;
 - (b) internal documents;
 - (c) an event analysis submitted by the Parties examining the effect of entry by TTI on chloride slag prices;
 - (d) a two-tier Cournot model submitted by the Parties; and
 - (e) TTI's capacity, including options to expand that capacity.
223. The CMA has taken into account the characteristics of this market such as negotiation and spot-buys, together with their impact on the pricing of chloride

feedstocks (as discussed in paragraphs 82 to 85) when considering the evidence discussed below.

Third party views

224. As discussed in paragraph 113, the CMA generally placed more weight on the views of customers than competitors, and also less weight on Rio Tinto's views, as part of its assessment.
225. Third parties (including most customers) suggested that the Merger would increase prices and reduce competitive tension in contract negotiations by removing the only material alternative merchant supplier of chloride slag to Rio Tinto outside China. For example:
- (a) One feedstock customer said that it believes that the Merger will cause feedstock prices to rise. It said that [REDACTED] the elimination of TTI post-Merger would reduce the number of current suppliers of chloride slag to just one (Rio Tinto). [REDACTED]. It leaves only Rio Tinto in the merchant market which means that the prices of chloride slag will go up.
 - (b) Another feedstock customer said that the Merger is a further consolidation of the feedstock industry which will affect the market. It currently purchases feedstock from TTI, and wishes to do so in the future. If TTI's chloride slag was not available, then it would have an impact on its current operations. It said that, generally speaking, having more than one supplier is important to ensure competitive tension between supplier options.
 - (c) Another feedstock customer said that there are really only two producers of chloride slag, and chloride slag is a highly critical feedstock for the TiO₂ industry globally. If Tronox follows through with its public statements about removing TTI's supply from the market, Rio Tinto will have a monopoly over chloride slag in the Western world. It will mean several chloride TiO₂ producers will have no alternative. It also noted that there is a differential in price between chloride slag and other high-grade feedstocks. If Rio Tinto ends up with a monopoly, then the price of chloride slag may go up to be more in line with natural rutile, synthetic rutile, and UGS.
226. Two feedstock competitors said they did not think the Merger would harm competition. However, as discussed in paragraph 113, the CMA is putting less weight on the views of feedstock competitors.

Internal documents

227. The CMA has also seen evidence from internal documents that TTI constrains Rio Tinto and other feedstock suppliers. In particular, the documents show that TTI is an effective alternative to Rio Tinto, and is looking to broaden its customer base.
228. **Effective alternative to Rio Tinto:** A TiZir Board pack from 26 April 2018 includes an update on the TiO₂ industry and pricing developments.¹³⁰ The pack notes that [REDACTED].¹³¹
229. In a TTI document entitled [REDACTED].
230. An Eramet corporate strategy document concerning the possible sale of TTI [REDACTED].¹³² The same document notes that [REDACTED].¹³³
231. The Parties' internal and public documents also indicate that TTI has a competitive advantage over Rio Tinto as the only chloride slag producer located within the EEA. In Eramet's Management Presentation to prospective purchasers of TTI, one slide emphasises that [REDACTED]. This is supported in Tronox's press release of May 2020 where Tronox chairman and chief executive officer Jeffry N. Quinn notes that the TTI site 'is ideally situated to supply feedstock to our European pigment facilities.'¹³⁴
232. **TTI strategy to diversify its customer base by winning new customers:** A document from the Eramet industry report - Mining and Metals Division from September 2019 entitled [REDACTED].¹³⁵
233. A 'Confidential Information Package' from March 2020 provided to prospective purchasers of TTI stated that TTI has [REDACTED].

Parties' event analysis

234. In [REDACTED], TTI decided to refurbish an existing furnace and switch from sulphate slag production to chloride slag production. The start-up of this furnace began in [REDACTED] and production of chloride slag began in [REDACTED].¹³⁶

¹³⁰ TiZir wholly owns TTI and 90% of GCO. Prior to July 2018, Eramet owned 50% of TiZir through a joint venture with Mineral Deposits Limited (MDL). In July 2018, Eramet completed the acquisition of MDL and is now the ultimate sole owner of TiZir.

¹³¹ [REDACTED].

¹³² [REDACTED].

¹³³ [REDACTED].

¹³⁴ 'Tronox to Acquire Norwegian Titanium Smelting Facility'. Tronox, May 14, 2020 - Press Release.

¹³⁵ [REDACTED].

¹³⁶ [REDACTED].

235. The Parties have used econometric modelling to assess the impact of TTI's entry into the supply of chloride slag on high-grade feedstock prices. They submitted that this modelling shows that TTI's switch from sulphate slag to chloride slag production had no impact on chloride slag or high-grade feedstock prices compared to the counterfactual (ie TTI not converting its furnace to chloride slag production). The Parties submitted that this demonstrates that TTI does not constrain Rio Tinto's pricing behaviour, and that this is because TTI is too small to impact prices.
236. The econometric analysis conducted by the Parties uses two different specifications: a time series and difference-in-difference approach. There are several limitations to both specifications, including:
- (a) First, the number of observations in the models is very small. The time series analysis uses 16 observations while the difference-in-difference analysis uses 32 observations. Having so few observations (fewer than 10 per each parameter estimate) is likely to have an adverse impact on the statistical power, and so on the ability of the models to detect the effect.¹³⁷
 - (b) Second, a number of factors mean that the impact of TTI's entry on competition and on prices may have been gradual and spread out over time. In particular: (i) TTI's plans to produce chloride slag were publicly known from December 2014, and may have impacted on negotiations for future supply even before TTI entered;¹³⁸ (ii) as supply in this market is largely carried out under contracts rather than on a spot basis, any impact on contractual prices will not have materialised until those contracts were renegotiated; and (iii) TTI may not immediately have been competing at its full current capacity.^{139, 140} All of those facts mean that testing of the effect as a one-time change from the point of TTI's plant conversion is too restrictive and cannot be taken as robust evidence of the absence of the effect.
 - (c) Third, it is important that the model adequately controls for endogeneity issues. Even if TTI's entry put downward pressure on prices, an econometric model may fail to identify such an effect if other factors, such

¹³⁷ The statistical power of a model is the probability of detecting an effect, if there is a true effect present to detect.

¹³⁸ [TZR-FINANCIAL-RESULTS-DECEMBER-2014.pdf \(tizir.co.uk\)](http://www.tizir.co.uk/wp-content/uploads/2013/06/TiZir-2014-Final-Annual-Report-signed-clean.pdf); <http://www.tizir.co.uk/wp-content/uploads/2013/06/TiZir-2014-Final-Annual-Report-signed-clean.pdf>; Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-00000027.

¹³⁹ [REDACTED].

¹⁴⁰ The CMA notes that when the Parties changed the date of the conversion as part of the robustness analysis, some model specifications produced significant effects for several alternative dates. This is consistent with the proposition that the modelling of the timing of the effect as an instantaneous change in the price series may not be appropriate.

as *force majeure*s or changes in demand for TiO₂ pigment, were putting upwards pressure on those prices at the same time.

- (d) The Parties use the price of chloride ilmenite as their preferred control seeking to capture what would have happened to chloride slag prices absent TTI's entry. They also use the price of sulphate ilmenite as an alternative control as part of the robustness analysis. However, the Parties do not explain why those two controls would be unaffected by TTI's entry – in which case they may not be appropriate controls – since ilmenite is used in the production of chloride slag.¹⁴¹ More generally, even if ilmenite was unaffected by TTI's entry, ilmenite prices may be driven by other factors, which do not affect chloride slag, making it a less effective product to use as a control.
- (e) Finally, even taken at face value, one of the Parties' specifications appears to show a significant impact resulting from TTI's entry on chloride slag prices.¹⁴² While the Parties submit that the same specification produces a counterintuitive result, in that it shows that sulphate slag prices fall after TTI's exit from sulphate slag and entry into chloride slag, that result may be driven by other factors which the CMA has not been able to examine (in light of the fact that the focus of the CMA's investigation has not been on sulphate feedstocks).

237. The CMA considers that the significant limitations identified above materially undermine the evidentiary weight of the analysis. The CMA would need to carry out more detailed robustness checks to place greater weight on this analysis. This has not been possible within the constraints of the Phase 1 process, especially as the event analysis was provided after the CMA's Issues Letter. For the same reasons, the CMA also put limited weight on the Parties' other analyses which rely on the elasticity calculated from these models (in particular the hypothetical monopolist test in paragraph 131 and the Cournot modelling in paragraphs 286 to 288).

Parties' two-tier Cournot model

238. The Parties submitted a two-tier Cournot model with respect to the vertical theory of harm. This is discussed in full in paragraphs 286 to 288, but taken at face value, the CMA notes that the analysis finds a post-Merger price rise of between [§<] in the upstream supply of chloride slag. However the CMA has

¹⁴¹ The Parties submitted that there is no bright-line distinction between chloride and sulphate ilmenite, but the term 'sulphate ilmenite' is sometimes applied to ilmenite that is used in chloride pigment plants.

¹⁴² Bates White Memorandum re Natural Experiment Robustness Checks (October 16, 2020), Annex Issues Paper Response 001.

not attached value to this analysis for the reasons set out in paragraphs 286 to 288.

TTI's capacity

239. The CMA believes that the evidence discussed in the sections above shows that TTI exerts a significant competitive constraint on Rio Tinto, irrespective of any further consideration of TTI's capacity.
240. Nonetheless, capacity is generally an important feature of competition in undifferentiated markets,¹⁴³ and the CMA expects that this is the case in relation to competition in the supply of chloride slag.¹⁴⁴ In particular, the more spare capacity that TTI has, the more difficult it is likely to be for Rio Tinto to raise market prices by withholding supply, and the easier it is likely to be for customers to threaten to switch to TTI in response to price increases.
241. The CMA therefore assessed TTI's current capacity and its efforts to improve and expand its capacity.

- *Parties' submissions*

242. The Parties submitted that TTI is capacity constrained. They stated that TTI's annual nameplate capacity is [REDACTED] of titanium slag per annum (ktpa), approximately [REDACTED] of which is chloride slag (the other [REDACTED] is accounted for by co-products produced from the same process, ie chloride fines and coarse slag).
243. The Parties submitted that TTI [REDACTED] but produces as close to its nameplate capacity as possible. The Parties submitted that TTI is carrying out operational performance improvements aimed at bringing production levels closer to its nameplate capacity. This ongoing work involves [REDACTED]. The Parties described these steps as minor adjustments to marginally increase capacity.
244. The Parties stated that TTI's ability to expand its nameplate capacity is limited. Although expansion options had been considered in the past, [REDACTED]. The Parties also said that certain expansion options that had been considered in the past were no longer considered viable. For example, the Parties said that [REDACTED].

¹⁴³ [Merger Assessment Guidelines](#), paragraph 5.3.3.

¹⁴⁴ The CMA has seen evidence suggesting that this is the case, for example TZMI monthly reports tracking capacity and production in detail, including new capacity projects. Annex 057 of Tronox's index to the FMN, 'TZ, Minerals International, Titanium Feedstock Supply/Demand, May 2019'.

- *Internal documents on TTI's capacity*

245. TTI's internal documents confirm that its nameplate capacity is [REDACTED], including co-products.¹⁴⁵
246. A TTI internal document indicates that [REDACTED].¹⁴⁶ [REDACTED].
247. Another TTI internal document indicates that [REDACTED]. Events that [REDACTED].¹⁴⁷ Another [REDACTED].¹⁴⁸
248. TTI's internal documents indicate that [REDACTED].¹⁴⁹ One of [REDACTED].¹⁵⁰ This internal document [REDACTED].
249. The same internal document also states that [REDACTED].¹⁵¹ Another internal document [REDACTED]. The plan, [REDACTED].¹⁵²
250. Another TTI internal document also suggests that [REDACTED].¹⁵³ Another TTI document outlines that [REDACTED].¹⁵⁴
251. TTI internal documents also make references to ways of expanding effective capacity. One TTI document from May 2020 prepared for potential purchasers of TTI notes that [REDACTED].¹⁵⁵
252. One avenue for [REDACTED]. The document explains that [REDACTED]. The document indicates that [REDACTED]. [REDACTED].¹⁵⁶ The CMA has also seen other internal documents that appear to relate to the project, and which discuss project planning and strategy.¹⁵⁷
253. A later internal document [REDACTED].¹⁵⁸
254. Another Eramet internal strategy document notes that [REDACTED].¹⁵⁹
255. The May 2020 internal document referred to above also refers to two further avenues for expansion, although without providing further detail in relation to

¹⁴⁵ Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10876496, page 14.

¹⁴⁶ [REDACTED].

¹⁴⁷ [REDACTED].

¹⁴⁸ [REDACTED].

¹⁴⁹ [REDACTED].

¹⁵⁰ [REDACTED].

¹⁵¹ [REDACTED].

¹⁵² [REDACTED].

¹⁵³ [REDACTED].

¹⁵⁴ [REDACTED].

¹⁵⁵ [REDACTED].

¹⁵⁶ [REDACTED].

¹⁵⁷ [REDACTED].

¹⁵⁸ [REDACTED].

¹⁵⁹ [REDACTED].

either of them (nor has the CMA seen other internal documents providing further information in relation to them). In particular, the document refers to further [REDACTED].¹⁶⁰ [REDACTED].¹⁶¹

- *Third party views on TTI's capacity*

256. The CMA asked feedstock producers whether individual feedstock producers were capacity constrained. Only one feedstock producer¹⁶² out of five said that TTI was capacity constrained for chloride slag.¹⁶³

- *Conclusion on TTI's capacity*

257. The above evidence indicates that TTI's nameplate capacity for titanium slag (including chloride slag) exceeds its historical volumes of production. While TTI [REDACTED]. On this basis, the CMA believes that TTI's excess nameplate capacity will constitute effective spare capacity in the near future, to the extent that it does not already. This spare capacity is likely to further strengthen TTI's competitive constraint on Rio Tinto.

258. The CMA accepts that [REDACTED]. The CMA considers, however, that the internal documents demonstrate that TTI had explored a number of different options to expand its effective capacity in the longer term. The CMA considers that these documents demonstrate that there may be a number of ways in which TTI might (absent the Merger) increase its capacity in the longer term and, therefore, that TTI had the potential to become an even stronger constraint on Rio Tinto in the future. The CMA considers that decisions about whether and when to expand capacity are potentially important features of competition in this market.

Conclusion on TTI's competitive constraint on Rio Tinto

259. The above evidence overall indicates that TTI poses a significant competitive constraint on Rio Tinto:

(a) Rio Tinto has a very significant position in the supply of chloride slag globally (excluding China) ([70-80]% absent the Merger). Even small increments to its share of supply could have a substantial effect in the context of few other constraints.

¹⁶⁰ [REDACTED].

¹⁶¹ [REDACTED].

¹⁶² Note that this respondent actually said TTI was constrained for 'upgraded slag', but the CMA considers this to be a typo, as TTI only produces chloride slag.

¹⁶³ Responses to competitor questionnaire, Q7.

- (b) As the other main supplier of chloride slag globally (excluding China), including in the UK, TTI is likely to represent an important constraint on Rio Tinto, and to be Rio Tinto's closest competitor. This is especially the case given that TTI would account for a substantial share of supply absent the Merger ([10-20]%) and that other suppliers of chloride slag (excluding China) would only account for [0-5]% of total supply.
- (c) This view is supported by third parties, with most customers raising concerns that the Merger would remove the only material alternative merchant supplier of chloride slag to Rio Tinto outside China. Internal documents also support that TTI is an effective alternative to Rio Tinto. The CMA considers that the Parties' event analysis and two-tier Cournot model do not undermine this view.
- (d) Finally, TTI will have effective spare capacity in the near future to the extent that it does not already and options to increase its capacity, which further strengthen the constraint that TTI provides on Rio Tinto.

Rio Tinto's ability and incentive to raise prices/reduce supply of chloride slag

260. As outlined in paragraph 198, the Parties submitted that the CMA should consider whether Rio Tinto would have the ability and incentive to increase prices (or reduce supply) of chloride slag. The CMA considers each of the Parties' submissions in this regard below.
261. **Constraints from other feedstocks:** The Parties submitted that Rio Tinto would not have the ability to raise prices and/or reduce supply of chloride slag due to the competitive constraints provided by other types of feedstock (irrespective of the exact frame of reference adopted). However, as discussed in the frame of reference section above, the CMA considers that there is limited substitution from chloride slag to other types of high-grade feedstock. The CMA acknowledges that some substitution is technically feasible, and it has seen some evidence that some customers would substitute limited volumes to other high-grade feedstocks (other than in relation to leucoxene). For this reason, the CMA has considered shares of supply including these feedstocks (see paragraphs 217 to 218). However, even when these are included, the Merger still results in a high degree of concentration (see paragraphs 217 to 218).
262. **Constraint from TTI:** The Parties submitted that TTI does not materially constrain Rio Tinto and that Rio Tinto is already pivotal in the supply of chloride slag, and therefore the removal of TTI from the merchant market as a result of the Merger would not increase Rio Tinto's ability to raise prices. However, as discussed above, the CMA considers that TTI is a significant

competitive constraint on Rio Tinto, and therefore its removal from the market is likely to affect Rio Tinto's ability to raise prices post-Merger.

263. **No reduction in chloride slag volumes on the merchant market:** The Parties submitted that Rio Tinto will not have additional pricing power following the Merger, because the Merger will not reduce the volume of chloride slag available on the merchant market.¹⁶⁴ They submitted that, following the Merger, Tronox [X]. They submitted that Tronox will replace these purchases with chloride slag from TTI. The excess volumes freed up would incentivise Rio Tinto to sell that chloride slag.
264. As discussed in paragraph 195, a merger gives rise to an SLC when it has a significant effect on rivalry over time, and therefore on the competitive pressure on firms to improve their offer to customers or to become more efficient or innovative. The CMA considers that it is appropriate to protect the structure of the market and the process of competition to ensure that competition for the supply of chloride slag provides good outcomes for customers, regardless of the eventual level of demand. Furthermore, the magnitude of the effect of removing Tronox's demand is unclear. As noted in paragraph 215, on the supply-side, the Merger will effectively reduce the number of suppliers of chloride slag from two to one, while on the demand side, removing or reducing Tronox's demand for chloride slag will reduce the number of customers for chloride slag by significantly fewer, leaving at least four customers of chloride slag (Chemours, Venator, Kronos and INEOS).
265. **Co-products and recouping investments:** The Parties submitted that Rio Tinto will continue to produce chloride slag because it will want to recoup investments in smelters/production facilities, and because it produces valuable co-products (zircon and pig iron) when producing chloride slag. The CMA considers that, following the Merger, there will be very few alternatives for Rio Tinto's chloride slag and therefore it could profitably raise prices without forgoing volumes of chloride slag or its co-products. Furthermore, with regard to co-products specifically, while these could be thought of as increasing the effective margin on chloride slag, the Parties did not submit evidence on the profitability of co-products nor demonstrate that a price rise would be unprofitable if it involved a reduction in sales of co-products.
266. **Rio Tinto does not compete downstream:** The Parties submitted that Rio Tinto cannot recoup any foregone revenue from upstream sales because it does not compete downstream. However, based on the evidence above (paragraphs 195 to 259), the CMA does not consider that Rio Tinto needs to

¹⁶⁴ The Parties also submitted that the quantity of feedstock available on the merchant market could increase due to efficiencies.

be vertically integrated and recoup profits in the downstream supply of TiO₂ pigment in order to profitably increase prices for chloride slag.

267. **Indirect constraints from downstream competition:** The Parties submitted that some suppliers in the downstream market for TiO₂ pigment for mass applications in Europe are not dependent on Rio Tinto's chloride slag as an input to produce TiO₂ pigment, including Chemours, Tronox, Lomon Billions and other Chinese pigment suppliers. The Parties submitted that competition from these suppliers would prevent those pigment suppliers that may depend on Rio Tinto from passing on any price increase for chloride slag to their customers in Europe (including in the UK), rendering any price increase by Rio Tinto unprofitable. The CMA does not consider that such indirect constraints would disincentivise Rio Tinto from raising prices. If TiO₂ pigment suppliers affected by a price rise reduced their supply, as some volumes are no longer profitable, this could reduce aggregate supply downstream and potentially push up all prices (including those of the unaffected suppliers). In addition, turning to the suppliers mentioned by the Parties:

- (a) **Chemours:** Chemours [REDACTED]. Although Chemours has more flexibility in its feedstock blend than its competitors,¹⁶⁵ [REDACTED]. Finally, in *Tronox/Cristal*, the Commission found evidence of close parallel conduct between the five main suppliers (including Chemours) of TiO₂ pigment in the EEA (including in the UK).¹⁶⁶ Given that the downstream market is even more concentrated following that transaction (with Tronox and Cristal having merged), the CMA considers that it is doubtful whether Chemours would constrain a price increase by Rio Tinto-dependent TiO₂ pigment suppliers.
- (b) **Chinese suppliers, including Lomon Billions:** The Parties submitted that imports from Chinese suppliers represent a growing constraint, providing data indicating that import volumes have increased each year between 2016 to 2020.¹⁶⁷ Nonetheless, Chinese suppliers, including Lomon Billions, still represent less than [10-20]% of the TiO₂ pigment market for mass applications in Europe.¹⁶⁸ They also represent less than [0-5]% of the supply of chloride-based TiO₂ pigment for mass applications in Europe. This is relevant given that there is some evidence that the degree of substitutability between chloride- and sulphate-based TiO₂

¹⁶⁵ FMN, paragraph 13.20; *Tronox/Cristal*, footnote 462.

¹⁶⁶ *Tronox/Cristal*, paragraphs 345-358.

¹⁶⁷ Figure 19 to the Parties' response to the Issues Letter. It should be noted, however, that the Parties' data indicates that the growth in imports slowed between 2017 and 2019. Whilst it showed a significant increase in imports in 2020, the Parties' data for 2020 was based on annualising data for YTD October 2020, and the CMA has seen some evidence that pigment demand is seasonal, suggesting that annualising data on this basis may not be reliable.

¹⁶⁸ CMA calculation based on Annex RFI2 Q6.02.

pigment for mass applications is limited (as discussed at paragraphs 184 to 188 above). There is also some evidence raising doubt as to whether customers would be willing to source significant volumes from Chinese suppliers, and the extent to which Chinese imports have been able to prevent price increases by Europe-based pigment suppliers in the past (as discussed at paragraph 191 above).

- (c) **Tronox:** In the absence of a significant pricing constraint from Chinese suppliers and Chemours, the CMA is doubtful whether Tronox could be expected to undermine a price increase, as opposed to following a price increase, by Rio Tinto-dependent TiO₂ pigment suppliers.

268. **Conclusion:** For the reasons discussed above, on the basis of the evidence available, the CMA considers there is a realistic prospect that Rio Tinto would have the ability to raise chloride slag prices profitably following the Merger.

Conclusion on horizontal unilateral effects

269. For the reasons set out above, the CMA considers that the removal of TTI as a competitor to other chloride slag suppliers (and in particular Rio Tinto) on the merchant market raises significant competition concerns in relation to the supply of chloride slag globally (excluding China), including the supply of chloride slag in the UK.¹⁶⁹

Vertical effects

270. Vertical effects may arise when a merger involves firms at different levels of the supply chain, for example a merger between an upstream supplier and a downstream customer.
271. Vertical mergers can weaken rivalry, for example when they result in foreclosure of the merged firm's competitors. The CMA only regards such foreclosure to be anticompetitive where it results in an SLC in the foreclosed market(s), not merely where it disadvantages one or more competitors.¹⁷⁰ In the present case, the CMA has considered whether Tronox may foreclose rival TiO₂ pigment producers by withdrawing TTI's chloride slag from the upstream merchant market, thereby reducing the available material suppliers of chloride slag upstream to one (Rio Tinto) and, as a result, leading to

¹⁶⁹ Venator, for example, which is not vertically integrated, currently purchases chloride slag from TTI for its TiO₂ pigment plant in Greatham in the UK [§]. For the reasons set out above, the CMA believes there is a realistic prospect that Rio Tinto would have the ability to raise chloride slag prices profitably for customers outside China following the Merger (including Venator in the UK) as a result of the removal of TTI from the merchant market.

¹⁷⁰ In relation to this theory of harm 'foreclosure' means either foreclosure of a rival or to substantially competitively weaken a rival.

increased prices and/or reduced supply of chloride slag for competitors. This could raise competitors' costs and harm their ability to provide a competitive constraint on the Merged Entity causing an increase in prices for TiO₂ pigment for mass applications in Europe (including in the UK).

272. The CMA's approach to assessing vertical theories of harm is to analyse (i) the ability of the merged entity to foreclose competitors, (ii) its incentive to do so, and (iii) the overall effect of the strategy on competition.¹⁷¹ These are each considered in turn below.

Parties' submissions

273. The Parties submitted that Tronox will not have sufficient market power to vertically foreclose competitors in Europe, because:

- (a) only a small proportion of TTI's chloride slag is sold to rival TiO₂ pigment producers; and
- (b) Tronox purchases [redacted] of TTI's chloride feedstock. In 2019, Tronox purchased [redacted] of chloride feedstock sold by TTI in the UK and EEA respectively.

274. Tronox submitted that vertically integrating TTI's supply will enable it to compete more effectively in the downstream supply of TiO₂ pigment by eliminating double marginalisation and thereby reducing its costs.¹⁷²

275. The Parties also submitted that, in any event, competition will not be harmed in the downstream pigment market for mass applications in Europe because pigment customers can switch to a significant number of chloride-based and sulphate-based suppliers of pigment who do not depend on Rio Tinto for feedstock. The Parties also submitted a two-tier Cournot model analysis which they suggested showed that any upstream price rise would not lead to downstream price increases.¹⁷³

¹⁷¹ [Merger Assessment Guidelines](#), paragraph 5.6.6.

¹⁷² The Parties also submitted that Tronox will have a strong incentive to expand its production of chloride slag post-Merger, and provided an economic model from Bates White to support this submission (FMN, paragraph 19.17 and Annex RFI 1 Q19). The CMA attaches little weight to this evidence because Tronox does not intend to supply the merchant market. Any additional production of chloride slag by Tronox is not therefore capable of countering Rio Tinto's incentives to restrict chloride slag supply and/or raise prices following the withdrawal of TTI from the merchant market post-Merger.

¹⁷³ The Parties additionally submitted that downstream competition would not be harmed because long term contracts afford feedstock customers time to adapt their purchases. The CMA is not persuaded by this argument given that the evidence discussed in the frame of reference section above indicates that alternative feedstocks are not sufficiently substitutable to enable rival suppliers to switch their feedstock purchases in the first place.

Ability

276. **Importance of the input:** The CMA considers that chloride slag is an important input in the production of TiO₂ pigment. TiO₂ pigment producers that use the chloride process rely on high-grade chloride feedstocks to produce TiO₂ pigment.¹⁷⁴ Chloride slag is the most abundant high-grade chloride feedstock, comprising 47% of global high-grade chloride feedstock available for supply in 2019. This share is expected to grow to 62% by 2024 (see paragraph 115). As the vast majority of high-grade chloride feedstock is used in the production of TiO₂ pigment, this suggests that chloride slag accounts for around half of all chloride feedstock used by TiO₂ pigment producers using the chloride process. Customers also have limited ability to switch away from chloride slag to other high-grade chloride feedstocks in response to a price increase (see paragraphs 108 to 165).
277. The CMA also understands that chloride feedstock is a large component of the cost of TiO₂ pigment. One feedstock customer said that feedstock makes up approximately 60% of the price of TiO₂ pigment. TZMI industry reports show that chloride feedstocks accounted for 41% and 39% of the manufacturing cash costs for chloride plants in 2017 and 2018 respectively.¹⁷⁵ As these figures also include fixed costs, they are likely to understate the importance of chloride feedstock as a variable input in the production of TiO₂ pigment.
278. **Market power:** The Merged Entity intends to remove all of TTI's production of chloride slag from the upstream merchant market and use it internally (see paragraphs 202 to 205). As set out in the assessment of horizontal unilateral effects above (see paragraphs 195 to 269), the CMA considers that removing TTI's supply of chloride slag from the upstream merchant market will leave Rio Tinto as the only significant supplier of chloride slag globally outside China, including in the UK, thus increasing Rio Tinto's market power and enabling it to restrict its supply of chloride slag and/or raise prices. As discussed in paragraph 276, customers are unlikely to switch away significant volumes from chloride slag to other high-grade chloride feedstocks in response to a price increase.¹⁷⁶

¹⁷⁴ According to the Parties, all high-grade chloride feedstocks can be used as inputs for TiO₂ pigment produced using the chloride process, regardless of the application for which the TiO₂ pigment is eventually used.

¹⁷⁵ Annex 102 of Tronox's index to the FMN, 'TiO₂ Pigment Producers Comparative Cost & Profitability Study a study of 2017 costs' and Annex 103, 'TiO₂ Pigment Producers Comparative Cost & Profitability Study: a study of 2018 costs'.

¹⁷⁶ For the reasons discussed at paragraphs 260 to 268 above, the CMA is also not persuaded by the additional submissions made by the Parties as to why Rio Tinto would not otherwise have the ability or incentive to restrict its supply of chloride slag and/or raise prices.

279. The CMA also considers that the fact that Tronox currently purchases [X] share of TTI's sales in Europe (including in the UK) does not prevent the Merged Entity from having the ability to foreclose competitors. First, having TTI as an alternative supplier is a constraint in negotiations (see paragraph 225). Second, if the removal of TTI increases prices of chloride slag globally excluding China, then this is likely to impact TiO₂ pigment producers in Europe (including in the UK) regardless of whether they source from TTI currently.
280. Given chloride slag is an important input in TiO₂ pigment production, and that the Merger increases upstream market power, the CMA believes that the Merged Entity may have the ability to foreclose downstream competitors.

Incentive

281. Tronox has indicated a clear business strategy to take TTI's capacity off the upstream merchant market (see paragraphs 202 to 205). This is also consistent with Tronox's past behaviour following prior mergers, where Tronox also removed the feedstock produced by the acquired entity and consumed it all internally. For example, a Tronox internal document from May 2018 states that [X].¹⁷⁷ In addition, Tronox has confirmed its intention to remove its own supply of chloride slag from the merchant market (see paragraphs 68 to 73), which is also consistent with this strategy.
282. The CMA considers that Tronox's stated intentions (and their consistency with its past behaviour) are strong evidence of an incentive to withdraw TTI's capacity from the market and foreclose downstream rivals through the increase in upstream market power it will cause, as it implies that Tronox expects the gains to the Merged Entity of doing so will outweigh the costs.

Effect

283. For the reasons set out in relation to the frame of reference and the assessment of horizontal unilateral effects (see paragraphs 88 to 165 and 195 to 269), the CMA believes it is unlikely that TiO₂ pigment producers would switch away sufficient volumes of chloride slag to prevent Rio Tinto restricting supply and/or raising prices for chloride slag. The CMA therefore considers that there is a realistic prospect of Rio Tinto restricting supply and/or raising prices for chloride slag as a result of the Merger.

¹⁷⁷ Tronox's response to s.109 notice of 7 October 2020, TRONOX-TTI-10212049.

284. The prospect of a reduction in supply and/or price increases for chloride slag, and the CMA's view that chloride slag is an important input that comprises a substantial proportion of the marginal costs of production of TiO₂ pigment, together suggest that the Merger could weaken the constraint Tronox's rivals exert in the supply of TiO₂ pigment, including in the supply of TiO₂ pigment for mass applications, and may in turn lead to an increase in the price of TiO₂ pigment for mass applications in Europe (including in the UK).
285. This is further supported by other sources of evidence, including Tronox's stated business strategy, published industry reports, and third party views:
- (a) **Tronox's business strategy:** If Tronox is net long in the production of chloride slag, Tronox could earn profits by supplying its excess chloride slag to rival producers of TiO₂ pigment. However, the CMA considers that Tronox's stated intention not to supply rival producers even in a scenario where it is net long (see paragraph 72) suggests that Tronox can earn greater profits by not supplying any excess chloride slag to the merchant market. The CMA considers that this is consistent with the potential for the Merged Entity's withdrawal of TTI's production from the merchant market to lead to higher prices for TiO₂ pigment. The Parties did not make any submissions on this point when it was put to them by the CMA in the Issues Letter.
 - (b) **Industry reports:** In an industry report produced by TZMI relating to the pricing of TiO₂ pigment, TZMI states that higher feedstock prices will lead to a 'higher trough price for TiO₂ pigment'.¹⁷⁸ TZMI reports also highlight that titanium slags are known to be 'the biggest influencer of TiO₂ price[s]'.¹⁷⁹
 - (c) **Third party views:** The CMA asked feedstock customers about the likely impact of a 5% increase in the price of titanium feedstocks¹⁸⁰ on the price of TiO₂ pigment. The majority of those who responded (accounting for [40-50%] of chloride slag used by respondents), said that the price of TiO₂ pigment would increase by 5% or more. One of these respondents said that it would try to pass the cost increase on to customers in the form of higher TiO₂ pigment prices to maintain profitability. It said that over the past 15-20 years there has been a one-to-one correlation between feedstock prices and TiO₂ pigment prices. This respondent also said that,

¹⁷⁸ Annex RFI 1 Q41.7, 'TiO₂ Pigment Price Forecast to 2022'.

¹⁷⁹ Annex RFI 1 Q41.15, 'TiO₂ Pigment Price Forecast to 2024'.

¹⁸⁰ The CMA notes that this question was asked with reference to all types of titanium feedstock. However, it considers that the evidence is relevant to an increase in the price of chloride slag because chloride slag constitutes a substantial proportion of all chloride feedstock use (see paragraph 276) and the CMA has not seen evidence that the ability to pass on a price increase necessarily differs by feedstock type.

if the prices of chloride slag went up, it would cause TiO₂ pigment prices to rise too and Tronox would benefit from increased margins. Another respondent (accounting for a significant proportion of chloride slag used by respondents) said that, while the price of TiO₂ is ultimately driven by supply and demand for TiO₂ (not TiO₂ producers' cost structures), producers always attempt to pass on feedstock price increases and that, over a long period, there is a correlation between TiO₂ pricing and feedstock pricing.

286. **Two-tier Cournot model:** The Parties submitted a two-tier Cournot model which they said shows that the Merger will not cause the price of TiO₂ pigment to increase. The CMA notes that this analysis is complex with a number of features that are not transparent.¹⁸¹ Based on the information provided alongside the model (which was submitted following the issues meeting), it has been difficult for the CMA to fully assess the model in the time available.
287. Nevertheless, as there is an element of negotiation over prices (at least upstream – see paragraphs 82 to 85), the CMA considers that it is not clear that a Cournot model captures all possible dynamics in the market¹⁸² and it therefore requires more consideration than has been possible within the constraints of a Phase 1 investigation.
288. The Parties' core model also used an estimate for the elasticity of demand to which the CMA attaches limited weight (see the discussion of the event analysis in paragraphs 234 to 237). The Parties provided a sensitivity of the model which used a smaller estimate. However, the Parties have not provided any basis for using this estimate, and the CMA considers that, based on customer responses to its merger investigation, the appropriate estimate of the elasticity of demand could be considerably smaller. In addition, this sensitivity still incorporates some efficiencies to which the CMA has not attached weight (see paragraphs 312 to 315). Although the Parties provided a sensitivity without efficiencies, the CMA considers that the appropriate sensitivity would *both* exclude efficiencies *and* use a lower estimate for the elasticity of demand and the CMA was not able to run this sensitivity within

¹⁸¹ For example:

- The percentage of chloride slag as a proportion of all feedstock inputs
- The percentage of feedstocks as a proportion of overall costs
- Whether, and how, the model allows for supplier to supplier variation in feedstocks used, their cost and individual negotiation
- Assumptions about competition downstream – which competitors are included in the model, geographic basis for data, etc.

¹⁸² A Cournot model assumes that products are homogenous, and that competition takes place purely on the volumes supplied to the market.

the time constraints of a Phase 1 investigation. For these reasons, the CMA has not been able to put weight on the Parties' Cournot modelling.

289. **Shares of supply of competitors that rely on the chloride process:** The foreclosure of rivals is more likely to lead to an overall impact on competition if those rivals are important to competition in the downstream market. The CMA therefore considered the overall importance of suppliers that rely on chloride slag for the supply of TiO₂ pigment for mass applications in Europe (including in the UK), in particular by reference to the proportion of TiO₂ pigment for mass applications that relies on the chloride process.
290. As explained in paragraph 185, TiO₂ pigment for mass applications can be produced using either the chloride process or the sulphate process. The chloride process relies on chloride feedstocks and the sulphate process relies on sulphate feedstocks.
291. Based on estimates provided by the Parties, the CMA has calculated that [50-60]% of TiO₂ pigment for mass applications sold in Europe was produced using the chloride process in 2019.¹⁸³ Furthermore, all of the competitors named by the Parties as active in the production of TiO₂ pigment for mass applications used the chloride process.¹⁸⁴ A substantial proportion of TiO₂ pigment production for mass applications may therefore be affected by any rise in chloride slag costs.
292. As can be seen in Table 2, a substantial proportion ([20-30]%) of the supply of TiO₂ pigment for mass applications is potentially vulnerable to an increase in the price of chloride slag procured from the merchant market (ie chloride-based TiO₂ pigment produced by producers excluding those that the Parties submitted are not dependent on externally produced chloride slag).¹⁸⁵

Table 2: The CMA's share of supply estimates for the supply of TiO₂ pigment for mass applications in Europe

	Share of TiO₂ pigment for mass applications
Sulphate-based supply	[40-50]%
Chloride-based supply which is largely 'independent' of Rio Tinto (Tronox, Chemours and Chinese suppliers)	[30-40]%
Chloride-based supply which is 'dependent' on Rio Tinto	[20-30]%
Total TiO ₂ pigment supply	100%

Source: CMA estimates using data provided by the Parties in RFI 2 Annex Q6.02.

¹⁸³ CMA calculation based on Annex RFI2 Q6.02.

¹⁸⁴ Annex RFI2 Q6.02. The CMA acknowledges nonetheless that some competitors use the sulphate process to produce TiO₂ pigment for mass applications.

¹⁸⁵ CMA calculation based on Annex RFI2 Q6.02.

293. The Parties submitted that, in the event that TiO₂ pigment producers dependent on Rio Tinto's chloride slag increased pigment prices in response to an increase in the price of Rio Tinto's chloride slag, pigment customers would be able to switch to non-Rio Tinto dependent suppliers. The Parties have not however substantiated that Tronox and Chemours would offer more competitive prices post-Merger (as opposed to following any price increase implemented by Rio Tinto-dependent pigment suppliers).¹⁸⁶ It is also unclear to what extent Chinese imports provide an effective alternative for TiO₂ pigment produced in Europe, in view of evidence indicating possible concerns regarding their quality and consistency, lead times, breadth of product portfolio, higher transport costs, and import duties.¹⁸⁷
294. In addition, given that there is some evidence that the degree of substitutability between chloride- and sulphate-based TiO₂ pigment for mass applications is limited and may vary depending on the quality or specific use of the end product in question (as discussed at paragraphs 185 to 187 above), the CMA considers it is also relevant to consider chloride-based TiO₂ pigment for mass applications in isolation. Considered on this basis, and given that all chloride-based pigment plants in Europe (including in the UK) currently use chloride slag in their blends, the impact of rising input costs could affect all output and all competitors of the Merged Entity. A substantial proportion ([60-70]%) of chloride-based TiO₂ pigment for mass applications sold in Europe is not produced by Tronox and is potentially vulnerable to an increase in the price of chloride slag. Even if, as the Parties suggest, Chemours and Chinese suppliers are less vulnerable to chloride slag price increases (see paragraph 292) a substantial proportion ([40-50]%) of chloride-based TiO₂ pigment for mass applications sold in Europe would nevertheless remain potentially vulnerable to an increase in the price of chloride slag.¹⁸⁸
295. **Conclusion on effect on downstream competition:** Overall, regardless of whether chloride- and sulphate-based TiO₂ pigments for mass applications are considered separately, a substantial proportion of Tronox's downstream competitors could be weakened by the removal of TTI's chloride slag from the merchant market (including suppliers who supply to UK customers). The CMA

¹⁸⁶ See further paragraph 267.

¹⁸⁷ See further paragraph 191. This is also supported by the fact that Chinese imports are not materially active in all possible sub-segments of the TiO₂ pigment market for mass applications in Europe including in the UK (eg Chinese suppliers are not active in the supply of TiO₂ pigment for engineering end-uses within the plastics segment).

¹⁸⁸ CMA calculations based on Annex RF12 Q6.02.

therefore considers that any foreclosure may have a substantial impact on competition.

Conclusion on vertical effects

296. For the reasons set out above, the CMA believes that, through withdrawing TTI's chloride slag from the upstream merchant market, Tronox may have the ability and incentive to foreclose rival TiO₂ pigment producers and thereby affect competition in the supply of TiO₂ pigment for mass applications in Europe (including in the UK), including through raising prices including for UK customers. Accordingly, the CMA believes that the Merger raises significant competition concerns as a result of vertical effects in relation to the supply of chloride slag globally (excluding China) including in the UK and the downstream supply of TiO₂ pigment for mass applications in Europe (including the UK).

Barriers to entry and expansion

297. Entry, or expansion of existing firms, can mitigate the initial effect of a merger on competition, and in some cases may mean that there is no SLC. In assessing whether entry or expansion might prevent an SLC, the CMA considers whether such entry or expansion would be timely, likely and sufficient.¹⁸⁹ In terms of timeliness, the CMA's Merger Assessment Guidelines indicate that the CMA will generally look for entry to occur within two years.¹⁹⁰
298. The CMA considers that, in order to prevent an SLC, potential entry or expansion would need to come from a supplier other than Rio Tinto in the upstream supply of chloride slag outside China. This is because the source of the CMA's concerns in relation to both theories of harm is the loss of TTI as an independent competitor to Rio Tinto in the global supply of chloride slag (excluding China). For the reasons set out at paragraphs 88 to 182, the CMA considers that suppliers of other feedstocks are a weaker constraint on suppliers of chloride slag, and that chloride slag from China is a weak constraint on chloride slag produced elsewhere.
299. The Parties submitted that there are no material barriers to entry or expansion in the production of chloride slag. Each of the Parties' submissions are considered in turn below.
300. **Set-up costs.** According to the Parties, supplying chloride slag requires a source of ilmenite and a processing facility. Tronox estimated that the cost of

¹⁸⁹ [Merger Assessment Guidelines](#), from paragraph 5.8.3.

¹⁹⁰ [Merger Assessment Guidelines](#), paragraph 5.8.11.

a newly built chloride slag smelter complex (two furnaces), such as its smelter at Saldanha in South Africa, would be approximately [REDACTED]. The CMA notes that this constitutes a substantial capital investment.

301. The Parties submitted that an existing sulphate slag smelter can also be converted to a chloride slag smelter at a lower cost to establishing a new chloride slag smelter. However, the only sulphate smelters that the Parties identified that could be converted were either owned by Rio Tinto or located in China.¹⁹¹ The CMA does not consider that the conversion of Rio Tinto smelters or Chinese smelters would prevent an SLC for the reasons discussed in paragraph 298 above.
302. **Accessing customers.** The Parties submitted that finding customers for upgraded feedstocks (including chloride slag) is easy as it does not require establishing distribution networks. However, feedstock customers indicated that the ability for new entrants to obtain customers is not necessarily easy. As one feedstock customer explained, any new supply of feedstock must be put through an approval process (which may involve laboratory testing, pilot testing, and plant trials) to ensure that the feedstock is of sufficient quality and is suitable to be used in the plant in question. Difficulties in obtaining customer approval was also one of the reasons why Chinese suppliers, in particular, have struggled to enter into supply arrangements with customers outside China.
303. **Minimum efficient scale.** The Parties submitted that there is no minimum viable scale for entry, citing chloride slag facilities in Ukraine (operated by ZTMK) and India (operated by Saraf Group) with very low chloride slag sales (≤ 15 ktpa). However, one feedstock customer indicated that obtaining feedstock in sufficient volume is an important factor in supply decision-making, especially where the feedstock supply involves shipping over long distances. This suggests, contrary to the Parties' submissions, that entry may be subject to a minimum viable scale, at least for suppliers seeking to operate globally.
304. **Technological barriers.** The Parties submitted that there are no material technological barriers to establishing a chloride slag smelter. However, [REDACTED] suggest that this is not necessarily the case (even if, as the Parties have noted, its design and scale are relatively unusual in the industry).¹⁹²

¹⁹¹ FMN, paragraph 22.19. In addition, one feedstock customer said that Rio Tinto has the only sulphate slag smelter in the western world.

¹⁹² FMN, paragraph 24.16-24.21. [REDACTED] are also attested by the fact that one of Tronox's stated strategic rationales underlying the Merger is to leverage TTI's expertise to assist with Jazan's commissioning.

305. **Recent entry and expansion.** The Parties only identified one example of recent entry in the supply of chloride slag globally (excluding China) that was unrelated to the Parties. This example relates to Saraf Group's development of a new chloride slag smelter in India in 2019. As explained above, Saraf Group has very low chloride slag sales (≤ 15 ktpa).
306. Third party feedstock producers that responded to the CMA's merger investigation did not identify any planned new entry or expansion by third parties in the supply of chloride slag outside China.¹⁹³ An industry report published by TZMI in February 2020 also anticipated no 'likely new supply' for chloride slag up to 2023.¹⁹⁴
307. **Conclusion on barriers to entry and expansion.** In view of the above, the CMA does not believe that entry or expansion would be timely, likely or sufficient to prevent a realistic prospect of an SLC as a result of the Merger.

Countervailing buyer power

308. In some circumstances, an individual customer may be able to use its negotiating strength to limit the ability of a merged firm to raise prices. The CMA refers to this as countervailing buyer power.¹⁹⁵
309. The Parties submitted that the Merger will allow Tronox to compete more effectively for customers of TiO₂ pigment. The Parties submitted that there are many competing suppliers of TiO₂ pigment and that TiO₂ pigment customers are 'large sophisticated buyers' and able to exploit competition in the market, enabling them to negotiate 'very favourable' pricing.
310. The Parties also submitted that pigment suppliers purchasing chloride slag from Rio Tinto also purchase sulphate feedstocks from Rio Tinto, thus increasing countervailing buyer power.
311. The CMA considers that it has not received sufficiently compelling evidence to indicate that any countervailing buyer power would prevent an SLC.¹⁹⁶ The Parties' arguments supporting countervailing buyer power were not quantified or backed up by specific detailed analysis or evidence. Nor has the CMA seen any other evidence, such as from third parties, to indicate that countervailing buyer power would prevent an SLC. Moreover, in relation to chloride slag specifically, given that, following the Merger, chloride slag customers will have

¹⁹³ Responses to CMA feedstock producer questionnaire, Q9.

¹⁹⁴ Annex 57 of Tronox's index to the FMN, 'Titanium Feedstock Supply/Demand', page 46.

¹⁹⁵ [Merger Assessment Guidelines](#), paragraph 5.9.1.

¹⁹⁶ When considering countervailing buyer power, efficiencies and prospects for entry and expansion, and having regard to the realistic prospect threshold, the CMA will require compelling evidence if it is to conclude on the basis of these factors that the merger should not be referred to Phase 2 ([Merger Assessment Guidelines](#) 5.1.3).

no material alternative to Rio Tinto, the CMA considers it unlikely that the fact such customers may also purchase sulphate feedstock from Rio Tinto would provide them with sufficient countervailing buyer power to prevent an SLC from arising.

Efficiencies

312. Efficiencies arising from a merger may enhance rivalry, with the result that the merger does not give rise to an SLC. For example, a merger of two of the smaller firms in a market resulting in efficiency gains might allow the merged entity to compete more effectively with the larger firms. Efficiencies may also be considered within the framework of relevant customer benefits.¹⁹⁷
313. The CMA must receive compelling evidence to be satisfied that efficiencies will enhance rivalry so that a merger does not result in an SLC. More specifically, the CMA must be satisfied that:
- (a) the efficiencies will be timely, likely and sufficient to prevent an SLC from arising (having regard to the effect on rivalry that would otherwise result from the merger), and;
 - (b) the efficiencies will be merger specific (ie a direct consequence of the merger judged relative to what would happen without it).¹⁹⁸
314. The Parties submitted that the Merger will result in ‘significant procompetitive efficiencies’. In particular, the Parties submitted that the Merger would:
- (a) increase chloride feedstock output,
 - (b) eliminate double marginalization and thus incentivise Tronox to increase output and lower prices in the downstream pigment market, and
 - (c) generate a number of additional merger-specific cost savings and efficiencies, including improved output at TTI and the acceleration of the commissioning of the Jazan smelter.
315. The CMA considers that it has not received sufficiently compelling evidence to indicate that the Merger would give rise to rivalry-enhancing efficiencies that would be timely, likely or sufficient to prevent an SLC. In particular, the CMA considers:

¹⁹⁷ [Merger Assessment Guidelines](#), paragraph paragraphs 5.7.1 to 5.7.4

¹⁹⁸ [Merger Assessment Guidelines](#), paragraph 5.7.4.

- (a) The evidence provided by the Parties is not sufficient to demonstrate that Tronox would have the incentive to pass on any cost savings to its downstream TiO₂ pigment customers in the form of lower prices, thereby increasing rivalry in the supply of TiO₂ pigment, taking into account the evidence discussed above in relation to vertical effects (from paragraph 270 onwards). The CMA also notes in this respect that the Parties submitted that Tronox intends to consume all of its internally produced feedstocks post-Merger because producing chloride feedstock internally is less costly than buying it, such that TiO₂ pigment produced with internally-produced chloride feedstocks ‘has lower costs and higher margins’.¹⁹⁹ This suggests that any cost savings may be absorbed by Tronox as higher margins.
- (b) Even if the Parties had demonstrated to the required standard that Tronox would pass on cost savings to TiO₂ pigment customers through lower prices, the Parties have not demonstrated to the requisite standard that any increased rivalry from Tronox in the downstream supply of TiO₂ pigment would prevent an SLC arising in the upstream supply of chloride slag.
- (c) The CMA has received insufficient evidence that each of the proposed synergies and benefits are Merger-specific and could not otherwise be achieved in the counterfactual. For example, the CMA has not received compelling evidence that the claimed expertise the Merger would bring to improve output at TTI and accelerate the commissioning of the Jazan smelter could not be achieved absent the merger.²⁰⁰

Third party views

316. The CMA contacted customers and competitors of the Parties. Third party comments have been taken into account where appropriate in the assessment above.

Conclusion on substantial lessening of competition

317. Based on the evidence set out above, the CMA believes that it is or may be the case that the Merger may be expected to result in an SLC as a result of horizontal unilateral effects in the supply of chloride slag globally (excluding China) including the supply of chloride slag in the UK, and vertical effects between the upstream supply of chloride slag globally (excluding China)

¹⁹⁹ FMN, paragraphs 15.4 and 19.15.

²⁰⁰ Notwithstanding [REDACTED], the Parties have not demonstrated to the requisite standard that [REDACTED].

including the supply of chloride slag in the UK, and the downstream supply of TiO₂ pigment for mass applications in Europe (including in the UK).

Decision

318. Consequently, the CMA believes that it is or may be the case that (i) arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation; and (ii) the creation of that situation may be expected to result in an SLC within a market or markets in the United Kingdom.
319. The CMA therefore believes that it is under a duty to refer under section 33(1) of the Act. However, the duty to refer is not exercised whilst the CMA is considering whether to accept undertakings under section 73 of the Act instead of making such a reference.²⁰¹ The Parties have until 11 January 2021²⁰² to offer an undertaking to the CMA.²⁰³ The CMA will refer the Merger for a phase 2 investigation²⁰⁴ if the Parties do not offer an undertaking by this date; if the Parties indicate before this date that they do not wish to offer an undertaking; or if the CMA decides²⁰⁵ by 18 January 2021 that there are no reasonable grounds for believing that it might accept the undertaking offered by the Parties, or a modified version of it.

Andrea Gomes da Silva
Executive Director, Markets and Mergers
Competition and Markets Authority
4 January 2021

²⁰¹ Section 33(3)(b) of the Act.

²⁰² Section 73A(1) of the Act.

²⁰³ Section 73(2) of the Act.

²⁰⁴ Sections 33(1) and 34ZA(2) of the Act.

²⁰⁵ Section 73A(2) of the Act.

APPENDIX A: SHARES OF SUPPLY BREAKDOWN BY FEEDSTOCK COMPETITORS

Table 3: The CMA's share of supply estimates by feedstock type for a global market (excluding China, excluding captive supply) for high-grade chloride feedstocks excluding leucoxene, in 2019

	TiO2 units	Share of supply
Chloride slag		
TTI	[X]	[10-20]%
Rio Tinto	[X]	[70-80]%
Saraf Agency	[X]	[0-5]%
Vietnam	[X]	[0-5]%
UGS		
Rio Tinto	[X]	[90-100]%
Synthetic rutile		
Iluka	[X]	[70-80]%
CMRL	[X]	[10-20]%
DCW	[X]	[10-20]%
Natural rutile		
Iluka	[X]	[40-50]%
Base Resources	[X]	[20-30]%
UMCC Vilnohirsk	[X]	[10-20]%
Rio Tinto	[X]	[10-20]%
Irel	[X]	[0-5]%
Kenmare Resources	[X]	[0-5]%
Lanka Mineral Sands	[X]	[0-5]%
TiZir GCO	[X]	[0-5]%
Chemours	[X]	[0-5]%
KMML*	[X]	[0-5]%

Source: CMA estimates using TZMI data provided by the Parties in RFI 1 Annex Q10 (d).

Notes:

- * KMML has less than [0-5]% of the share of supply.
- The CMA has excluded Tronox's supply from the share of supply calculations as the CMA considers that in the counterfactual, it would not be supplying the merchant market (see paragraphs 68-73).

Table 4: The CMA’s share of supply estimates for the global supply (excluding China) of high-grade chloride feedstocks excluding leucoxene (excluding captive supply) by feedstock competitor

	Absent the Merger	Post-Merger	Change
Chloride slag			
TTI	[10-20]%	[0-5]%	-[10-20]%
Rio Tinto	[70-80]%	[90-100]%	+ [10-20]%
Saraf Agency	[0-5]%	[0-5]%	[0-5]%
Vietnam	[0-5]%	[0-5]%	+ [0-5]%
Chloride slag and UGS			
TTI	[10-20]%	[0-5]%	-[10-20]%
Rio Tinto	[80-90]%	[90-100]%	+ [10-20]%
Saraf Agency	[0-5]%	[0-5]%	+ [0-5] %
Vietnam	[0-5]%	[0-5]%	[0-5]%
Chloride slag, synthetic rutile and UGS			
TTI	[10-20]%	[0-5]%	-[10-20]%
Rio Tinto	[60-70]%	[70-80]%	+ [5-10]%
Iluka	[10-20]%	[10-20]%	+ [0-5]%
CMRL	[0-5]%	[0-5]%	+ [0-5]%
DCW	[0-5]%	[0-5]%	[0-5]%
Saraf Agency	[0-5]%	[0-5]%	[0-5]%
Vietnam	[0-5]%	[0-5]%	[0-5]%
Chloride slag, synthetic rutile, UGS and natural rutile			
TTI	[5-10]%	[0-5]%	-[5-10]%
Rio Tinto	[50-60]%	[50-60]%	+ [5-10]%
Iluka	[20-30]%	[20-30]%	+ [0-5]%
Base Resources	[5-10]%	[5-10]%	+ [0-5]%
UMCC Vilnohirsk	[0-5]%	[0-5]%	+ [0-5]%
CMRL	[0-5]%	[0-5]%	[0-5]%
DCW	[0-5]%	[0-5]%	[0-5]%
Saraf Agency	[0-5]%	[0-5]%	[0-5]%
Vietnam	[0-5]%	[0-5]%	[0-5]%
Irel	[0-5]%	[0-5]%	[0-5]%
Kenmare Resources*	[0-5]%	[0-5]%	[0-5]%
Lanka Mineral Sands*	[0-5]%	[0-5]%	[0-5]%
TiZir GCO*	[0-5]%	[0-5]%	[0-5]%
Chemours*	[0-5]%	[0-5]%	[0-5]%
KMML*	[0-5]%	[0-5]%	[0-5]%

Source: CMA estimates using TZMI data provided by the Parties in RFI 1 Annex Q10(d).

Notes:

- * shares of supply are less than [0-5]% for these competitors.
- The CMA has excluded Tronox’s supply from the share of supply calculations as the CMA considers that in the counterfactual, it would not be supplying the merchant market (see paragraphs 68-73).
- In the post-Merger shares of supply estimates, the CMA has removed the volumes supplied by TTI to the merchant market from the numerator and the denominator. The shares of supply are then reallocated to the remaining suppliers in proportion to their pre-Merger shares of supply.
- ‘Vietnam’ represents all competitors in that country and not an individual feedstock competitor.
- Sibelco has been excluded from these shares of supply as it exited the market in 2019.