PVC plants are durable and highly specialized (Goodrich, slip op. at 36, n.85; Klass 4397, 4621-24; Disch Dkt. 9159, 686; *See* Disch 652).

270. PVC plants are specialized in that one cannot normally make materials other than PVC in a PVC plant (Goodrich, slip op. at 36, n.85; Goodrich F 63; Disch 686). It is very difficult to convert a PVC plant to another use, and it may be easier to start fresh and build a new plant (Goodrich F 63; H. Wheeler 1724-25, 1744-45). Sunk costs represent 75-80% of the total value of a PVC plant (Goodrich F 63; H. Wheeler 1744-45; Schaefer Dkt. 9159, 1219). Total costs for an efficient sized plant could exceed as much as $100 million (Goodrich F 63; Schaefer Dkt. 9159, 1211-12; Dkt. 9159 CX 6S).

271. The significance of the specialized nature of PVC plant assets upon the conditions of entry is not merely a theoretical one. The industry recognizes that investment in a new plant entails considerable risk (Goodrich F 63; DiLiddo Dkt. 9159, 3134-3137). Should it become necessary to close the plant, virtually the entire investment could be lost (Goodrich F 63; Liao Dkt. 9159, 1519-22; *cf.* DiLiddo Dkt. 9159, 3396).

272. Theoretically, it is possible that the magnitude of sunk costs required for construction of either a dispersion PVC plant or a suspension PVC copolymer plant could be reduced by conversion of such plant to suspension PVC production, if entry into the intended market proved unsuccessful. However, conversion of a dispersion PVC plant to suspension PVC production would not likely be practical (Boyer CX 185C-D ¶ 5-6). It would require changes in the reactor, changes in raw material tanks and changes in the VCM stripping and recovery system (Boyer CX 185C ¶ 5; *See also* Flammer CX 184C ¶ 5, describing, for the same reasons, the conversion of a suspension plant to a dispersion plant as "economically impractical"). Mr. Boyer also noted that the use of spray-dryers in the resin drying system is specialized to the production of dispersion PVC (Boyer CX 185C ¶ 5). A spray dryer with an annual capacity of 50 million pounds would have a capital cost of approximately $15-20 million (JX 3, PX 8 at 74 ln. 19 - 75 ln. 4). [##] (Hill CX 183C ¶ 5 *In Camera*; Hornack CX 182B-C ¶ 6 *In Camera*; Flammer CX 184C ¶ 5; JX 3, PX 15 at 83; JX 3, PX 20 at 30). [##] (Hornack CX 182B-C ¶ 6 *In Camera*; Hill CX 183C ¶ 5

In Camera). These investments would be wasted in the event the plant is converted to homopolymer production. In addition, investment in a grassroots dispersion or suspension PVC copolymer plant requires, at a minimum, the same magnitude of sunk investment per pound of capacity that is required of a suspension PVC plant.

E. Vertical Integration in the PVC Industry Increases the Difficulty of Entry into the Relevant Markets

273. If complete ownership integration as to VCM and PVC occurs, a new entrant may be required to enter the PVC and VCM industries simultaneously (Kaserman Dkt. 9159, 2338-39). Such a trend could make entry into the relevant PVC markets that much more difficult (Kaserman Dkt. 9159, 2340-41).

274. Vertical integration between two stages of production may make entry into one stage more difficult if (1) the vertical integration makes it necessary to enter both stages rather than just one, and (2) if two-stage entry is more difficult then entry at only one level (Kaserman Dkt. 9159, 2337-40). Two-stage entry might be more difficult because entry at the second stage might be more difficult than at the first (Kaserman Dkt. 9159, 2337-40). For example, where the size of the minimum efficient size plant is larger at the second stage than at the first, the new entrant will have to enter both stages at the larger size (Kaserman Dkt. 9159, 2337-40).

275. In mass and suspension PVC the requirement of simultaneous entry into VCM would make entry more difficult since the size of a minimum efficient sized VCM plant is 800 million to one billion pounds per year, as compared to the 300 to 600 million pounds per year needed for mass or suspension PVC (*See* Goodrich, slip op. at 40). Simultaneous two-stage entry would require entering at both levels at the larger size. This disparity would be even greater for entry into suspension PVC copolymer or dispersion PVC.

276. [##] (Goodrich F 76; Dkt. 9159 CX 667 *In Camera*). [##] (Dkt. 9159 CX 17Z14 *In Camera*; Dkt. 9159 CX 16R *In Camera*; Dkt. 9159 CX 67N *In Camera*; *See* CX 310C *In Camera*; CX 11L *In Camera*; Dkt. 9159 CX 50B; Dkt. 9159 524X *In Camera*; Dkt. 9159 RX 1061L-O). The increase in vertical integration has caused concern that a prospective PVC entrant might also need to enter

VCM in order to secure a VCM supply (Disch Dkt. 9159, 727; *See* Goodrich, slip op. at 78, n.174).

277. [##] (Goodrich F 76; Dkt. 9159 CX 667I-J *In Camera*). However, the degree of vertical integration has increased since the time of the Goodrich proceeding. Occidental's successive acquisition of Tenneco's PVC operations and Shell's VCM manufacturing facilities, has eliminated both Tenneco and Occidental from the ranks of non-integrated PVC producers, and has eliminated Shell as a source of VCM for prospective entrants into PVC manufacture. The increasing degree of vertical integration does act as an additional deterrent to new entry, although to the extent that it is not complete, the deterring effect is reduced (Goodrich ID at 92; Kaserman Dkt. 9159, 2340-41). If the degree of vertical integration were to proceed to completion it would make entry that much more difficult (Kaserman Dkt. 9159, 2340-41).

F. Entry into the Relevant Markets Takes a Long Period of Time

278. The lead time required for a new entrant to enter the industry and begin production is significant (Kaserman JX 1, 324 ln. 25 - 325 ln. 14; *See* Klass Dkt. 9159, 5289-91). First, this provides incumbent firms with a period of time to profit from anticompetitive behavior without the risk of entry response (Goodrich at 30; Kaserman JX l, 324 ln. 25 - 325 ln. 8; Kaserman Dkt. 9159, 2326-27). Second, this provides incumbent firms the opportunity to engage in strategic response, measures, increasing the risk of new entry (Goodrich, slip op at 30 & n.70; Kaserman JX l, 324 ln. 25 - 325 ln. 14; Kaserman Dkt. 9159, 2326-27). [##] (Kaserman Dkt. 9159, 2326-27; Dkt. 9159 CX 14D *In Camera*; DiLiddo Dkt. 9159, 3187-88, 3396; Dkt. 9159 CX 114 *In Camera*).

279. [##] (Goodrich, slip op. at 31; Goodrich F 64; Goodrich ID at 92; JX 3, PX 8 at 76 ln. 13 - 80 ln. 8; JX 3, PX 92; Dkt. 9159 CX 15A *In Camera*; Dkt. 9159 CX 16B-Z 10; Dkt. 9159 CX 182I *In Camera*; Dkt. 9159 CX 196A *In Camera*; Dkt. 9159 CX 439B; Dkt. 9159 CX 446C; *See* DSCC Admission 445, Dkt. 9159 CX 6S *In Camera*). This long lead time increases the likelihood and potential duration for anticompetitive behavior in each of the relevant markets (Kaserman JX l, 325 ln. 15-17; Kaserman Dkt. 9159, 2328).

280. Actual physical construction of a PVC plant is likely to take as long as two years (Goodrich, slip op. at 32; Goodrich F 65; JX 3, PX 11 653 ln. 4-20; JX 3, PX 8 79 ln. 25 - 80 ln.2; JX 3, PX 18 at 47; JX 3, PX 20 at 30; Schaefer Dkt. 9159, 1134; McMath Dkt. 9159, 1938-40, Disch Dkt. 9159, 653; *See also* Dkt. 9159 CX 446C).

281. In the present governmental climate, it is necessary to obtain environmental permits prior to beginning plant construction[19]

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[19] Air emissions from VCM and PVC resin plants are subject to the restrictions of the Clean Air Act, as amended, 42 U.S.C. 7401-7642. PVC plants are subject to specific air-quality standards restricting vinyl chloride emissions from manufacturing facilities in accordance with the National Emissions Standard for Vinyl Chloride, 40 CFR 61.60-.68, promulgated pursuant to the National Emission Standard for Hazardous Air Pollutants (NESHAP), 42 U.S.C. 7412. In addition, the Prevention of Significant Deterioration (PSD) regulations include vinyl chloride as a pollutant covered under the regulations, with a one ton per year emission rate as the triggering amount. 40 CFR 51.24(b)(23), 52.21(b)(23). New PVC plants, as well as major expansions of existing PVC manufacturing facilities, may otherwise be subject to federal PSD requirements as major potential sources of any of the other air pollutants subject to regulation under the Clean Air Act, including the need to obtain preconstruction permits. 42 U.S.C. 7470-7479; 40 CFR 51.24, 52.21. Federal PSD air emission requirements apply only to sources locating in areas presently meeting the National Ambient Air Quality Standards (NAAQS). 42 U.S.C. 7407(d), 7475. For new or existing sources locating or located in "nonattainment areas," a more stringent set of regulations applies. 42 U.S.C. 7501-7508; 40 CFR 52.24. *See also* 40 CFR Part 51, Appendix S ("Emission Offset Interpretative Ruling").

Effluent discharges from PVC plants are subject to the restrictions of the Clean Water Act, as amended by the Federal Water Pollution Control Act, 33 U.S.C. 1251-1376. Vinyl chloride has been specifically designated by the EPA as a toxic pollutant under the Act (33 U.S.C. 1317; 40 CFR 401.15), and PVC manufacturing facilities have been identified as a category of pollutant discharge point sources (33 U.S.C. 1316(B)((1)(A)). *See* 40 CFR 401.12, 416.10-.15. New and existing PVC manufacturing facilities are therefore subject to the permit requirements of the National Pollutant Discharge Elimination System (NPDES) program as potential sources of the discharge of pollutants (33 U.S.C. 1342). A PVC plant may also be subject to local regulatory authority preconstruction permits, particularly land-use requirements.

Because these pre-permit monitoring requirements are relatively new, few if any firms had to comply regarding new plants constructed in the past. It is, therefore, a factor that is likely to make the lead time for future plants longer than in the past. Furthermore, a longer lead time means a higher cost both for monitoring and in accumulated interest charges on expenses attendant to pre-permit applications.

(Goodrich, slip op. at 32-33; Goodrich F 66; Schaefer Dkt. 9159, 1133; Dkt. 9159 CX 597; Dkt. 9159 CX 642; Dkt. 9159 CX 643; DS Admission 443, Dkt. 9159 CX 6S; Dkt. 9159 CX 4Z23). Securing the necessary permits is a costly and time consuming process (Goodrich, slip op. at 33; Goodrich F 66; JX 3, PX 6 98 ln. 20 - 99 ln. 3; DS Admission 415, Dkt. 9159 CX 6Q). [##] (Goodrich, slip op. at 31; Goodrich F 66; JX 3, PX 92; Schaefer Dkt. 9159, 1133, Dkt. 9159 CX 38V *In Camera*; Dkt. 9159 CX 506B *In Camera*; Dkt. 9159 CX 592 *In Camera*). The time required for securing regulatory permits should be increasing as enforcement of Federal emission standards tightens (CX 162A-B). [##] (Dkt. 9159 CX 196A *In Camera*. *See also* Goodrich, slip op. at 32- 34; Dkt. 9159 CX 67Z7 *In Camera*; Dkt. 9159 CX 183D *In Camera*).

282. Substantial engineering work must be done prior to applying for necessary regulatory permits because detailed data must be presented in the permit application (Goodrich, slip op. at 31-32 & n.74; Goodrich F 67; DiLiddo Dkt. 9159, 3337). [##] (Goodrich F 67; DiLiddo Dkt. 9159, 3337; Dkt. 9159 CX 183D *In Camera*). The engineering work necessary before filing for permits is likely to take six months (Goodrich, slip op. at 31-32; Goodrich F 67; DiLiddo Dkt. 9159, 3337). In 1980, EPA amended its Prevention of Significant Deterioration Regulations to require that air quality near the site may have to be monitored for a period of time prior to applying for the permits (Goodrich slip op. at 33; Goodrich F 67; 40 CFR 51.24(m), 40 CFR 52.21(m)). This change may add additional time to the process of obtaining permits. DSCC, now part of Occidental, observed that:

On August 7, 1980 EPA amended its Prevention of Significant Deterioration (PSD) Regulations. These Regulations outline the requirements for obtaining a federal air pollution construction permit for grass root plants and plant expansion in attainment areas - areas presently meeting the National Ambient Air Quality Standards.

The major impact of these regulations is the requirements for continuous air monitoring data to be presented prior to the processing of a permit application. This could add up to one year to the time it takes to get a construction permit. This means it will take from one to two years to get a PSD Permit before construction can begin.

(Goodrich, slip op. at 33; Dkt. 9159 CX 446D). A consultant working for Tenneco noted the significance of the new regulations:

[A]n action plan is proposed to ensure that unnecessary delays are not encountered in the permitting stages of the project development. It is important to option the site as soon as possible since prime industrial tracts that satisfy this project's requirements are becoming scarce in the river region.

It is critical that the Prevention of Significant Deterioration (PSD) permit be submitted by early December before the proposed revisions to the PSD regulations are scheduled to be instituted. Under the revised regulations, one year ambient air quality monitoring will likely be required before the preconstruction permit can be submitted.

(Goodrich, slip op. at 33; Dkt. 9159 CX 574J; *See also* Kienholz Dkt. 9159, 803-04).[20]

283. Since the site for the plant must be known at the time of the permit application, the site must be selected prior to filing. Selection of a site is a "complicated" process (Goodrich F 68; *See* DiLiddo Dkt. 9159, 3335-36). [##] (Goodrich F 68; Dkt. 9159 CX 574I & M-U *In Camera*; *See also* Dkt. 9159 CX 193B *In Camera*; Dkt. 9159 CX 643; Dkt. 9159 CX 594A-B; Dkt. 9159 RX 1061 D-E; Dkt. 9159 RX 1304; Dkt. 9159 RX 1308).

284. A new entrant may also need to take time to evaluate and license PVC manufacturing technology. Such work is likely to take approximately one year (Goodrich, slip op. at 32; Disch Dkt. 9159, 645-47; Schaefer Dkt. 9159, 1133).

285. Since entry into any of the relevant markets is a major strategic decision involving substantial amounts of sunk capital, a new entrant is likely to make an extensive study of the market prior to any entry decision (*See* Goodrich F 71; Dkt. 9159 CX 594A-B; Dkt. 9159 CX 53A).

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[20] Because these pre-permit monitoring requirements are relatively new, few if any firms had to comply with it for new plants constructed in the past. It is, therefore, a factor that is likely to make the lead time for future plants longer than in the past. Furthermore, a longer lead time means a higher cost both in monitoring costs and in accumulated interest charges on expenses attendant to pre-permit applications.

286. Given the time required for construction and permitting, and the extensive efforts needed to obtain technology, find a site, conduct the necessary strategic studies, and complete the pre-permit engineering and air quality monitoring, a lead time of four years (two years for construction, one year to obtain permits, and one year for pre-permit engineering, air quality monitoring, site selection, licensing of technology, and strategic analysis) is a fairly conservative estimate of the amount of time required for *de novo* entry (Goodrich, slip op. at 30-31; Goodrich ID at 92).

287. Actual entry experience buttresses the conclusion that the likely lead time to enter any of the relevant markets is about four to five years (Goodrich, slip op. at 34-35). Formosa Plastics began looking for a site for its PVC/VCM complex in the latter half of 1978 (Liao Dkt. 9159, 1523-24), and began full production in the first quarter of 1983 (Goodrich F 70; Liao 1534-35). This time period -- approximately four and one-half years -- does not include any strategic analysis done prior to Formosa's search for a site. Furthermore, Formosa had some advantages over other possible entrants in that it already had its own PVC production technology (Liao Dkt. 9159, 1539), and had prior experience in the United States market through its participation in the Rico Chemicals project (Liao Dkt. 9159, 1519-22; Goodrich F 15).

288. [##] (Goodrich, slip op. at 35; Goodrich F 71; DiLiddo Dkt. 9159, 3337; Dkt. 9159 CX 36S *In Camera*). Prior to its July 1979 announcement, Goodrich had completed an extensive PVC/VCM strategy study over an eight-month time period (Goodrich, slip op. at 35; Goodrich F 71; DiLiddo Dkt. 9159, 3334-35; Dkt. 9159 CX 53A). During these eight months Goodrich had also completed a complicated site relation process and chosen the Convent, Louisiana site (Goodrich, slip op. at 35; Dkt. 9159 DiLiddo 3335-36; *See Weyerhaeuser Co.*, 106 FTC at 287-88 & n. 69). The lead time for the Convent project was likely to be shorter than that for other potential entrants, since Goodrich was utilizing its own technology (DiLiddo Dkt. 9159, 3336), obviating the need for obtaining needed licenses from other companies.

289. In 1981, Diamond Shamrock projected the lead time for a new Diamond Shamrock suspension PVC homopolymer plant at Deer Park, Texas, using existing Diamond Shamrock technology, to be

four to five years (Goodrich, slip op. at 35; Goodrich F 2; Dkt. 9159 CX 439B).

290. [##] (Dkt. 9159 CX 185Z2 *In Camera*; *See also* Dkt. 9159 CX 182I *In Camera*).

291. [##] (Goodrich, slip op. at 36 n. 85; *Cf.* DiLiddo Dkt. 9159, 3162-64; Dkt. 9159 CX 51Y-Z *In Camera*).

292. That long lead times increase the risk that industry conditions will change between the time the decision is made to enter and the completion of a new plant is supported by actual experience in the mass and suspension PVC market. In the late 1970's several firms decided to build new plants, including Goodrich, Borden and Formosa Plastics (*See* DiLiddo Dkt. 9159, 3131; Liao Dkt. 9159 1523-24). [##] (DiLiddo 3187-88, 3396; *Cf.* Dkt. 9159 CX 114 *In Camera*). [##] (Dkt. 9159 CX 302F *In Camera*; Liao 1534-35). [##] (Dkt. 9159 CX 14F *In Camera* [##]).

G. New Entry into the Relevant Markets Is Unlikely Despite High Prices and Profits Realized by Incumbent Firms

293. Some PVC producers have recently announced expansions to their existing plant capacities, with the greatest expansions on the part of Occidental, Shintech and Formosa, three of the larger mass and suspension PVC homopolymer producers (*See, e.g.,* CX 165A). These expansions would substantially increase the risk of new entry into the mass and suspension PVC market. A potential new entrant would necessarily evaluate the risks and benefits of entry in terms of the likelihood that demand would be strong enough to support current capacity, announced expansions, and the additional capacity that would be added by a new entrant. The announced capacity expansions therefore increase the risk that, with a change in business conditions, entry into the production of PVC would be unprofitable. This factor thus makes new entry into the production of PVC the more unlikely, especially in view of the experience of the PVC industry during the early 1980's.

294. Excess existing capacity in an industry makes new entry less likely by affording incumbent firms the opportunity to deter entry through strategic behavior (Kaserman Dkt. 9159, 2328-29).

295. [##] (Goodrich ID at 92; Dkt. 9159 CX 666H *In Camera*). The magnitude of excess capacity has declined significantly since that time as the industry has recovered from a substantial temporary decline in demand during the recent recession (*See* CX 165A; DiLiddo Dkt. 9159, 3116-18; Eades Dkt. 9159 1471-73). [##] (Donnelly CX 176B-C ¶ 3 *In Camera*; Kulkaski CX 195C ¶ 4 *In Camera*; CX 165A).

296. However, given the excess capacity that as recently as the early 1980's was a significant factor in the PVC industry, the ability of producers in these markets to deter entry through strategic behavior remains enhanced (*See* Kaserman Dkt. 9159, 2328-29). Potential new entrants would probably be unwilling to risk a large amount of the needed sunk capital costs, given the experience of producers who entered into PVC markets in the late 1970's and early 1980's, when growth projections for PVC were optimistic.

297. Announced incremental capacity expansions by Occidental, Shintech, and Formosa, three of the larger-firms in the industry, serve to deter both potential new entry into mass and suspension PVC homopolymer production, and possible larger expansion by smaller mass and suspension PVC producers who might otherwise have sought to attain increased market share.

298. [##] (Goodrich, slip op. at 36 n. 85 (DiLiddo Dkt. 9159, 3151-53; Dkt. 9159 CX 51Z2, Z16 *In Camera*; Dkt. 9159 CX 47B; Dkt. 9159 CX 226I-M)). [##] (DiLiddo Dkt. 9159, 3151-53; Dkt. 9159 CX 51Z2, Z16 *In Camera*; Dkt. 9159 CX 226I-M; Dkt. 9159 CX 47B). Similarly, Occidental's strategy in its planned expansion of its Pasadena plant is to "maintain its position as the recognized market leader" (RX 1L).

299. Industry members recognize that entry into the relevant markets is difficult (Goodrich, slip op. at 36). In developing its preemptive strategy, Goodrich concluded that "[r]elatively high barriers to entry should prevent a large number of expansions or new entries" (Goodrich, slip op. at 36; Dkt. 9159 CX 199Z76; *See also* Dkt. 9159 CX 199Z82). [##] (Dkt. 9159 CX 248E *In Camera*).

300. [##] (Goodrich, slip op. at 36; Goodrich ID at 92; Kaserman Dkt. 9159, 2341-44; Dkt. 9159 CX 664G-W *In Camera*).[21]

301. Three important factors made entry and expansion easier in mass and suspension PVC during the 1970's than exist at present. First, during the 1970's the industry substantially converted from small to large reactor technology (Disch Dkt. 9159, 637-42). New firms entering with modern large reactor plants had a cost advantage over those incumbent firms with old small reactor facilities (Kaserman Dkt. 9159, 2344). Second, extensive EPA and OSHA regulation of the PVC industry was instituted during the 1970's (Goodrich, slip op. 32 n.76; Disch Dkt. 9159, 698-53). One effect of these regulations was to force some plants to shutdown, and to temporarily reduce the effective capacity of many other plants (Disch Dkt. 9159, 652-53; Dkt. 9159 CX 447J; Dkt. 9159 CX 505T; DS Admission 439, Dkt. 9159 CX 6R; Goodrich Admission 396, Dkt. 9159 CX 4Z23). This reduction of capacity created opportunities for new entry and construction of new plants by incumbent firms (Kaserman Dkt. 9159, 2344-45; Klass Dkt. 9159, 5355). Finally, demand for PVC grew rapidly during the 1970's, and this rapid growth created opportunities for entry and for construction of new plants by incumbent firms (Kaserman Dkt. 9159, 2344-45).

302. The conditions that facilitated entry in the 1970's have changed drastically during the 1980's, making entry more difficult. The large reactor technology has become widely diffused through the industry (Goodrich F 198; Klass Dkt. 9159, 5488-89; *See* generally Disch Dkt. 9159, 637-428). Furthermore, the rate of technological change in PVC has become slow, as PVC manufacturing technology has approached its limitations (Goodrich F 197, 232; Dkt. 9159 CX 642Z50-51). Thus, a firm presently seeking to enter any of the relevant markets through new-plant construction would not have a technological or cost advantage over incumbent firms. Moreover, PVC firms have adjusted to the imposition of environmental and safety regulations, and current and planned capacity is sufficiently geared to meet demand (Goodrich F 232; Disch Dkt. 9159, 649-51;

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[21] [##] (Goodrich F. 70 & n. 15, F. 56; CX 318A,D *In Camera*; Liao Dkt. 9159, 1519-22; Dkt. 9159 CX 308D-E; Dkt. 9159 CX 333A; Dkt. 9159 CX 354B).

Dkt. 9159 CX 642Z6, Z49-Z137). Finally, demand growth is slow compared to the 1970's, making entry more difficult (Goodrich F 232, 235-36; CPF 272-278). These changed conditions thus help to explain the lack of *de novo* entry since the mid-1970's (Kaserman Dkt. 9159, 2345-47).

H. Barriers to New Entry into PVC Production

303. As the Commission stated in Goodrich, more stringent environmental regulations not only increase the lead time required for new entry into PVC production, but also "may be characterized as a barrier to entry into the PVC market" (Goodrich, slip op. at 35). The difficulty that a new entrant would have in obtaining permits "represent a new cost that incumbent firms did not have to bear" (*Id.*).

I. Entry into the Suspension PVC Copolymer Market Through Conversion of an Existing Suspension PVC Homopolymer Plant Is Unlikely

304. An existing producer of suspension PVC homopolymer would have little advantage relative to other firms in attempting to enter the suspension PVC copolymer market (Flammer CX 184D ¶ ¶ 6-7; Disch JX 3, PX 8 at 86 ln. 5-23). [##] (Hill CX 183C ¶ 5 *In Camera*; Flammer CX 184C ¶ 5; Fisher CX 208D ¶ 4; Disch JX 3, PX 8 at 68 ln. 14-22; Lull JX 1, 509 ln. 9-510 ln. 13).

305. The minimum efficient size of a suspension PVC copolymer plant converted from a suspension PVC homopolymer plant would be approximately 70-80 million pounds of capacity (Disch JX 3, PX 8 at 67 ln. 3-9).

306. In the suspension PVC copolymer market, a minimum efficient scale of 70 to 80 million pounds would be significant (Kaserman JX 1, 327 ln. 25-328 ln. 8). [##] (Goodrich, slip op. at 41; Kaserman JX l, 328 ln. 9-18; *See* Boyer CX 185G ¶ 16; Hill CX 183B ¶ 3 *In Camera*; Hornack CX 182C ¶ 7 *In Camera*).

307. [##] (Hornack CX 182C ¶ 7 *In Camera*; Hill CX 183F ¶ 16 *In Camera*; Boyer CX 185G ¶ 16; Flammer CX 184D ¶ 7; JX 3, PX 6 at 82 ln. 11-23; JX 3, PX 8 at 18 ln. 7-15; JX 3, PX 98 at 40885). This projected decline makes it unlikely that a suspension PVC homopolymer producer would enter the suspension PVC copolymer

market (Kaserman 329 ln. 13-17; Boyer CX 185G ¶ 16; Flammer CX 184D ¶ 7; JX 3, PX 8 at 89 ln. 16-90 ln. 2; Schaefer JX l, 585 ln. 21-586 ln. 14; JX 3, PX 136 at 91 ln. 24-92 ln. 20).

308. Air Products exited the suspension PVC copolymer market because the size of the market was insufficient, in light of the existing capacity and projected decline in demand, to allow Air Products "to produce and sell a sufficient volume of suspension copolymer resin to cover its production costs at the Calvert City plant" (Fisher CX 208B ¶ 2).

309. [##] (Hornack CX 182A ¶ 2 *In Camera*), [##] (Hornack CX 182A-B ¶ 4 *In Camera*). [##] (Hornack CX 182D ¶ 8 *In Camera*). [##] (Fisher CX 208C ¶ 3; *See* Boyer CX 185G ¶ 7; Hill CX 183B ¶ 4 *In Camera*; Flammer CX 184D ¶ 6). [##] (CX 114 *In Camera*). [##] (Disch CX 219E *In Camera*). Tenneco does not shift capacity between suspension PVC homopolymer and suspension PVC copolymer in response to changes in the relative prices of the two resins (Disch JX 3, PX 8 at 32 ln. 7-11). The production of these resins are "two distinct situations" (*Id.*).

310. [##] (Disch CX 219D *In Camera*). [##] (Hornack CX 182D ¶ 8 *In Camera*; Fisher CX 208C ¶ 3). [##] (Fisher CX 208C ¶ 3; Hornack CX 182D-E ¶ 9 *In Camera*). Mr. Boyer agreed that contamination problems would reduce the value of the plant output relative to what would be experienced in a plant that had dedicated capacity (Boyer CX 185G ¶ 15).

311. [##] (CX 126C *In Camera*). [##] (CX 72 *In Camera*; CX 61B *In Camera*). [##] (CX 61B *In Camera*). [##] (CX 125 *In Camera*). [##] (CX 126E *In Camera*). Armstrong, perhaps the largest purchaser of suspension PVC copolymer, would not purchase copolymer resin from a supplier that produced resin on an "intermittent basis" throughout the year, because it is "interested in long-term stable consistent sources of supply" (Beveridge JX l, 85 ln. 1-7).

312. [##] (Hornack CX 182D ¶ 8 *In Camera*). [##] (Hornack CX 182D ¶ 8 *In Camera*). [##] (Hornack CX 182D ¶ 8 *In Camera*). Mr. Fisher testified that even with thorough cleaning of the reactors, a process which would require shut down of the reactors for a number of days, it is was likely that contamination problems could never be completely avoided (Fisher CX 208C-D ¶ 3). Thus, he noted that frequent swinging of capacity would reduce overall reactor

productivity, resulting in increased production costs (Fisher CX 208D ¶ 3). He further testified that making infrequent switches between copolymer and homopolymer, in an attempt to reduce the cost of swinging, would not likely present a less costly alternative, noting the additional significant inventory carrying and dedicated storage costs (Fisher CX 208D ¶ 3).

313. Mr. Schaefer, an Occidental Vice-President, testified regarding the likelihood of entry through conversion of existing homopolymer facilities. Mr. Schaefer stated that Occidental would not consider reopening a shut-down PVC facility at Perryville, Maryland, to produce suspension copolymer resin, even if the price would increase three or four cents a pound and stayed at that level for a year (Schaefer JX l, 585 ln. 21-586 ln. 1). This is the exact question the *DOJ Merger Guidelines* asks to assess the likelihood of entry. *DOJ Merger Guidelines, supra*, Section 3.3, 2 Trade Reg. Rep. (CCH) ¶ 4493 at 6879-15. In addition to the one-year period in which Occidental would not even consider entry, there must be added the additional time it would take to enter at Perryville, if Occidental should ever consider it. Mr. Schaefer testified that it would take 18 months to get the shut-down plant up and running, and would take two to four years to find a market for the output of the plant (Schaefer JX 1, 585 ln. 9-15). Under any set of circumstances, the time for entry -- if Occidental were to change its mind and consider entry -- would extend beyond the two-year period set forth in the *DOJ Merger Guidelines, supra,* Section 3.3.

314. [##] (Schaefer JX 1, 585 ln. 21-586 ln. 4; *See also* Flammer CX 184D ¶ 7 *In Camera*). This is consistent with the statement in the *DOJ Merger Guidelines*: "Entry is generally facilitated by the growth of the market and hindered by its stagnation or decline." *DOJ Merger Guidelines, supra,* Section 3.3 n.21, 2 Trade Reg. Rep. (CCH) ¶ 4493 at 6879-15.

315. Mr. Schaefer also testified that Occidental would not convert additional capacity to copolymer at Pottstown, Pennsylvania, where Occidental presently produces copolymer (Schaefer JX 1, 586 ln. 24-587 ln. 3). The reason advanced for not converting additional capacity at Pottstown was again because no additional market existed for the product (Schaefer JX l, 587 ln. 2-6).

316. Mr. Schaefer also testified generally as to the likelihood of entry into copolymer. He concluded that there was no scale at which a company could profitably enter copolymer as long as the outlook for consumption continued to be one of negative growth (Schaefer JX 1, 587 ln. 7-11). Entry at any scale would have too much of a depressing effect on price (Schaefer JX 1, 587 ln. 12-14; *See also* Harris JX 1, 902 ln. 6-15; Flammer CX 184D ¶ 7; *See* Goodrich, slip op. at 41).

317. Mr. Schaefer's testimony is supported by the testimony of other PVC producers. Air Products is one producer identified by Occidental as having previously had suspension PVC copolymer capacity. Mr. Fisher testified that an increase of less than 30-50% in the price of suspension PVC copolymer, relative to the price of suspension PVC homopolymer, would not induce Air Products to consider entry into the copolymer market (Fisher CX 208C ¶ 3). Similarly, Mr. Boyer of Formosa testified that a 10-percent increase in the price of copolymer resin would not induce Formosa to enter the market (Boyer CX 185G ¶ 16). Formosa's Delaware City plant had previously been used by Stauffer Chemical in the production of copolymer resin (Boyer CX 185G ¶ 15). Mr. Boyer testified that entry by Formosa would, because of the small size of the market, and the declining demand for copolymer resin, create excess supply of resin and drive the market price of the resin down to an unprofitable level (Boyer CX 185G ¶ 16). [##] (Hornack CX 182C ¶ 7 *In Camera*). *See* generally Goodrich, slip op. at 41.

318. [##] (CX 210C *In Camera*). [##] (CX 210D *In Camera*),

319. Long-term, fixed-price contracts between potential entrants and prospective customers, or backward-integration by suspension PVC copolymer customers, would not solve the problem of lack of profitability of entry. Entry would expand the available supply of suspension PVC copolymer in the market, and would drive the post-entry price down to unprofitable levels, notwithstanding the profits currently realized by incumbent firms in the market. PVC customers who have signed a long-term, fixed-price contract to induce entry would be at a severe disadvantage compared with their competitors. For this reason, fixed-price contracts are not observed in the suspension PVC copolymer market (Kaserman JX 1, 340 ln. 5-342 ln. 16).

320. The construction time required for conversion of a suspension PVC homopolymer plant to suspension PVC copolymer production would be approximately 9-10 months, if the plant, or part of the plant being converted, were shut down during such construction *(See e.g.*, JX 3, PX 8 at 66 ln. 18-25 ; Lull JX l, 517 ln. 7-14; JX 3, PX 98 at 40891, 40909; Schaefer 585 ln. 1-12). [##] (Hill CX 183C-D ¶ 7 *In Camera*). [##] (Hill CX 183D ¶ 7 *In Camera*).

321. The time required for conversion of a suspension PVC homopolymer plant to suspension PVC copolymer production would also include the time required for ordering the necessary equipment. That time would involve at least three to four months (JX 3, PX 8 at 69 ln. 20-70 ln. 1).

322. The time for planning and making the decision with respect to the conversion of a suspension PVC homopolymer plant to suspension PVC copolymer could take as long as two years (JX 3, PX 8 at 76 ln. 20-77 ln. l, 78 ln. 9-12).

323. New environmental permits, which would add to the lead time required for entry, may also be required, due to the addition of the vinyl acetate in the suspension polymerization process (Goodrich, slip op. at 32-33 & n. 76; *See e.g.*, Lull JX l, 532 ln. 11-533 ln. 9; JX 3, PX 8 at 77 ln. 24-78 ln. 8; JX 3, PX 98 at 40891). [##] (Hill CX 183C ¶ 6 *In Camera*). [##] (CX 5D-E *In Camera*). [##] (Lull JX 1, 533 ln. 3-9; *See* Hill CX 183C ¶ 6 *In Camera*).

324. It would take a total of two to two and one-half years, including equipment-ordering lead time and environmental permitting, to convert a suspension PVC homopolymer plant to the production of suspension PVC copolymer resin (Flammer CX 184D-E ¶ 8; *See* JX 3, PX 25 at 9, 15, 24 (projects with capital expenditures greater than one million dollars required a minimum of three years, as many as four, from the date of the initial proposal to completion of the project); Schaefer JX l, 585 ln. 1-17). Essentially only the reactors, boilers, and other infrastructure could be used (Flammer CX 184E ¶ 8).

325. Further, after completion of the physical conversion of the plant, at least 3 to 6 months of trial production operations would be required before a marketable copolymer resin could be produced (Flammer CX 184E ¶ 8).

326. Customer approval of a resin would be required before the copolymer could be sold, which could increase the lead time for entry by a period of three months to over one year (Beveridge JX l, 84 ln. 16-25; JX 3, PX 8 at 70 ln. ll-71 ln. 2; *See* Friedman JX l, 129 ln. 7-14). The intention on the part of a copolymer producer to produce both copolymer and homopolymer in the same plant facilities, at different times, could discourage potential customers from even qualifying that producer (Beveridge JX l, 85 ln. 1-4).

327. The long lead time required for conversion of a suspension PVC homopolymer plant to copolymer production increases the potential for and duration of anticompetitive conduct in the suspension PVC copolymer industry (Kaserman JX l, 324 ln. 24-325 ln. 14; *See* Goodrich, slip op. at 31).

328. [##] (Fisher CX 208D-E ¶ 4; Hill CX 183C ¶ 5 *In Camera*; Hornack CX 182C ¶ 6-7 *In Camera*; *See* Lull JX l, 550 ln. 10-17; JX 3, PX 98 at 4010-11; JX 3, PX 8 at 70 ln. 2-9; CX 51 *In Camera*). The most significant portion of this investment would go to the installation of a recovery system designed to recover mixed streams of VCM and vinyl acetate monomer (VAM) (Fisher CX 208D-E ¶ 4). The type of recovery system used to recover these mixed streams is different from the type of recovery system that would be- used to recover only VCM (Fisher CX 208D-E ¶ 4). [##] (CX 5D-E *In Camera*). These capital investments could not be recovered if entry by conversion of a suspension PVC homopolymer plant proved unsuccessful (JX 3, PX 8 at 71 ln. 3-7). This sunk cost further reduces the likelihood of entry by conversion into suspension PVC copolymer production (Goodrich, slip op. at 41-42, n.96).

329. [##] (Hill CX 183C-D ¶ 7 *In Camera*, CX 183B-C ¶ 4; Fisher CX 208C-D ¶ 3; Flammer CX 184D ¶ 6; JX 3, PX 6 at 76 ln. 21-78 ln. 3; JX 3, PX 8 at 71 ln. 8-72 ln. 6; Kaserman 327 ln. 18-328 ln. 18). Mr. Lull testified to the technical problems that some PVC producers have had in attempting to produce copolymer resin (Lull JX l, 534 ln. 16 - 535 ln. 15). Mr. Boyer noted that the production of suspension PVC copolymer by Stauffer Chemical at the Delaware City plant had an overall negative impact on plant operations at the plant, because of inter-product contamination, and because of the corrosive effect of vinyl acetate on plant equipment (Boyer CX 185G ¶ 15). [##] (Boyer CX 185G ¶ 15; *See also* Hill CX 183B-C ¶ 4 *In*

Camera). Formosa has explained to one copolymer customer that it stopped manufacture of copolymer resin because of "the problems of manufacturing copolymer resin" (CX 121; *See also* CX 122).

330. [##] (Hornack CX 182D ¶ 8 *In Camera*). Mr. Fisher noted that any production of suspension PVC copolymer at Air Products' Calvert City plant would result in a reduction in total plant production capacity of 20-30 percent (Fisher CX 208D ¶ 3). The cost of a reduction in homopolymer sales increases as the price of homopolymer increases relative to the price of copolymer, as it has over the past year. Thus, the effect on overall plant operations and the opportunity cost of forgone homopolymer sales reduce the likelihood of entry into the suspension PVC copolymer market through conversion of a suspension PVC homopolymer plant (JX 3, PX 6 at 76 ln. 21-78 ln. 3; Harris JX 1, 896 ln. 16-22).

331. As a result of the significant minimum efficient size required, the declining copolymer demand, the magnitude of the sunk costs, the lead time required for entry, and the effect of entry on overall plant operations and production capacity,[22] entry into the suspension PVC copolymer market through conversion of all or a portion of a suspension PVC homopolymer plant is unlikely to occur in response to non-competitive pricing in the suspension PVC copolymer market (Kaserman JX 1, 342 ln. 17-343 ln. 5, 344 ln. 3-7; *See* JX 3, PX 8 at 89 ln. 16-90 ln. 2; *See* generally Goodrich, slip op. at 31-43).[23]

J. Entry into the Dispersion PVC Through Conversion of an Existing PVC Plant Is Unlikely

332. An existing producer of suspension PVC would have very little advantage relative to firms not in the PVC industry in attempting to enter the dispersion PVC market (Flammer CX 184D ¶ ¶ 6-7; Disch JX 3, PX 8 at 86 ln. 5-23).

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[22] [##] (CX 210 F-H *In Camera*). [##] (Compare Lull JX 1, 516 ln. 5-24 with CX 51 *In Camera*).

[23] The Ashtabula, Ohio PVC plant purchased by Vygen Corp. from GenCorp, Inc., was already configured to produce, and was used by GenCorp to produce, suspension PVC copolymer resin (Kaserman 470 ln. 13-471 ln. 21).

333. Entry into the dispersion PVC market through conversion of existing suspension PVC capacity would involve primarily the addition of a spray dryer, which is substantially different and more powerful than the dryer used to manufacture suspension resin, grinding equipment for reducing the size of the dispersion PVC particles, different VCM stripping equipment and specialized packaging and conveyance equipment (Boyer CX 185B-C ¶ 3,¶ 5; Flammer CX 184C ¶ 4-5, 184E ¶ 8 ("Essentially only the reactors, boilers and other infrastructure could be used."); JX 3, PX 8 at 811 ln. 9-18).

334. The minimum efficient size of a dispersion PVC plant would depend on the capacity of the spray dryer that would be added (JX 3, PX 8 at 82 ln. 4-14). A spray-dryer is a major capital investment in a dispersion PVC plant (Boyer CX 185C ¶5). It is likely that a dispersion PVC plant created through conversion of former suspension PVC capacity would be scaled at such a size that it would constitute a significant percentage of total market dispersion PVC demand (*See* Boyer CX 185D ¶ 7; JX 3, PX 8 at 81 ln. 1-9, 82 ln. 4-14, 73 ln. 22 - 74 ln. 13).

335. Entry into the dispersion PVC market at a large scale, through conversion, would be likely to have a depressing effect on prices, and, accordingly, entry through such conversion is unlikely (Goodrich, slip op. at 41; Kaserman JX 1, 328 ln. 9-18; *See* JX 3, PX 8 at 119 ln. 7-120 ln. 16).

336. It is projected that, over the next five years, the demand for dispersion PVC will be flat (Flammer CX 184D ¶ 7; Boyer CX 185E ¶ 10; JX 3, PX 8 at 80 ln. 9-81 ln. 2; JX 3, PX 9 at 100 ln. 24-101 ln. 8). The projected flat demand makes it unlikely that a suspension PVC homopolymer producer will, through plant conversion, enter into the dispersion PVC market (Flammer CX 184D ¶ 7; JX 3, PX 9 at 100 ln. 24-101 ln. 8; JX 3, PX 136 at 96 ln. 10-21; Schaefer JX 1, 587 ln. 15-20; *See* Kaserman JX 1, 338 ln. 6-13).

337. The time required for conversion of a suspension PVC homopolymer plant to dispersion PVC production would be at least two to two and one half years (Boyer CX 185D-E ¶ 6; Flammer CX 184D-E ¶ 8; JX 3, PX 136 at 97 ln. 20-24).

338. [##] (Flammer CX 184E ¶ 8; *See* van Haaren CX 187D ¶ 13-14 *In Camera*).

339. A suspension PVC producer converting a plant would also be required to develop a research and development operation, and obtain customer approval for its resin (Boyer CX 185C-D ¶ 8; Flammer CX 184D-E ¶8; JX 3, PX 8 at 82 ln. 19-83 ln. 7). [##] (van Haaren CX 187D ¶13-14 *In Camera*; Boyer CX 185E ¶9; Flammer CX 184D-E ¶8; JX 3, PX 9 at 56 ln. 22-57 ln. 8; Beveridge JX 1, 89 ln. 4-10; JX 3, PX 8 at 83 ln. 8-13; *See* Friedman JX l, 129 ln. 7-14). Mr. Boyer noted that it would take 6 months to a year before a converted plant could produce high quality dispersion resin (Boyer CX 185E ¶9).

340. The capital cost of converting a suspension PVC plant to dispersion PVC would range from $20-$30 million (Disch JX 3, PX 8 at 81 ln. 19-21). A large portion of this capital investment would be for the installation of spray-dryers, equipment specialized to the production of dispersion PVC (Disch JX 3, PX 8 at 84 ln. 1-9; Boyer CX 185C ¶5). This investment would not be recovered if entry by conversion of a suspension PVC plant proved unsuccessful (Disch JX 3, PX 8 at 84 ln. 1-9). This sunk cost would increase the riskiness of an investment by a suspension PVC producer in converting a plant to the production of dispersion PVC, thus reducing the likelihood of such entry (Goodrich, slip op. at 41-42, n.96; Kaserman JX l, 331 ln. 18-22).

341. A suspension PVC producer would also have to consider the cost of loss of use of the plant during construction (Disch JX 3, PX 8 at 71 ln. 21-72 ln. 5). This cost and the loss of suspension PVC production, and sales attributable to the plant capacity that is withdrawn from suspension PVC use, reduces the attractiveness of conversion of a suspension PVC plant to dispersion PVC, thus further reducing the likelihood of such entry (*See* Kaserman JX 1, 337 ln. 19-338 ln. 5). The cost of lost suspension output increases as the price of suspension PVC resin increases relative to the price of dispersion PVC resin, as it has over the last year.

342. As a result of the significant minimum efficient size required, the declining dispersion PVC demand, the significant lead time required for entry, and the magnitude of the sunk costs and opportunity costs, entry into dispersion PVC through conversion of a suspension PVC plant is unlikely in response to non-competitive

pricing in the dispersion PVC market (Goodrich, slip op. at 31-43; Kaserman JX 1, 342 ln. 17-343 ln. 5, 344 ln. 3-7).

K. Entry Through Restart of Shutdown PVC Plants Is Unlikely

343. It is respondents' contention that non-competitive pricing in the relevant PVC markets would likely be defeated by the restart of shutdown PVC facilities. It is unlikely, however, that these plants would be restarted for such purpose.

344. [##] (RX 1N *In Camera*).

345. In a market that is competitive, one would expect that idle plants would be brought on stream were it economical to make the required investment. Occidental, in 1985, studied the possibility of restarting its Perryville, Maryland plant (JX 3, PX 136 at 79 ln. 11-19). At that time, it decided that restart of the plant would not be economical (JX 3, PX 136 at 79 ln. 14-16). Mr. Schaefer testified that the cost of refurbishing the plant would be high, and that "the manufacturing economics there would have not been competitive . . ." (JX 3, PX 136 at 79 ln. 20-24). [##] (CX 100O).

346. [##] (CX 43L; Pflugrath CX 177F ¶ 11 *In Camera*; Donnelly CX 176D-E ¶5 *In Camera*; *See* RX 198B *In Camera*).

347. [##] (Donnelly CX 176D-E ¶5 *In Camera*; CX 43K-L). [##] (*See* Goodrich, slip op. at 32-34; Donnelly CX 176D-E ¶ 5 *In Camera*; *See* CPF 296). The capital investment that would be required in order to bring these plants on stream is an important factor affecting the likelihood of their re-opening (CX 43L).

348. Other than plants owned by Occidental or Goodrich, the shutdown PVC plants identified by Occidental as potential restarters are, in fact, in the process of being dismantled, or are planned soon to be dismantled.

349. [##] (Taylor CX 181C *In Camera*). [##] (Taylor CX 181D *In Camera*). [##] (Taylor CX 181B *In Camera*). [##] (Taylor CX 181C *In Camera*). [##] (Taylor CX 181D *In Camera*). [##] (*See* Taylor CX 181C-D *In Camera*).

350. Borden has dismantled its Leominster, Massachusetts, site, and has transferred equipment from there to other Borden operations throughout the United States (Standly CX 186). It is offering the site for sale as real estate (Standly CX 186). [##] (RX 1N *In Camera*).

351. Of the shutdown plants identified by Occidental, the only plants not already being dismantled are owned by Occidental and Goodrich, respectively. Assuming arguendo these plants could be returned to production, the fact remains that Goodrich and Occidental are currently keeping these plants idle notwithstanding skyrocketing PVC prices and supply allocation by PVC producers. Accordingly, the plants are not likely to be a source for defeating collusive price increases in the industry. One cannot rely on the restart or sale to third parties of idle plants by the leading PVC producers to serve the purpose of new entry (*Cf.* Kaserman, Dkt. 9159, 2947-49, 2891-92, 2963-64). Indeed, as the Commission noted in Goodrich, "restarting mothballed capacity will usually constrain the pricing discretion of incumbent firms only if undertaken by a fringe firm that is not likely to be a party to a collusive arrangement" (Goodrich, slip op. at 42, n.97).

352. It is therefore found that it is unlikely that the restart of idle PVC resin plants will deter or defeat non-competitive pricing in any of the relevant markets.

L. The Potential for Capacity Expansions Does Not Deter Non-competitive Pricing in the Relevant Markets

353. Respondents contend that the potential for new entry through capacity expansion is likely to deter or defeat an attempted exercise of market power in any of the relevant markets.

354. However, capacity expansion is not analogous to new entry, and thus the plant expansions currently being undertaken by a number of PVC producers are not properly analogized to new entry that would thwart an attempted exercise of market power (Goodrich, slip op. at 35). [##] (*See, e.g.*, Pflugrath CX 177F ¶ 11 *In Camera*; Heath CX 178E ¶ 8 *In Camera*). Indeed, capacity expansion by firms already in the relevant markets may deter new entry that would otherwise reduce market concentration. *See* Spence, *Entry, Capacity, Investment and Oligopolistic Pricing*, 8 Bell J. of Econ. 53 (1977). Thus, one cannot rely on expansions by incumbent firms to serve the same purpose as new entry (Goodrich, slip op. at 35; Kaserman Dkt. 9159, 2947-49, 2891-92, 2963-64).

355. The *DOJ Merger Guidelines* recognize that expansion is, in almost all circumstances, not equivalent to new entry. The *DOJ Merger Guidelines* consider expansion equivalent to new entry only in those situations where "fringe firms in the market greatly expand existing capacity." *DOJ Merger Guidelines* Section 3.3 n.20, 2 Trade Reg. Rep. (CCH) ¶4,493 at 6879-15. Clearly this circumstance does not apply in any of the relevant markets.

356. That capacity expansion is not analogous to new entry that would erode or deter non-competitive pricing in the relevant PVC markets is illustrated by the nature of the expansion activity currently being undertaken by PVC producers. Some of the largest producers such as Shintech and Occidental have announced large additions to capacity. Formosa has also announced a relatively large capacity expansion, noting at the same time that it hopes it is doing the expansion "in such a way as not to stir the marketplace up" (CX 165B). Similarly, Vista has noted its intention to make capacity expansions that would match market growth, so as to maintain a constant market share (CX 166).

357. Thus, expansion of PVC capacity is not being undertaken by producers in the relevant markets in order to obtain a larger share of the market, but merely to accommodate expected demand growth and maintain full capacity utilization levels (RX IR). [##] (CX 43C; Donnelly CX 176C-D ¶ 4 *In Camera*; Heath CX 178E ¶ 8 *In Camera*; Kulkaski CX 195C ¶ 4 *In Camera*; Pflugrath CX 177F ¶ 11 In Camera).

358. Finally, expansion by existing PVC producers is likely to be difficult and take a long time. Construction of new plants by incumbent firms involves the same obstacles of large minimum efficient scale, high sunk costs, and long lead times as for potential new entrants. An incumbent firm may be able to bring a new plant on stream slightly faster because it may already have the technology and may have an existing and usable site.

359. Smaller expansions of existing plants ("debottlenecking" projects), which generally result in a relatively small addition to industry capacity, and hence do not have a significant competitive effect, can also involve a substantial period of time. For example, there was testimony in the Goodrich proceeding that a plant expansion by Shintech took approximately two years, with unknown

additional time for planning and permitting (McMath Dkt. 9159, 1940).

360. Thus, it is not likely that expansion by existing PVC producers would defeat or deter non-competitive pricing in any of the relevant PVC markets (Goodrich, slip op. at 35).

VIII. OTHER QUALITATIVE FACTORS NEEDED TO EVALUATE THE LIKELIHOOD OF COLLUSION IN EACH OF THE RELEVANT MARKETS

A. *Because Demand for PVC in Each of the Relevant Markets Is Inelastic, PVC Producers Have a Strong Incentive to Raise Prices Above Competitive Levels*

1. Introduction

361. The fact that mass and suspension PVC, suspension PVC copolymer, and dispersion PVC are each relevant product markets means that demand for each of the relevant products is sufficiently inelastic that firms could profit if they coordinated their actions and engaged in collusion. In other words, if PVC producers in any of the relevant markets increased price by a small but significant and nontransitory amount, the increase in profits due to the higher price would more than offset the decrease in profits due to lower sales (Kaserman JX 1, 252-54).

362. [##] (Goodrich, slip op. at 19-20, 75; Becker Dkt. 9159, 1325-26; Schaefer Dkt. 9159, 1141; Kaserman JX 1, 257, 260-62, 269, 270-71, 345, 357; Kaserman Dkt. 9159, 2381; *accord*, Dkt. 9159 CX 297Z1-Z2 *In Camera*; Dkt. 9159 CX 295Z53-Z54 *In Camera*). The price inelasticity of demand for each of the relevant products increases the incentive to collude in each of the relevant markets (Kaserman JX 1, 345, 357; Kaserman Dkt. 9159, 2353-55, 2381; *See* Goodrich slip op. at 70-71).

363. The price elasticity of demand is the percentage change in the quantity demanded for a product divided by the percentage change in the price of the product (Goodrich slip op. at 70 & n.156; Kaserman JX 1, 254; Kaserman Dkt. 9159, 2348-49). It is a measure of the responsiveness of consumers to changes in the price (Kaserman JX 1, 254; Kaserman Dkt. 9159, 2349). The degree to which demand for a product is elastic or inelastic is a function of the extent

to which other products are close substitutes for the product at a particular price (*See* Kaserman JX 1, 254; Kaserman Dkt. 9159, 2350-51). The more customers will shift to other products for a given price increase, the more elastic is demand. Conversely, to the extent that customers do not switch to other products for a given price increase, the less elastic (or more inelastic) is demand.

364. The lower the elasticity of demand for a product, the more an industry would profit from a price increase resulting from collusion (Kaserman JX 1, 345; Kaserman Dkt. 9159, 2353-55; *See* Goodrich, slip op. at 70-71). The lower the price elasticity of demand, the smaller is the restriction in output necessary to cause a given increase in industry prices (Klass Dkt. 9159, 4268; *See* Kaserman JX 1, 357). In other words, when demand is price inelastic, a small cutback in output or sales by a collusive group will lead to a significant increase in price.

365. In estimating the price elasticity of demand for the relevant PVC products, it is important that each of these is an intermediate (or input) product rather than a consumer good (Goodrich F 95; Goodrich, slip op. at 71-72; Kaserman JX 1, 260, 70; Kaserman Dkt. 9159, 2369). The price elasticity of demand for an intermediate product is a function of three factors: (1) the ease of substitutability between the intermediate product and other inputs in the production of the final product; (2) the cost share of the intermediate product in the production of the final products; and (3) the price elasticity of demand for the final products produced from the intermediate product (Goodrich, slip op. at 72; Kaserman JX 1, 260, 270; Kaserman Dkt. 9159, 2370-71). Where there is no substitutability between the intermediate product and other inputs in the manufacture of the final product, the price elasticity of demand of the intermediate product will necessarily be lower than the price elasticity of demand for the final product (Kaserman Dkt. 9159, 2377. *See* Klass Dkt. 9159, 4267). How much lower is a function of the cost share of the intermediate product used in the manufacture of the final product (Kaserman Dkt. 9159, 2375-76).

366. Analysis of the elasticity of demand for an intermediate product is made more complicated where, as in the case of mass and suspension PVC homopolymer and the case of dispersion PVC resin, there are hundreds of end use products made from the intermediate

product (*See* Kaserman JX l, 262). The aggregate (or industry) price elasticity of demand for each of the relevant products is the weighted average of the price elasticity of demand for the resin used in each of its end uses. The price elasticity of demand for the resin used in any one end use is a function of the price elasticity of demand for the final end use product and the cost share of the PVC resin in that product. Thus, an end use segment that consumes a large amount of the relevant product is relatively more important in determining the overall elasticity of demand for the relevant product than is a segment that uses a small amount.[24]

367. Analysis of these factors shows that the price elasticity of demand for each of the relevant products is very low. First, there is no substitutability between each of the relevant products and other input products in the manufacture of final products normally made from the respective relevant product (Goodrich F 95; Goodrich, slip op. at 19-20, 72; Kaserman JX 1, 260, 270; Kaserman Dkt. 9159, 2376-77). Second, the cost share of each of the relevant products is only a portion of the total cost of the end product, and very often the proportion is quite low (Goodrich F 96; Goodrich, slip op. at 72-74; Kaserman JX l, 260, 270-71; Kaserman Dkt. 9159, 2375). Third, the elasticity of demand for final products made from each of the relevant products is low (Goodrich F 97-98; Goodrich, slip op. at 74-75; Kaserman Dkt. 9159, 2373-75; Kaserman JX l, 270-71). Because there is little substitutability between each of the relevant products and other input products in the manufacture of final products, the price elasticity of demand for each of the relevant products is necessarily lower than the price elasticity of demand for the final products (Goodrich F 96; Kaserman Dkt. 9159, 2377. *See* Klass Dkt. 9159, 4267). The price elasticity of demand for each of the relevant products is significantly less than the price elasticity of demand for the final products due to the low cost share of mass and suspension PVC in many final products (*See* Goodrich F 96; Goodrich, slip op. at 74).

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[24] *In Camera* [##] (Waggoner Dkt. 9159, 3620-21; CX 756Z20; RX 165E *In Camera*). Furthermore, municipal water pipe in small diameters of 4, 6, and 8 inches may be more important in terms of volume demanded than large diameter municipal water pipe of 10 and 12 inches.

2. Mass and suspension PVC homopolymer

a. There is no substitutability of other inputs for mass and suspension PVC homopolymer

368. There are no substitutes for mass and suspension PVC homopolymer in the manufacture of mass and suspension PVC end use products (Goodrich, slip op. at 19, 72, 75; Goodrich F 95; Kaserman Dkt. 9159, 2376-77; Kaserman JX l, 260, 270). Generally, PVC resin is the primary raw material input and imparts essential properties to the product (Goodrich, slip op. at 72; Goodrich F 95. *See* H. Wheeler Dkt. 9159, 1751-52). The fabrication process is essentially one of giving the product its necessary shape (Goodrich F 95; *See* Disch Dkt. 9159, 661-662). Furthermore, in many cases, the fabrication equipment for mass and suspension PVC products can process only mass or suspension PVC resins (Goodrich, slip op. at 19-20, 72; Goodrich F 95; H. Wheeler Dkt. 9159, 1751-52; *See* McMath Dkt. 9159, 1922-23; Disch Dkt. 9159, 663).

b. The cost share of mass and suspension PVC homopolymer in many end-use products is low

369. Mass and suspension PVC homopolymer accounts for only a portion of the cost of the finished products made from these resins. Value is added to the PVC resin at several stages in the production of the final PVC end product. First, all mass and suspension PVC homopolymer resins are compounded before they are processed (Goodrich, slip op. at 72; Disch Dkt. 9159, 655-56). Compounding involves mixing the resin with various additives, which may include heat and light stabilizers, impact modifiers plasticizers, and pigments (Goodrich, slip op. at 72-73 & n.l62; Disch Dkt. 9159, 656-57; *See* Goodrich F 96). The amount of value added at the compounding stage varies. For example, flexible compounds require the addition of plasticizers while rigid compounds do not (*See* Goodrich at 72-13 & n.l62; Goodrich F 96; Disch 657-58). As a result of the addition of plasticizers and other additives, flexible compounds may contain no more than 50 to 70 percent resin by weight (*Id.*; *See* Disch Dkt.

9159, 659; DiLiddo Dkt. 9159, 3377; Becker Dkt. 9159, 1308-09). Rigid compounds that require special additives, like UV (ultraviolet) stabilizers for siding or impact modifiers for bottles, are more costly than pipe compounds (*See* Goodrich F 96; Disch Dkt. 9159, 660; Becker Dkt. 9159, 1300). Second, mass and suspension PVC compounds are converted into fabricated products through various production processes that include extrusion, calendering, blow-molding, injection-molding, and compression-molding (Goodrich, slip op. at 72; Goodrich F 96; Disch Dkt. 9159, 661-662). Once again, the value added varies with each PVC product (*See* Goodrich, slip op. at 72-75; Goodrich FF 96-19), for a discussion of the cost share in the various mass and suspension PVC homopolymer end products). Finally, some products must be installed before they can be used. For products such as pipe, siding, and windows, the cost share of the mass and suspension PVC homopolymer resin is a very small portion of the total installed cost of the finished PVC product (*See* Goodrich, slip op. at 73-74 & n.164; Goodrich FF 163, 168, 178). The low cost share of mass and suspension PVC homopolymer resin in end products means that the demand for mass and suspension PVC homopolymer resin is significantly less elastic than the demand for the end products themselves (*See* Goodrich F 96; Goodrich, slip op. at 74; Kaserman Dkt. 9159, 2375-78; Kaserman JX 1, 260, 270).

c. The price elasticity of mass and suspension PVC homopolymer end-use products is low

370. [##] (*See* Goodrich F 97; Goodrich, slip op. at 73-74; Disch Dkt. 9159, 663-80; Becker Dkt. 9159, 1268-1325; H. Wheeler Dkt. 9159, 1727-28, 1753; Dkt. 9159 CX 591G-K *In Camera*).

371. Because mass and suspension PVC homopolymer is used in so many applications, it is difficult to generalize about why demand for mass and suspension PVC homopolymer products is inelastic and why products made out of other materials are not close substitutes. However, two major reasons can be identified. First, mass and suspension PVC homopolymer products have specific properties that distinguish them from products made from other materials (Goodrich F 98; Yu Dkt. 9159, 2118-2129; Becker Dkt. 9159, 1274-79; DiLiddo Dkt. 9159, 3348-50; Disch Dkt. 9159, 672-77). As a result, mass and

suspension PVC products are often chosen on the basis of their properties, and not on the basis of changes in the prices of the products. Second, where mass and suspension PVC products are chosen because they offer a cost savings to the purchaser, the cost savings are often so substantial that the PVC product would still be far less expensive than alterative products, even if mass and suspension PVC resin prices rose by a small but significant amount (Goodrich, slip op. at 74-75; *Id.*). Thus, customers would continue to buy the PVC product even if mass and suspension PVC resin prices would rise by a small but significant amount (*See* Kaserman JX 1, 260, 270).

(1) Pipe and pipe fittings

372. [##] (Goodrich F 99; Disch Dkt. 9159, 663; *See also* Dkt. 9159 RX 145L *In Camera*; Commission Physical Exhibit 6). PVC pipe fittings, which are used primarily in conjunction with PVC pipe (Goodrich F 99; Becker Dkt. 9159, 1323-24), account for an additional 3% to 4% of PVC resin consumption (Goodrich F 99; Disch Dkt. 9159 663; *See* Commission Physical Exhibit 7). Like other rigid applications for PVC, PVC pipe is a relatively new product, coming into commercial prominence in the late 1960's and 1970's (Goodrich F 99; Becker Dkt. 9159, 1276-78). In the mid-to-late 1960's, only about 134 million pounds of mass and suspension PVC were consumed in the pipe segment of the market (Goodrich F 99; Dkt. 9159 RX 3Z14). [##] (Goodrich F 99; Dkt. 9159 RX 165E *In Camera*; *See* generally Dkt. 9159 CX 756Z19). [##] (*See, e.g.*, Dkt. 9159 CX 244F; Dkt. 9159 CX 49K; Pflugrath CX 177B ¶ 3 *In Camera*; Heath CX 178B-C ¶ 3 *In Camera*; Wilhite CX 179A-C ¶ Z-3 *In Camera* Porter CX 198B-C ¶ 3 *In Camera*; Stuart CX 201A-C ¶ 2-5 *In Camera* Underwood CX 203B ¶ 3 *In Camera*).

373. The PVC pipe market has grown primarily because PVC pipe provides a superior package of properties that make it a substantially better pipe product than pipe made from other materials in many pipe applications (Goodrich F 100; Dkt. 9159 CX 49K; Dkt. 9159 CX 244G). [##] (Goodrich F 100 & n.21 at 27; Pflugrath CX 177B ¶ 3 *In Camera* Heath CX 178B-C ¶ 3 *In Camera*; Wilhite CX

179B-C ¶ 3 *In Camera* Porter CX 198B-C ¶ 3 *In Camera*; Alberti CX 199F-G ¶ 9 *In Camera*).

374. [##] (Goodrich F 101; Pflugrath CX 177B ¶ 3 *In Camera*; Porter CX 198B-C ¶ 3 *In Camera* Stuart CX 201C ¶ 5 *In Camera* McMath Dkt. 9159, 1924-26; Dkt. 9159 CX 591H *In Camera*; Dkt. 9159 CX 247A, L *In Camera*; Dkt. 9159 RX 958A; CPF 391; *See also* Becker Dkt. 9159, 1293-94). [##] (Goodrich F 101; Wilhite CX 179B-C ¶ 3 *In Camera* Alberti 199F-G ¶ 9 *In Camera*; Stuart CX 201B ¶ 3 *In Camera*; Dkt. 9159 CX 247A, L *In Camera*). [##] (Goodrich, slip op. at 74-75; Dkt. 9159 CX 247A *In Camera*). [##] (Dkt. 9159 CX 591H *In Camera*; *See* Goodrich F 101; *See also* Alberti CX 199F ¶ 9 *In Camera*; Wilhite CX 179A-B ¶ 2-3 *In Camera*; Dkt. 9159 CX 566D; Dkt. 9159 CX 244G).

375. PVC pipe is easier to handle and less costly to install than most other types of pipe. PVC pipe is also lighter in weight compared to most traditional pipe material (Yu Dkt. 9159, 2122-23 DiLiddo Dkt. 9159, 3347; Goodrich F 102). The light weight of PVC pipe means that it can often be installed by hand-labor, whereas heavy equipment is required to lay ductile iron pipe or cement pipe into a trench (Goodrich F 102; Stuart 201B-C ¶ 3-4; Yu Dkt. 9159, 2123-24; DiLiddo Dkt. 9159, 3347-48). PVC pipe is made in relatively long lengths compared to pipe manufactured from other materials, such as ductile iron, clay and asbestos cement (Yu Dkt. 9159, 2123-24; DiLiddo Dkt. 9159, 3347; Waggoner Dkt. 9159, 3632). Longer lengths of pipe mean that fewer joints are necessary. PVC pipe generally is joined with a bell joint or with solvents, which tends to be faster and easier than the methods for joining traditional pipe material (Goodrich F 102; Yu Dkt. 9159, 2126-27; Waggoner Dkt. 9159, 3632. *See also* Dkt. 9159 CX 377B). Because there are fewer joints and easier joining procedures, PVC pipe can often be installed more quickly than other pipe products (Goodrich F 102; Yu Dkt. 9159, 2126-27; Waggoner Dkt. 9159, 3632). [##] (Goodrich F 102; Yu Dkt. 9159, 2123-27; Dkt. 9159 CX 247A *In Camera*). [##] (*See* Dkt. 9159 CX 247A *In Camera*). Because the most important cost factor to the pipe end user is usually the total installed cost (DiLiddo Dkt. 9159, 3348; Goodrich F 102 & n.22 at 28), [##] (Dkt. 9159 RX 4V *In Camera*). [##] (Dkt. 9159 CX 566E; Goodrich F 102 & n.22 at 28; *See also* Dkt. 9159 CX 247 A *In Camera*).

376. PVC pipe is resistant to corrosion from chemicals. It will not corrode in acid, alkaline or wet soils, whereas metal pipe may rust and deteriorate (Goodrich F 103; Yu Dkt. 9159, 2121-22; DiLiddo Dkt. 9159, 3348-50; Becker Dkt. 9159, 1274). [##] (Yu Dkt. 9159, 2121-22; DiLiddo Dkt. 9159, 3348-50; Becker Dkt. 9159 1274; Goodrich F 103; *See* Pflugrath CX 177B ¶ 3 *In Camera*; Alberti CX 199F-G *In Camera*). Given the fact that the cost of installation may exceed the cost of the pipe itself, the replacement costs associated with pipe materials that corrode over time can be a major expense, and can add significantly to the actual long-term costs of an installed pipe system (*See* Yu Dkt. 9159, 2112-14, 2121-22).

377. PVC pipe has excellent flow properties. For example, the smooth walls of PVC pipe may allow a 12" PVC pipe to carry as much water at a given pressure-rating as a 14" ductile iron pipe (Yu Dkt. 9159, 2118-21; Goodrich F 104; *See also* Waggoner Dkt. 9159, 3576). Moreover, PVC pipe's smooth walls mean that deposits do not build up on the inside wall (Yu Dkt. 9159, 2118-21; Becker Dkt. 9159, 1276-78; Goodrich F 104). With some traditional pipe materials such as ductile iron, these deposits can build up over time, reducing the effective diameter of the pipe over the life of the pipe (Yu Dkt. 9159, 2118-21; Becker Dkt. 9159, 1276-78; Goodrich F 104). This can have a significant impact on the service life of a pipe under certain conditions, *e.g.*, water conditions with high mineral content (Becker Dkt. 9159, 1277-78).

378. PVC pipe has distinctive properties compared to other plastic pipe which substantially limit the likelihood that other plastics will be used as a substitute pipe material. "PVC is the most versatile and economical of the plastic materials and is used twice as much in piping as all the other thermoplastic materials combined" (Dkt. 9159 RX 3Z13). An A.D. Little study estimating PVC demand growth concluded that PVC pipe had substantial advantages over other plastics in the areas in which PVC pipe is used:

> With regard to competition from other plastics, *i.e.*, ABS, polyethylene, polybutylene, etc., we believe that polyvinyl chloride represents a better performance value, has better and more widespread code approval, has the advantage of flame resistance, and can be easily joined and handled in the field. This gives a substantial advantage to PVC. There is also a suitable supply of PVC fittings, whereas polyolefin must suffer from the disadvantages of problems in

joining, lack of suitable fittings, lack of code approval, fallibility restrictions, etc. We therefore believe that PVC pipe will continue its dominance of the field, and that its growth will be rapid as long as there is not an overall disapproval of all plastic pipe in any uses. Major areas of growth that we foresee are in electrical conduit; conduit for telephone lines; drain, waste and vent in single residents housing; its use in large development tract housing; and a substantial increase in non-code areas such as farming. A new development which will enhance growth in drain, waste and vent use is a structural foam pipe being made by Armotech, a joint venture of Robintech U.S.A. and Armosig in France. We foresee continued increase in demand for PVC pipe in the handling of chemicals and other corrosive materials where PVC has the advantage of rigidity, corrosion resistance, and non-flammability. We know of no plastic pipe which will effectively compete with PVC in these areas.

(Dkt. 9159 CX 45S-T (emphasis added)). One significant property that PVC provides in pipe applications is the ability of PVC to withstand internal pressure, a necessary property of the "pressure pipe" applications, such as water pipe and irrigation pipe. A Goodrich product manager explained how the properties of PVC pipe give it a distinct cost advantage among plastics for pressure pipe applications:

A prime example is PVC pressure pipe. The ability to withstand internal pressure in a piping system is dependent upon the physical, chemical and thermal properties of a particular material. When considering PVC and other thermoplastics for use in a pressure piping system, cost effectiveness is the bottom line. To handle a particular pressure, a thinner wall thickness is required for PVC compared to other major thermoplastic materials. So PVC is the most economical material for pressure piping systems.

(Dkt. 9159 CX 457D).

379. The selection of a particular pipe material for use in a given application is a function of the combination of in-use conditions to which the pipe will be subjected, and the suitability of the pipe material for use in that application given the inherent characteristics of the material (*See* Waggoner Dkt. 9159, 3623-28). Thus, despite the distinct performance advantages that PVC provides in most pipe applications, PVC pipe also has a number of characteristics that make it unsuitable for general use in certain applications. For example, PVC lacks the requisite stiffness for use in above-the-ground irrigation applications (Yu Dkt. 9159, 2154; Goodrich F 105). There

is also continuing controversy over the extent to which PVC pipe emits toxic smoke when it burns (*See, e.g.*, Dkt. 9159, CX 45S; Goodrich F 105). As a result, the use of PVC pipe is banned by many building codes for use in drain, waste, and vent (DWV) and conduit applications, particularly in high-rise buildings (*See* Waggoner Dkt. 9159, 3638; Goodrich F 105). PVC pipe also does not have the degree of strength of such materials as ductile iron pipe. Thus, ductile iron pipe may be preferred over PVC pipe in municipal water pipe applications involving rocky or shifting soils, or installation under heavily traveled roads and railroad crossings, (*See* Waggoner Dkt. 9159, 3578-79; Goodrich F 105). To protect it from breakage in rocky or shifting soils, PVC pipe may require a special gravel backfill whereas another kind of pipe may not (*See* Waggoner Dkt. 9159, 3578-79; Goodrich F 114). The cost of this backfill requirement may sometimes eliminate the installation cost advantage of PVC pipe (*See* Waggoner Dkt. 9159, 3651-53; Goodrich F 114). Thus, PVC pipe is not always suitable for use in all piping applications or circumstances.

380. PVC pipe is a relatively new product compared to traditional pipe products. Thus, PVC pipe does not have a long track record on which users and purchasers can rely in judging its long-term performance properties (Yu Dkt. 9159, 2121-22, 2131-33; DiLiddo Dkt. 9159, 3350-51; Waggoner Dkt. 9159 3628-30, 3634-35; Goodrich F 105). This aspect is particularly significant because, in many applications, pipe may be expected to function for 50 years or more (Yu Dkt. 9159, 2122; Waggoner Dkt. 9159, 3630; *See* Goodrich F 105).

381. Overall, the use of pipe is not a single undifferentiated demand with a single set of end use requirements. The distinctive differences in performance properties among PVC pipe products and other types of pipe are of varying importance depending upon the wide variety of circumstances in which the pipe is used. A closer analysis shows that, in most of the applications for which PVC pipe can be used, it has substantial performance and cost advantages over other types of pipe (*See* Goodrich, slip op. at 74-75). Most of the mass and suspension PVC homopolymer used in pipe is accounted for by the following applications: (1) municipal water pipe; (2) rural water pipe; (3) water service and distribution pipe; (4) sewer pipe; (5)

drain, waste and vent pipe; (6) irrigation pipe; (7) communications duct; and (8) electrical conduit (*See* Goodrich F 106; Dkt. 9159 CX 756Z20).

(a) *Municipal water pipe*

382. Municipal water pipe is pipe that carries the municipal, potable (*i.e.*, drinking) water supply from reservoirs, lakes or rivers to treatment facilities, and thence to water mains that distribute the water throughout the community. Municipal water pipe is a pressure pipe application, which means that the pipe conveys water under pressure. The higher performance requirements in pressure pipe applications have implications for the design and cost of pressure pipe products, *i.e.*, the pipe product is engineered and tested to withstand high internal and external pressures, and to provide an assurance of safety and longevity once installed (*See* Yu Dkt. 9159, 2096-99; Goodrich F 107). Municipal water pipe comes in a wide range of diameters; the largest diameter pipes being used to transport water from the reservoir to the treatment center and the main lines (Yu Dkt. 9159, 2114-15; Goodrich F 108). Smaller lines are used to distribute the water through individual subdivisions (Yu Dkt. 9159, 2115-16; Goodrich F 108). Water mains generally vary in size from 4 inches to about 36 inches in diameter (Yu Dkt. 9159, 2115; Goodrich F 108; *See also* Waggoner Dkt. 9159, 3579-80; Dkt. 9159 RX 3Z35). PVC municipal water pipe is generally sold in diameters of 12 inches or less (Yu Dkt. 9159, 2115; Eecker Dkt. 9159, 1278; Waggoner Dkt. 9159, 3580; Goodrich F 108; *See* Dkt. 9159 CX 377A-F). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 109).

383. Purchasers of municipal water pipe are generally the contractors who install the system (Waggoner Dkt. 9159, 3574; Yu Dkt. 9159, 2112; Goodrich F 110). However, the contractor's choice of pipe is limited by the specifications for the project, as prepared by the design or consulting engineer for the municipality (Waggoner Dkt. 9159, 3574-75, 3584-85; Yu Dkt. 9159, 2107-12; Goodrich F 110) These specifications set forth the required diameters, pipe classes, installation methods, and materials that may be used (Waggoner Dkt. 9159, 3586; Goodrich F 110). In some cases, an engineer will approve only one pipe material, such as PVC or ductile iron, in the

specification (Waggoner Dkt. 9159, 3626; Goodrich F 110). In other cases, more than one material will be permitted (Waggoner Dkt. 9159, 3586). In considering what pipe materials to specify, an engineer will take into account a number of factors, including soil conditions, terrain, and the depth of the trench, to determine whether a given kind of pipe can provide the performance required for a particular situation (Waggoner Dkt. 9159, 3585, 3623-26; Goodrich F 110). An engineer may also have a preference for a certain type of pipe based on previous experience (Yu Dkt. 9159, 2132-33; Waggoner Dkt. 9159, 3624, 3629, 3631; DiLiddo Dkt. 9159, 3352-53; Goodrich F 110; *See also* Dkt. 9159 CX 756Z23).

384. [##] (Yu Dkt. 9159, 2116-17; Waggoner Dkt. 9159, 3626-27, 3645-46; Becker Dkt. 9159, 1275; Goodrich F 111; *See* Wilhite CX.179A-C ¶ ¶ 2-3 *In Camera*; Porter CX 198B-C ¶ 3 *In Camera*). [##] (Goodrich F 111; Wilhite CX 179 A-C ¶ 2-3 *In Camera*; *See* Porter CX 198B-C ¶ 3 *In Camera*; Waggoner 3617-18; Yu 2131-32; Becker 1276-78; DiLiddo 3348-53) .

385. PVC pipe has smooth interior walls that remain clean over the life of the pipe (Yu Dkt. 9159, 2118-21; Becker Dkt. 9159, 1276-77; Dkt. 9159 RX 3Z37; Goodrich F 112). In comparison, concrete pipe and ductile iron pipe may accumulate deposits over time on the interior walls, a phenomenon known as tuberculation (Yu Dkt. 9159, 2118-21; Becker Dkt. 9159, 1276-77; Dkt. 9159 RX 3Z37; Goodrich F 112). Over time, the effective pipe diameter may be reduced in such cases, thereby decreasing the useful life of the system (Yu Dkt. 9159, 2118-21; Becker Dkt. 9159, 1276-77). The problem of tuberculation of traditional pipe products can be overcome, but at added cost and weight to the pipe (*See* Dkt. 9159 Waggoner 3577: must add a cement liner to ductile iron pipe; Goodrich F 112). Thus, in areas where the water supply has a high mineral content, PVC pipe may well tend to be the material specified (*See* Dkt. 9159 Becker 1276-77).

386. PVC pipe does not corrode in acid, alkaline, or wet soils (Becker Dkt. 9159, 1274, 1276; Yu Dkt. 9159, 2121-22; Dkt. 9159 DiLiddo 3348-50; Dkt. 9159 RX 3Z37; Goodrich F 113). Ductile iron pipe and steel pipe are subject to corrosion, thus reducing the life of the pipe (Yu Dkt. 9159, 2121-22). Accordingly, PVC may be the preferred material in areas where the soil conditions may cause other

types of pipe to corrode (*See* Yu Dkt. 9159, 2121-22; Goodrich F 113).

387. Ductile iron pipe is stronger than PVC pipe (*See* Waggoner Dkt. 9159, 3575, 3628-29; Goodrich F 115). Ductile iron pipe may therefore tend to be specified in areas with shifting or rocky soils, and where the specifying engineer may be concerned that PVC pipe would break (*See* Dkt. 9159 Waggoner 3631; Goodrich F 115). Ductile iron pipe may also be selected over PVC pipe for a water line running under a major road or railroad crossing. In these circumstances, the pipe may be subject to great stress, so that the high strength characteristics of ductile iron pipe may be preferred (Waggoner Dkt. 9159, 3625; Goodrich F 115). It is not unusual to find instances of a water line of PVC pipe which is interrupted by a length of ductile iron pipe where such circumstances are presented (Waggoner Dkt. 9159, 3625; Goodrich F 115).

388. All of the traditional materials have an advantage over PVC pipe in that they have a longer history of use. Use of PVC pipe in municipal water applications is relatively recent (Yu Dkt. 9159, 2131-32; Waggoner Dkt. 9159, 3626-27). The American Water Works Association only issued a standard covering PVC municipal water pipe as recently as 1975 (Waggoner Dkt. 9159, 3615; Dkt. 9159 CX 756Z23; Goodrich F 116). The issuance of this standard was critical for the market acceptance of PVC pipe, because many communities install only code-approved products (Dkt. 9159 RX 3Z37). Since that time, demand for PVC pipe has grown consistently at the expense of other materials in the diameters in which PVC pipe is used (*See e.g.*, Becker Dkt. 9159, 1276-78; Dkt. 9159 CX 244F; Dkt. 9159 CX 49K). [##] (Underwood CX 203B ¶ 3 *In Camera*; Yu Dkt. 9159, 2122; Goodrich F 116 & n.24 at 32. *See* Waggoner Dkt. 9159, 3628-30, 3634-35). Specifying engineers who have not as yet had experience with PVC pipe, or who are reluctant to forego established materials, may be reluctant to permit the use of PVC pipe in a project (Yu Dkt. 9159, 2131-33; Becker Dkt. 9159, 1280; DiLiddo Dkt. 9159, 3352-53, *See* Waggoner Dkt. 9159, 3524, 3629, 3634-43).

389. Where the specifications in a project permit the use of more than one kind of pipe, the favorable properties of PVC pipe are significant factors affecting its selection. For example, a contractor

may prefer working with PVC pipe based on such factors as ease of installation (*See* Waggoner Dkt. 9159, 3627-28).

390. PVC pipe frequently is easier and less expensive to install than other materials used for municipal water pipe (Yu Dkt. 9159, 2122-27; Dkt. 9159 RX 3Z36-37; CPF 391; *See* Goodrich F 111). [##] (*See* Wilhite CX 179B-C ¶ 3 *In Camera*; Alberti CX 199F-G ¶ 9 *In Camera*; Stuart CX 201B ¶ 3 *In Camera*; DiLiddo Dkt. 9159, 3348; Yu Dkt. 9159, 2112-14; Goodrich F 102 & n.22 at 28). The cost of installation tends to be a substantial portion of the total cost of a job or project (Yu 2112-14; *See also* Dkt. 9159 RX 3Z36). PVC pipe is approximately 25 percent the weight of ductile iron pipe (Yu Dkt. 9159, 2122-23; *See also* DiLiddo Dkt. 9159 3347; Waggoner Dkt. 9159, 3656). [##] (Stuart CX 201B-C ¶ 4 *In Camera*; Yu Dkt. 9159 2123-24; *See* Goodrich F 114; *See also* Dkt. 9159 RX 3Z36-Z37; DiLiddo Dkt. 9159, 3347). [##] (Stuart CX 201B-C ¶ 4 *In Camera*; Yu Dkt. 9159, 2123-24; *See also* Dkt. 9159 RX 3Z36-37, 54-55). PVC pipe is made in longer lengths, thereby requiring fewer joints (Yu Dkt. 9159, 2124-27; Waggoner Dkt. 9159, 3632; *See* Goodrich F 114). The bell joint or solvent joining systems for PVC pipe also tend to be easier and faster than joining methods used for other materials (Yu Dkt. 9159, 2126-27; Goodrich F 114). PVC pipe can also be cut more easily in the field than can traditional pipe materials (Yu Dkt. 9159, 2127; Goodrich F 114). The extent of any installation cost advantage for PVC pipe will vary from project to project, depending upon the depth of the line, soil conditions, and other factors (Yu Dkt. 9159, 2112-14; Goodrich F 114). For example, in some soil conditions it may be necessary to install a special backfill for PVC pipe (*See* Waggoner Dkt. 9159, 3578-79; Goodrich F 114). The added cost of this requirement may offset the installation cost advantage that would otherwise exist for PVC pipe (Waggoner Dkt. 9159, 3651-53; Goodrich F 114).

391. Ductile iron pipe is not a close substitute for PVC pipe in municipal water applications. In many situations, PVC pipe or ductile iron pipe will be selected on the basis of their respective distinct performance properties rather than the relative prices of the two products. Moreover, PVC pipe is generally less expensive than ductile iron pipe (*See* Waggoner Dkt. 9159, 3631, 3635, 3652-53, 3673; Dkt. 9159 CX 756Z23; Goodrich F 118). The price advantage

of PVC pipe over ductile iron pipe is substantial in small (4-8 inch) diameters (Waggoner Dkt. 9159, 3635-36; Goodrich F 117-18). [##] (Heath CX 178B-C ¶ 3 *In Camera*; Alberti CX 199F-G ¶ 9 *In Camera*; Waggoner Dkt. 9159, 3635-36), [##] (Alberti CX 199F ¶ 9 *In Camera*; CPF 624.; *See, e.g.*, Dkt. 9159 CX 566D; Dkt. 9159 CX 522B *In Camera* -- [##]).

392. Pre-stressed concrete pipe is also not a close substitute for PVC pipe in municipal water applications. PVC pipe is substantially less expensive than pre-stressed concrete pipe in the smaller diameters in which PVC pipe is used (*See* Waggoner Dkt. 9159, 3645; Goodrich F 118). Pre-stressed concrete pipe tends to be even more expensive than ductile iron pipe in small diameters (*See* Dkt. 9159 Waggoner 3645). Concrete pipe is more commonly used in larger diameters (Dkt. 9159, RX 3Z36, Z48, Z50).

393. Asbestos cement pipe is not a significant competitive factor in potable water pipe applications (Waggoner Dkt. 9159, 3626-27). [##] (Underwood CX 203B ¶ 3 *In Camera See* Waggoner Dkt. 9159, 3626-27; Goodrich F 118; *See also* Dkt. 9159 CX 756Z34). [##] (RX 72C *In Camera*). Its use is now largely confined to the Texas and Arizona area (*See* Waggoner Dkt. 9159, 3626-27). The use of asbestos cement pipe may eventually be banned in potable water applications (*See* Dkt. 9159 CX 566C, G).

394. Thus, as discussed above, the demand for PVC municipal water pipe is inelastic primarily for two reasons. First, in many situations the choice of pipe material is based on factors other than price. These factors include the needs of a municipality for the distinctive properties of one kind of pipe or another to meet the use conditions presented in a particular area. Another significant factor guiding the selection of pipe materials is the unwillingness of some engineers to specify a relatively new and unproven material such as PVC municipal water pipe. Where the pipe product is selected on the basis of factors other than price, the small change in the price of PVC pipe resulting from a PVC resin price increase will not affect the purchase decision (*See* Kaserman Dkt. 9159, 2373-75; Goodrich, slip op. at 74-75). Second, in cases where price is an important consideration for pipe selection, the total installed cost of a PVC pipe system is often substantially less than that of a system using ductile iron or some other material (Goodrich F 117). For example, PVC

pipe tends to be much less expensive than ductile iron pipe in small (4-8 inch) diameters (Goodrich F 118). In the majority of cases where the installation cost of PVC is lower than that of other materials (*See, e.g.*, Waggoner Dkt. 9159, 3651-53), the cost advantage of PVC pipe will widen even further. Thus, in many cases, even after a small but significant PVC resin price increase, PVC municipal pipe will still be substantially more cost-effective than other materials pipe, particularly on an installed cost basis (*See* Goodrich F 117-18). Given these factors, it is not surprising that industry members observed limited substitution between PVC pipe and other municipal pipe as a result of PVC resin price changes. Regarding the sensitivity of the level of demand for PVC pipe in municipal water applications to changes in the price of PVC resin, Mr. Rodney Becker testified:

> I don't think in the time that I was in the plastics business that we ever saw significant shifts on the basis of changes in price.
>
> Typically, PVC resins have varied from 15 cents to 35 cents a pound. In that kind of range I don't think it made very much difference what the price was. When demand is down, it is down and the price is not going to convince a municipality, which doesn't have any money to carry forward the process, to go ahead with it.

(Becker Dkt. 9159, 1281-82; *See generally* Yu Dkt. 9159, 2178-79).

(b) *Rural water pipe*

395. Rural potable water pipe includes pipe used in water wells and Farmers' Home Administration ("FmHA") projects (Dkt. 9159, RX 3Z401; Goodrich F 121; *See also* Dkt. 9159 CX 756Z21-22). PVC pipe is the predominant material used in FmHA projects (Dkt. 9159 CX 756Z22622; Dkt. 9159 RX 3Z41; Goodrich F 121. *See* Dkt. 9159 CX 378A-F).[25] [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 121).

396. PVC has a dominant position in the rural water pipe segment because its distinctive properties are particularly suited to the requirements of this application (Goodrich F 122; Dkt. 9159 CX

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[25] PVC pipe is also used as the drop pipe in many wells. However, precise market share data on the well segment is almost nonexistent (CX 756Z21-22).

756Z22; Dkt. 9159 RX 3Z41). Rural water systems can generally employ pipe with a somewhat lower break-resistance safety factor than that required for municipal uses. A lower safety factor is possible in rural areas where the pipe is relatively easier to replace, because replacement would not require digging up a paved street or building (Goodrich F 122; *See* Yu Dkt. 9159, 2099-100, 2133-34). PVC pressure pipe used in rural applications has a large cost advantage over traditional pipe materials (Waggoner Dkt. 9159, 3619-22; *See also* Dkt. 9159 CX 756Z22). The light weight, long lengths and ease of joining factors mean that PVC pipe can be installed quickly and easily by hand labor. This ease of installation adds to the cost advantage of using PVC (*See* Yu Dkt. 9159, 2134, 2112-17). As a result, the vast majority (up to 85%) of PVC water pressure pipe sold on a footage basis is sold for rural water applications (*See* Dkt. 9159 Waggoner 3620-21; Dkt. 9159 CX 756Z20; Goodrich F 122). [##] (Goodrich F 122; Dkt. 9159 RX 3Z41; *See* Stuart CX 201B-C ¶ 4 *In Camera*).

397. Thus, the demand for PVC in rural water pipe applications is inelastic as a result of the distinctive properties of PVC pipe, and because of its large cost advantage on the basis of the cost of the pipe alone, and on an installed cost basis. Thus, even after a small but significant PVC resin price increase, PVC pipe would still be preferred in rural applications, and would remain substantially more cost-effective than other materials used for this purpose.

(c) *Water service and distribution pipe*

398. Water service pipe is used for conveying potable water from water mains to individual homes or buildings (Dkt. 9159 RX 3Z37; Goodrich F 123). Distribution pipe carries water from the water meter to taps and other outlets (Dkt. 9159 CX 3Z37). As with other potable water pipe applications, service and distribution pipes are pressure applications (Dkt. 9159 CX 756Z20; Goodrich F 123). Pressure pipe used in these applications are significantly smaller in diameter than pipes used in water mains: "Pipe diameters are normally one-half to one inch for single family residential use with larger sizes used in multi-family, commercial or other nonresidential

applications" (Dkt. 9159 RX 3Z38; Goodrich F 123). [##] (Goodrich F 123; Dkt. 9159 RX 165E *In Camera*).

399. The most popular traditional material for water service and distribution pipe applications has been copper (Becker 1272-74; Dkt. 9159 RX 3Z38; Dkt. 9159 CX 756Z26; Goodrich F 124). Steel has also been used, but this material corrodes, suffers from deposit build-up, is difficult to join, and is heavy (Dkt. 9159 RX 3Z38; Goodrich F 124). It has, therefore, generally been displaced by other materials (Dkt. 9159 RX 3Z38; Goodrich F 124). Previously restricted by lack of code approval, PVC pipe is now enjoying major growth in the service pipe market (Dkt. 9159 RX 3Z37-40; Dkt. 9159 CX 756Z26-Z27; Goodrich F 125). Among plastics, "PVC is the material of choice because of its strength and low cost" in service pipe applications (Dkt. 9159 RX 3Z38; Goodrich F 125). PVC pipe is also used for distribution pipe, although it is not used for hot water applications because of heat distortion problems (Becker Dkt. 9159, 1272-73; Dkt. 9159 CX 756Z26; Goodrich F 125). (However, CPVC (chlorinated PVC) can be used in hot water applications (Dkt. 9159 RX 3Z39)). [##] (*See* Stuart CX 201B ¶ 3 *In Camera*). A 1983 Goodrich document estimated the manufacturing cost per foot for two inch diameter pipe in the years 1976-82 as follows: [##] (Dkt. 9159 CX 247L *In Camera*; Goodrich F 126). Copper tubing is only slightly less expensive than steel tubing (*See* Dkt. 9159 CX 756Z29, Z31; Goodrich F 126). [##] (*See* Dkt. 9159 RX 247L *In Camera*). [##] (Dkt. 9159 CX 247L *In Camera*; Dkt. 9159 RX 3Z38), [##] (*See* Stuart CX 201B ¶ 3 *In Camera*).

(d) *Sewer and drain pipe*

400. The sewer and drain pipe segment includes sanitary sewers, storm sewers and drainage applications (Dkt. 9159 RX 3Z44 Dkt. 9159 CX 756Z24; Goodrich F 127). While there are some pressure sewer applications, about 90 percent of this application involves gravity sewer systems, which is a non-pressure use (Dkt. 9159 CX 756Z24-Z25; Goodrich F 127; *See* Dkt. 9159 CX 380A-L; Dkt. 9159 CX 383A-L). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 127).

401. The principal materials other than PVC used in sewer and drain pipe are concrete, clay, corrugated iron (Yu Dkt. 9159, 2141

Waggoner Dkt. 9159, 3645-46; Goodrich F 128). [##] (Waggoner Dkt. 9159, 3645; Goodrich F 128; *See* Stuart CX 201B-C ¶ 4 *In Camera*; Underwood CX 203B ¶ 3 *In Camera*). Very small amounts of ductile iron pipe are used in sewer applications, and generally only in pressure situations (Dkt. 9159 CX 756Z25; Goodrich F 128).

402. The distinct properties of PVC pipe are again a significant factor in its selection for use in sewer and drain applications. PVC pipe is not subject to attack and corrosion from hydrogen sulfide gas, as are concrete and asbestos cement pipe (Dkt. 9159 RX 3Z48-49; Goodrich F129). Concrete is therefore likely to be used only where hydrogen sulfide gas is not a problem, such as in storm sewer and drainage applications (Dkt. 9159 RX 3Z48; *See* Goodrich F 129).[26] As with water pipe, the corrosion resistance of PVC pipe makes it particularly well suited for certain types of soils, as compared with corrugated metal pipe (Yu Dkt. 9159, 2142). [##] (Dkt. 9159 CX 756Z24-25; *See* Goodrich F 129; Yu 2142-44; Dkt. 9159 RX 3Z49; Dkt. 9159 CX 300Z7 *In Camera*). Many engineers remain reluctant to specify PVC pipe, as opposed to pipe with which they are familiar and for which performance characteristics are proven (*See* Dkt. 9159 Yu 2146-48; CX 756Z24-25; Goodrich F 130). [##] (Dkt. 9159 CX 300Z7 *In Camera*).

403. [##] (Yu Dkt. 9159, 2142-44; Dkt. 9159 CX 300Z7 *In Camera*; Goodrich F 129).

404. Ductile iron pipe is not a close substitute for PVC pipe in sewer and drain applications. About 90 percent of such applications are non-pressure (Dkt. 9159 CX 756Z25; *See* Goodrich F 131). In non-pressure applications, PVC pipe can be made with thinner walls than that required in pressure applications (Yu Dkt. 9159, 2137-39; Waggoner Dkt. 9159, 3643-44; Goodrich F 131). The cost of PVC sewer pipe is therefore even less than that of PVC municipal water pipe, as illustrated by the prices for these two PVC pipe products furnished given by Mr. Yu of J-M Manufacturing Co., Inc., one of the largest PVC pipe producers in the United States:

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[26] The hydrogen sulfide problem is less acute in pressure sewers since there is little airspace. It is most acute in flat areas, where the sewage is slow moving with large airspaces (*See* RX 3Z48).

Diameter (inches)	PVC Water Pipe Class 150	PVC Sewer Pipe
8"	$3.90	$1.82

(Yu Dkt. 9159, 2105-06, 2140-41; Goodrich F 131). Ductile iron pipe producers sell the same pipe product for both pressure and non-pressure applications (Waggoner Dkt. 9159, 3579, 3644; Goodrich F 131). As PVC pressure pipe is already considerably less expensive than ductile iron pipe in most diameters, the substantial cost disadvantage of ductile iron pipe relative to PVC pipe in municipal water applications becomes an even greater disadvantage in gravity sewer applications (Waggoner Dkt. 9159, 3583; Goodrich F 132). Mr. Waggoner of Griffin Pipe Products Co., a ductile iron pipe producer, agreed that PVC pipe has a significant cost advantage over ductile iron pipe in gravity sewer applications (Waggoner Dkt. 9159, 3643-44). Mr. Waggoner explained:

A gravity sewer application is when you are moving sewage from housing development or from municipality to the treatment plant. A gravity sewer line is where the contractor lays it at an incline or a decline so that the sewage is moving along at its own rate or the lay of the land controls it versus a pressure sewer where there is some pressure exerted to move that sewage along. So for that application we would sell the same piece of ductile iron pipe for that application as we would for a water main application but obviously you don't need the pressure rating or the strengths. PVC has managed to segment that market, they have products that are thinner wall and less pressure rated to handle that type of application. So when we get into the sewer applications, we have a more significant cost disadvantage than we would for a pressure application.

(Waggoner Dkt. 9159, 3644). Thus, ductile iron pipe has but a small fraction of the market in sewer and drain applications (*See* Dkt. 9159, CX 756Z25).

405. [##] (Dkt. 9159 CX 3Z48 *In Camera*; Waggoner Dkt. 9159, 3646; Goodrich F 130), [##] (Wilhite CX 1198-C ¶ 3 *In Camera*; Yu Dkt. 9159, 2142-44; Waggoner Dkt. 9159, 3646; Dkt. 9159 CX 300Z7 *In Camera*; Goodrich F 130). [##] (*See* Dkt. 159 CX 579M, 5 *In Camera*; Goodrich F 130). [##] (Dkt. 9159 CX 525J *In Camera*; Goodrich F 130). [##] (Dkt. 9159 CX 579R *In Camera*; Goodrich F 130). The dramatic rate of replacement of clay pipe by PVC pipe in

sewer applications has occurred because PVC offers substantial advantages in cost and performance over clay pipe (*See* Dkt. 9159 Waggoner 3646; Goodrich F 130).

406. Concrete pipe is also not a close substitute for PVC pipe in sewer and drain pipe applications. The susceptibility of concrete to hydrogen sulfide attack, and the difficulties in sealing joints, has resulted in a distinct disadvantage for concrete pipe for most sanitary sewer uses (*See* Dkt. 9159 RX 3Z48; Goodrich F 132). As in the case of municipal water pipe, concrete is not cost competitive in small diameters, particularly on an installed cost basis (Dkt. 9159 RX 3248, Z50; Goodrich F 132). Thus, concrete pipe tends to be used for very large diameter needs, and thus does not compete directly with PVC pipe in most sewer and drain applications (Goodrich F 132; Dkt. 9159 RX 3Z48).

407. Thus, the demand for PVC sewer and drain pipe is inelastic (Becker Dkt. 9159, 1286-87). In many situations, the choice of sewer pipe material is based on factors other than price, such as a preference or demand for the distinctive properties of PVC pipe. In addition, the total installed cost of a PVC sewer pipe system is often substantially less than that of a system using other materials. Thus, even after a small but significant PVC resin price increase, PVC sewer pipe would still be substantially more cost-effective than other materials, particularly on an installed cost basis. Mr. Rodney Becker, former Sales and Marketing Manager for Diamond Shamrock, testified as follows regarding the sensitivity of the level of demand for PVC sewer pipe to changes in the price of PVC resin:

> Once again, I would go back to the fact that in the price range that PVC typically has been sold, and I use the broad range of 15 to 35 cents per pound, I don't think it would make very much difference.
>
> For example, . . . the municipality already has a sewer system they have to replace. You can imagine the tearing up of the streets or anything else that is involved. They don't want to replace that system again.
>
> So, if they could be convinced that PVC is going to last longer than whatever was in there before, I think they would even be willing to pay more money for the pipe.

(Becker Dkt. 9159, 1286-87).

(e) *Drain, waste and vent (DWV) pipe*

408. The drain, waste and vent (DWV) pipe segment includes pipe that drains water and waste from buildings into sewer systems (Dkt. 9159 CX 756Z25-Z26; Dkt. 9159 RX 3Z52; Waggoner Dkt. 9159, 3637; Goodrich F 133). These indoor drainage systems include vent pipes to the outside to permit air to vent the system (Dkt. 9159 RX 3Z52; *See* Goodrich F 133). The contents of a DWV system are moved by gravity; it is therefore a non-pressure application (Dkt. 9159 CX 756Z20; Waggoner Dkt. 9159, 3639; Goodrich F 133). Typical diameters are in the 1-2 inch to 8 inch range (*See, e.g.*, Dkt. 9159 CX 379; Goodrich F 133). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 133).

409. [##] (Wilhite CX 179A-B ¶ 2 *In Camera*; Becker Dkt. 9159, 1292; Dkt. 9159 RX 3Z54-55; Waggoner Dkt. 9159, 3637-38; Goodrich F 134). Use of copper has essentially disappeared in DWV applications (Dkt. 9159 RX 3Z54-55; *See* Goodrich F 134).

410. PVC pipe has replaced traditional pipe material in this segment because it offers substantial savings in both the cost of pipe and the cost of installation (Dkt. 9159 RX 3Z54-55; Dkt. 9159 CX 756Z25-Z26; Goodrich F 135). However, cast iron soil pipe provides lower noise conductivity, an attribute that is particularly important in multi-family dwellings; moreover, there remain substantial concerns about the toxicity of smoke emitted by PVC pipe when it burns (Waggoner Dkt. 9159, 3638; Dkt. 9159 RX 3Z54; Goodrich F 135). As a result, the use of PVC DWV pipe is often banned in high-rise structures (*See* Waggoner Dkt. 9159, 3637-39; Dkt. 9159 RX 3Z54; Dkt. 9159 CX 756Z35; Goodrich F 135). Nevertheless, PVC pipe has essentially captured this application in single family dwellings (*See* Dkt. 9159 Waggoner 3637; Goodrich F 135). The significant cost savings offered by PVC pipe suggests that it may continue to displace traditional material pipe to the extent permitted by building codes (Dkt. 9159 RX 3Z55; Dkt. 9159 CX 756Z26; Goodrich F 135).

411. Until about 1973, more ABS pipe was used in DWV applications than PVC pipe (Dkt. 9159 CX 583 Z80; Goodrich F 136). [##] (Wilhite CX 179A-B ¶ 2 *In Camera*; Dkt. 9159 CX 583Z80; Dkt. 9159 RX 3Z55; Goodrich F 136). The development of improved PVC compounds yielded a PVC pipe with properties

comparable to ABS (Dkt. 9159 CX 583Z80; *See* Goodrich F 136). [##] (Wilhite CX 179A-B ¶ 2 *In Camera*; Stuart CX 201C ¶ 5 *In Camera*; Weber Dkt. 9159, 1806-09; Dkt. 9159 CX 583Z80; Dkt. 9159 CX 756Z26; Goodrich F 136). "In single family residential construction PVC has become the dominant material for DWV pipe" (Dkt. 9159 CX 756Z25; *See also* Weber Dkt. 9159, 1806-09). ABS pipe producers have developed a foam core product to cut costs, but it does not significantly alter the wide economic advantage of PVC pipe (Dkt. 9159 CX 756Z26; Goodrich F 136).

412. [##] (Stuart CX 201C ¶ 5 *In Camera*). Goodrich estimates the manufacturing costs for the three type of pipe for the period 1976-82 for a three inch diameter pipe as follows: [##] (Dkt. 9159 CX 247L *In Camera*; Goodrich F 137). Because of easier installation, the cost gap between PVC DWV pipe and cast iron soil pipe is even wider on an installed cost basis.

413. [##] (Wilhite CX 179A-B ¶2 *In Camera*; Becker Dkt. 9159, 1294-95).

(f) *Irrigation pipe*

414. Irrigation pipe is a pressure application (Yu Dkt. 9159, 2099-100; Dkt. 9159 CX 156Z20; Goodrich F 138; *See, e.g.*, Dkt. 9159 CX 378A-F; Dkt. 9159 CX 381A-D). However, pressure ratings for irrigation pipe are lower than those used for municipal water pipe applications, so that a thinner wall PVC pipe may be used for irrigation purposes (Yu Dkt. 9159, 2049-100, 2150-52; Goodrich F 138). Irrigation systems can be divided into three major categories: below-ground systems, above-ground systems, and on-the-ground systems (*See* Yu Dkt. 9159, 2148-50; Goodrich F 138). Below-ground systems can be further divided into sprinkler systems and drip pipe systems (Dkt. 9159 CX 756Z23-Z24; Dkt. 9159 RX 3Z67- 68; Goodrich F 138). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 138).

415. The lower pressure ratings and smaller diameters used mean that traditional materials such as ductile iron and asbestos cement are not significant competitive materials in irrigation applications (*See* Dkt. 9159 CX 756Z23-Z24; Dkt. 9159 RX 3Z68; Yu Dkt. 9159, 2153; *See* Goodrich F 139). Mr. Waggoner of Griffin Pipe explained

that the reason why ductile iron pipe is rarely used in a majority of irrigation applications was because the high strength characteristics of ductile iron would not be needed; and that the pressure ratings and the depth of an irrigation system would cause ductile iron pipe not to be a significant factor in that market (Waggoner Dkt. 9159, 3642; *See* Goodrich F 141 & n.28 at 41). Mr. Waggoner agreed that, because the strength characteristics of ductile iron would not be needed, the cost disadvantage of ductile iron pipe in irrigation applications would be overwhelming: "Yes, we wouldn't even be in the ballpark" (Waggoner Dkt. 9159, 3642; *See* Goodrich F 141 & n.28 at 41).

416. For the large majority of irrigation systems, the only types of pipe used are PVC and aluminum (Yu Dkt. 9159, 2153; Dkt. 9159 CX 756Z24; *See* Goodrich F 139). A small amount of polyethylene is used in drip irrigation systems (Dkt. 9159 CX 756Z24; *See* Goodrich F 141 & n.28 at 41).

417. PVC pipe is becoming the material of choice in below-ground sprinkler systems (Dkt. 9159 CX 756Z24; Goodrich F 139). Almost all PVC pipe used in irrigation is for underground applications (Dkt. 9159 CX 756Z24; Goodrich F 139), where PVC pipe has a significant performance advantage over aluminum pipe in that it has better impact resistance. In diameters over 6 inches, aluminum does not have the requisite impact resistance for below-ground use and may be crushed on installation (Yu Dkt. 9159, 2154; *See* Goodrich F 139). PVC pipe also enjoys a substantial cost advantage over aluminum (Becker Dkt. 9159, 1290; Dkt. 9159 CX 756Z24; Goodrich F 139). [##] (Dkt. 9159 CX 247L *In Camera*).

418. PVC pipe is generally not used in above-the-ground sprinkler systems (Yu Dkt. 9159, 2152-54; Goodrich F 140). In these systems, the pipe is suspended above the ground and is moved across the field on large wheels (Yu Dkt. 9159, 2153-54). PVC pipe does not have the necessary stiffness to be used in this application (Yu Dkt. 9159, 2153-54; Goodrich F 140). [##] (Dkt. 9159 CX 756Z24; Dkt. 9159 CX 300Z7 *In Camera*; *See* Goodrich F 140).

419. Both aluminum and PVC pipe are used in portable on-the-ground systems (Yu Dkt. 9159, 2154), although aluminum has held a commanding position in above and on-the-ground applications (Dkt. 9159 CX 756Z24; Goodrich F 141). The large cost advantage of PVC over aluminum found in on-the-ground systems is not as

great as that in below-ground systems, because of the need to add stabilizers to the PVC compound to protect the PVC pipe from degradation on exposure to heat and light (Dkt. 9159 CX 756Z24 Becker Dkt. 9159, 1289-90; Goodrich F 141). Nevertheless, PVC pipe has a significant cost advantage over aluminum in on-the-ground systems (Dkt. 9159 CX 756Z24; Becker Dkt. 9159, 1290). This cost advantage should widen over time due to projected increases in the price of aluminum versus PVC (Dkt. 9159 CX 756Z24; *See* CPF 467; Goodrich F 140). [##] (Dkt. 9159 CX 300Z7 *In Camera*; *See* Goodrich F 141).

420. Thus, the selection of pipe material for irrigation applications is determined largely by the type of system chosen. Furthermore, the type of irrigation system selected depends primarily upon particular performance needs and requirements of specific systems, rather than the cost of alternative systems (*See* Yu Dkt. 9159, 2150-51, 2152-53; Goodrich F 139). Thus, the demand for PVC pipe in irrigation applications overall is inelastic (Becker 1291). Since PVC pipe is generally not suitable for use in the above-the-ground and drip systems, a PVC resin price increase will not affect PVC pipe demand in those applications. In below-ground systems, the cost advantage of PVC pipe over aluminum is so significant that it would remain significant even after a substantial PVC resin price increase. In addition, PVC pipe has superior impact-resistance characteristics in the larger diameter underground irrigation pipe applications. Finally, the widening gap between PVC pipe and aluminum pipe prices should leave room for increased PVC resin prices without a loss of market share in any of the types of present irrigation systems.

(g) *Communications duct*

421. Communications duct (or conduit) is used to protect telephone cable and wire running to and from telephone company facilities (Becker Dkt. 9159, 1296; Dkt. 9159 RX 756Z27; Goodrich F 142). [##] (Goodrich F 142; Dkt. 9159 CX 756Z20; *See* Alberti CX 199A ¶ 1 *In Camera*). Nearly all communications conduit is buried, and most is made of non-corrosive materials (Dkt. 9159 CX 756Z28; Dkt. 9159 RX 3Z59; *See* Goodrich F 142). [##] (Dkt. 9159 CX

756Z26-26; Dkt. 9159 CX 300Z7-Z8 *In Camera*; Dkt. 9159 CX 3Z59-60). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 142).

422. "In communications conduit, PVC has gained a dominant position" (Dkt. 9159 CX 756Z28; *See* Goodrich F 143). [##] (Dkt. 9159 RX 165E *In Camera*; *See also* Dkt. 9159 CX 756Z28; Dkt. 9159 RX 3Z60-Z62). [##] (Dkt. 9159 CX 300Z7-8 *In Camera*). [##] (Dkt. 9159 CX 300Z7-8 *In Camera*). [##] (Dkt. 9159 CX 241L *In Camera*; *See also* Dkt. 9159 RX 3Z59).

423. PVC communications conduit and concrete and steel conduit each have distinct properties that make each well suited for particular applications (Dkt. 9159 CX 756Z27; Dkt. 9159 RX 3Z59). Moreover, the cost disparity between PVC communications conduit and both concrete and steel communications conduit is so great that PVC communications conduit is very likely to remain substantially more cost-effective than either concrete or steel conduit, even after a substantial PVC resin price increase. Thus, PVC communications conduit will continue to be selected in those applications where it meets the necessary performance requirements notwithstanding PVC resin price fluctuations or increases (*See* Goodrich F 143).

(h) *Electrical conduit*

424. Electrical conduit is used for the protection of bundled wires (Dkt. 9159 CX 756Z27; Goodrich F 144). [##] (Dkt. 9159 CX 300Z7 *In Camera*; Dkt. 9159 CX 756Z27-28; Goodrich F 144). [##] (Dkt. 9159 RX 165E *In Camera*; Goodrich F 144).

425. [##] (Dkt. 9159 RX 3Z62; Dkt. 9159 CX 300Z7-Z8 *In Camera*; *See* Goodrich F 146). These properties of PVC electrical conduit make it particularly well-suited for underground applications (Dkt. 9159 CX 756Z28; Dkt. 9159 RX 3Z61; Goodrich F 146). [##] (Dkt. 9159 CX 247L *In Camera*; *See also* Dkt. 9159 CX 756Z28; Dkt. 9159 CX 300Z7-Z8 *In Camera*). [##] (Dkt. 9159 CX 300Z7-Z8 *In Camera*; *See* Goodrich F 145). In addition, PVC electrical conduit requires the use of a ground wire (Dkt. 9159 CX 756Z28; Goodrich F 146).

426. Steel is the principal material used in most electrical conduit (Dkt. 9159 CX 756Z28; Dkt. 9159 RX 3Z60-Z61; Goodrich F 145). One reason for this is that much electrical conduit is used in

above-ground applications (Dkt. 9159 RX 3Z60), [##] (Dkt. 9159 CX 756Z28; Dkt. 9159 RX 3Z60-Z61; Goodrich F 145; *See also* Dkt. 9159 CX 300Z8 *In Camera*). In addition, the controversy surrounding the toxicity of smoke from burning PVC pipe has caused PVC conduit to be banned by fire and building codes in many areas (Dkt. 9159 CX 756Z28; Goodrich F 146).

427. Thus, PVC and steel have distinct properties that make each well suited for particular applications. In addition, the cost disparity between PVC and steel in electrical conduit is so great that PVC electrical conduit will remain substantially more cost-effective than steel, even after a substantial PVC resin price increase. Thus, while steel may be used in those areas where PVC is barred by codes, or where the strength of steel is required, PVC conduit will continue to be selected in the applications where it is used notwithstanding fluctuations or increases in the price of PVC resin (*See* Becker Dkt. 9159, 1295-98).

(i) *Summary of pipe*

428. Thus, in the applications in which it is used, PVC pipe has distinct performance properties that are an important factor affecting its selection.[27] In many applications, PVC pipe also has a substantial cost advantage over pipe made from other materials (*See* Goodrich, slip op. at 14-75). The fact that PVC pipe products and pipe products made out of other materials are not close substitutes as a result of substantial differences in performance properties and costs is shown by the testimony of the witness representing the only PVC pipe manufacturer to appear in the proceeding, Mr. Yu of J-M Manufacturing Co., Inc., one of the largest PVC pipe producers in the United States (Yu Dkt. 9159, 2091-92). [##] (Yu Dkt. 9159, 2156-58; *See* Stuart CX 201B ¶ 3 *In Camera*). Accordingly, pipe made from materials other than PVC are not close substitutes for PVC pipe.

429. The elasticity of demand for mass and suspension PVC resin is less than the elasticity of demand for PVC pipe because the

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[27] Because the use of PVC pipe fittings follows from the use of PVC pipe, the demand for PVC pipe fittings is inelastic with respect to changes in the price of PVC resin (Becker 1323-24).

resin is only a portion of the cost of PVC pipe. The cost share of the resin is about 55% of the cost of PVC pipe sold to distributors (Yu Dkt. 9159, 2104; Goodrich, slip op. at 73 & n.163; Disch Dkt. 9159, 663). [##] (Yu Dkt. 9159, 2106-07; Dkt. 9159 CX 247B-I *In Camera* [##]). Finally, PVC pipe must be installed before it is used. In many cases, the installation cost is a significant portion of the cost (*See* Yu Dkt. 9159, 2112-14, 2144-45). Thus, on a total installed cost basis, the cost share of the PVC resin is only a small fraction of the total installed cost of a PVC pipe system. This factor further reduces the elasticity of demand for PVC resin sold into the pipe segment (*See* Goodrich, slip op. at 73 & n.163).

430. It is likely that the elasticity of demand for mass and suspension PVC resin in pipe applications is less than is reflected in the Goodrich record. At that time, it was generally believed that the price of pipe-grade resin could go as high as only 33 or 34 cents per pound before PVC would lose business to alternative materials in pipe applications (*See* DiLiddo Dkt. 9159 3264). [##] (CX 217E; *See* Pflugrath CX 177D-E ¶ 7-8 *In Camera*; Alberti CX 199F-G ¶ 9 *In Camera*). [##] (Porter RX 261B ¶ 4, 6 *In Camera*). Thus, although the Commission found in Goodrich that the demand for PVC in pipe was relatively inelastic, Goodrich, slip op. at 88, it is likely that it is even more inelastic than the Commission concluded on the basis of that record.

(2) Wire and cable applications

431. [##] (Disch 663 Goodrich F 147; *See also* Dkt. 9159 CX 428Z100; Dkt. 9159 CX 126C; Dkt. 9159 RX 145L *In Camera*). [##] (Bendavid CX 194A-B ¶ 2 *In Camera*; Disch Dkt. 9159, 674; Becker Dkt. 9159, 1269-70, 1303; Goodrich F 147). [##] (Dkt. 9159 CX 591I *In Camera* Goodrich F 141; *See* Dkt. 9159 Commission Physical Exhibits 9 & 12).

432. Mass and suspension PVC homopolymer coatings for wire and cable have long been the established industry standard. Such coatings have been used since World War II, when a shortage of natural rubber occurred (Dkt. 9159 CX 45Y; Goodrich F 148). Rubber, which had been the traditional material used until the war is flammable and gives off a good deal of smoke when it burns

(DiLiddo Dkt. 9159, 3108). Rubber also oxidizes and becomes brittle over time, so that it cracks off the wire, necessitating the replacement of entire wiring systems (Becker Dkt. 9159, 1304-05). In contrast, PVC was found to be flame resistant, an important factor in this application (Disch Dkt. 9159, 676; Goodrich F 148), and to have good weathering capabilities, excellent insulation properties, and flexibility, thus providing an assurance of longevity and good performance once installed (Disch Dkt. 9159, 674-76; Becker Dkt. 9159, 1270; DiLiddo Dkt. 9159, 3108; Goodrich F 148). As a result, the entire output of PVC during World War II was used by the U.S. government primarily for the coating of wire in naval ships (DiLiddo Dkt. 9159, 3107; Goodrich F 148).

433. [##] (Clark CX 193B ¶ 2 *In Camera*; Bendavid CX 194B ¶ 3 *In Camera*; Dkt. 9159 CX 45Z; Becker Dkt. 9159, 1269-70; Goodrich F 149). [##] (Dkt. 9159 CX 126P-Q ; Becker Dkt. 9159, 1269; Goodrich F 149), [##] (Clark CX 193B ¶ 2 *In Camera*; Dkt. 9159 CX 45H; Dkt. 9159 CX 126C; *See* Goodrich F 149-50).

434. [##] (Dkt. 9159 CX 300Z8 *In Camera*; Disch Dkt. 9159, 675-76; Goodrich F 150). [##] (Clark CX 193B ¶ 2 *In Camera*; Bendavid CX 194B ¶ 3 *In Camera*; Disch 676; Dkt. 9159 CX 126C; Goodrich F 150). In addition to its flame resistance properties, PVC is also lower in cost than many other potential alternative materials (Dkt. 9159 CX 126C; Dkt. 9159 CX 45H; *See* Goodrich F 150).

435. [##] (Clark CX 193D ¶ 5 *In Camera*; Disch Dkt. 9159, 675; Becker Dkt. 9159, 1305; Goodrich F 151). One reason for this is that the properties of PVC in this end use are very desirable from the standpoint of both wire and cable producers and purchasers (Disch Dkt. 9159, 675; Goodrich F 151). The large volume of mass and suspension PVC homopolymer consumed in the wire and cable market is a result of its inherent flame retardancy, and its historical good performance in this end use (Dkt. 9159 CX 126C).

436. Moreover, as materials used in wire and cable jacketing and insulation are subject to building code approval, meeting the governing standard or specification is the primary purchasing criteria on the part of wire and cable producers (Dkt. 9159 CX 126Z1; Goodrich F 151). Many potential alternative materials lack building code acceptance (Dkt. 9159 CX 45Z; Goodrich F 151). [##] (Clark

CX 193B ¶ 2 *In Camera*; Disch Dkt. 9159, 675; Goodrich F 151 & n.30 at 44).

437. [##] (Goodrich, slip op. at 74; Clark CX 193D ¶ 5 *In Camera*). The single largest cost component is for the copper or aluminum conductor (Becker Dkt. 9159, 1305). PVC resin used in wire and cable applications is also compounded with additives and ingredients that give PVC its preferred properties. As a result, the cost of the PVC resin alone as a percentage of the cost of the wire and cable compound is most likely in the range of 30% to 50%, depending on the specification for the compound (Goodrich, slip op. at 74; Becker Dkt. 9159, 1305-07; *See* Goodrich F 151 & n.31 at 44).

438. Thus, demand for mass and suspension PVC homopolymer resin used in wire and cable applications is inelastic (*See* Goodrich, slip op. at 74).

(3) Packaging film and sheet

439. [##] (Goodrich F 152; *See* Dkt. 9159 CX 591J-K *In Camera*; Dkt. 9159 CX 581A *In Camera*; Dkt. 9159 CX 428Z100. *See also* Disch Dkt. 9159, 663; Dkt. 9159 RX 206A *In Camera*; Dkt. 9159, RX 145LZ32, Z57 *In Camera*). [##] (Dkt. 9159 CX 581A-D *In Camera*; Dkt. 9159 CX 45P; Dkt. 9159 CX 591K *In Camera*; *See* Goodrich F 152; *See also* Disch Dkt. 9159, 679; Becker Dkt. 9159, 1307). [##] (Dkt. 9159 CX 581A-D *In Camera*; Dkt. 9159 CX 45P; Goodrich F 152; *See also* Dkt. 9159 CX 428Z75-Z76; Dkt. 9159 CX 444D). [##] (Becker Dkt. 9159, 1321-25; Dkt. 9159 CX 428Z76; Dkt. 9159 CX 444D; Goodrich F 152; *See also* Dkt. 9159 CX 581D-E, H *In Camera*), [##] (Dkt. 9159 CX 581H-J *In Camera*; Dkt. 9159 RX 145Z30 *In Camera*; Goodrich F 152).

440. [##] (Dkt. 9159 CX 45H; Dkt. 9159 RX 145Z29 *In Camera*; Goodrich F 152). [##] (Disch Dkt. 9159, 679; Becker Dkt. 9159, 1308; McMath Dkt. 9159, 1936; Dkt. 9159 CX 581B *In Camera*; Dkt. 9159 CX 45H; Dkt. 9159 RX 145Z29 *In Camera*; Goodrich F 152). Of particular importance in the packaging of fresh meat and produce is the ability of the packaging material to maintain the freshness of the product and to promote the product's appeal, both of which PVC film accomplishes as a result of its superior breathability characteristics and clarity (Becker Dkt. 9159, 1308, 1310-11;

McMath Dkt. 9159, 1936; Disch Dkt. 9159, 679; Goodrich F 152). [##] (Dkt. 9159 CX 581B *In Camera*; Dkt. 9159 CX 45H; Dkt. 9159 CX 92V; Dkt. 9159 CX 300Z9 *In Camera*; Dkt. 9159 RX 145Z29 *In Camera*; Goodrich F 152). PVC is also preferred for blister packs of non-food items because of its clarity, strength, and tear-resistant properties, and because it is easy to vacuum-form (Becker Dkt. 9159, 1322-24; McMath Dkt. 9159 1921; Goodrich F 152).

441. [##] (Dkt. 9159 CX 300Z9 *In Camera*; Goodrich F 153). [##] (Dkt. 9159 CX 300Z9 *In Camera*; Goodrich F 153), [##] (Becker Dkt. 9159, 1310-11; Disch Dkt. 9159, 680; McMath Dkt. 9159, 1936; Dkt. 9159 CX 300Z29 *In Camera*; Dkt. 9159 RX 39F; Goodrich F 153).

442. The overall demand for mass and suspension PVC homopolymer resin in packaging film and sheet applications is relatively insensitive to fluctuations in PVC resin price for a number of reasons (Becker Dkt. 9159, 1309; Disch Dkt. 9159, 680; *See* Goodrich F 153). First, a strong preference for PVC film and sheet exists in the applications for which it is used as a result of PVC's unique combination of properties (Disch Dkt. 9159, 680; Becker Dkt. 9159, 1309; Goodrich F 153). In addition, PVC is fairly well entrenched in the applications in which it is used because the packaging fabrication equipment has been developed based on PVC (Dkt. 9159 CX 444D; Goodrich F 153; *See also* McMath Dkt. 9159, 1936). [##] (RX 59 *In Camera*).

443. Thus, demand for mass and suspension PVC homopolymer resin used in packaging applications is relatively inelastic (Goodrich, slip op. at 74).

(4) Siding

444. Approximately 300 million pounds of mass and suspension PVC resin is consumed annually in the production of vinyl siding and accessories, accounting for about 5% of PVC consumption (Belt Dkt. 9159, 2065; Goodrich F 154; *See also* Disch Dkt. 9159, 664). Vinyl siding consists of extruded panels of compounded PVC resin used as exterior sheeting that is typically installed over the existing walls of a house (Belt Dkt. 9159, 1986-87; Goodrich F 154). Vinyl siding accessories consist of extruded products used to install the vinyl

siding, such as trim, corner posts, soffits and fascia board, and are typically sold in conjunction with the vinyl siding (Belt Dkt. 9159, 2000-01; Goodrich F 154; *See* Commission Physical Exhibit 14). [##](Belt Dkt. 9159, 2002; Dkt. 9159 CX 590B *In Camera*; Goodrich F 154). The remaining 5% to 10% of vinyl siding is sold into the new construction market, which includes both site-built and manufactured homes, such as mobile homes (Belt Dkt. 9159, 2002; Goodrich F 154).

445. Several distinct properties of vinyl siding have led to its increasing popularity. It is light weight and pliable, which makes it easy to install (RX 21G-H). [##] (RX 67C *In Camera*; RX 21G-H; Belt Dkt. 9159, 2010-11; Goodrich F 155). [##] (Belt Dkt. 9159, 2010-11, 1987-88; Dkt. 9159 CX 300Z8 *In Camera*; Dkt. 9159 CX 45H; Goodrich F 155).

446. [##] (Belt Dkt. 9159, 2004-05; Becker 1299; Dkt. 9159 CX 300Z8 *In Camera*; Goodrich F 156). [##] (RX 67C *In Camera*; RX 21G-H; Becker Dkt. 9159, 1299; Dkt. 9159 CX 300Z8 *In Camera*; Dkt. 9159 CX 454H; *See* Goodrich F 158). Vinyl siding has also displaced aluminum as a re-siding material as a result of a number of its superior properties. Unlike aluminum, vinyl siding does not dent and is thus easier to handle and install; vinyl siding is colored completely through the panel, unlike aluminum siding color which is painted on and easily scratched. Vinyl siding is less noisy than aluminum, and is more energy-efficient (RX 21G-H). [##] (Belt Dkt. 9159, 2011; Becker Dkt. 9159, 1299; Dkt. 9159 CX 300Z8 *In Camera*; *See* Goodrich F 157). Compared to steel siding, vinyl siding is much lighter, much easier to install, and generally superior as a siding product (RX 21G-H; Belt Dkt. 9159, 2011-12; *See* Goodrich F 159). [##] (Belt Dkt. 9159, 2011-12; Dkt. 9159 CX 590D *In Camera*; Goodrich F 159).

447. [##] (RX 67C; RX 21G-H; Belt Dkt. 9159, 2011; Dkt. 9159 CX 300Z8 *In Camera*; Goodrich F 160). [##][28] (Belt Dkt. 9159,

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[28] (Belt 2007-08; CX 590C, *In Camera*; Goodrich F 160 & n.35 at 48). The alternative distribution channel consists of sales from the manufacturer to chain home centers or lumber yards to professional home remodelers or do-it-yourselfers (Belt 2007-08; Goodrich F 160 & n.35 at 48).

2017-18 *In Camera*; Goodrich F 160; *See also* Dkt. 9159 CX 588A-B).

448. The substantial price advantage that vinyl siding has over both aluminum and steel siding is generally acknowledged to be of a permanent nature, stemming from the greater energy costs involved in producing aluminum and steel (Belt Dkt. 9159, 2013-14; Becker Dkt. 9159, 1299-3000; Dkt. 9159 CX 588A-B; *See* Goodrich F 160). [##] (Becker Dkt. 9159, 1299-3000; Belt Dkt. 9159, 2014, 2020; Dkt. 9159 CX 590G, K *In Camera*; Goodrich F 161; *See also* Dkt. 9159 RX 70C *In Camera*; Dkt. 9159 RX 90G *In Camera*).

449. [##] (Belt Dkt. 9159, 2024-25, 1984 *In Camera*; Goodrich F 162). [##] (Belt Dkt. 9159, 2025 *In Camera*; Goodrich F 162; *See* generally Dkt. 9159 CX 559).

450. [##] (Belt Dkt. 9159, 2019; Becker Dkt. 9159, 1302; Dkt. 9159 CX 590K *In Camera*). [##] (Dkt. 9159 CX 590C *In Camera*). [##] (Dkt. 9159 CX 590D *In Camera*). [##] (Dkt. 9159 CX 590B *In Camera*). [##] (Dkt. 9159 CX 590C, G *In Camera*).

451. [##] (Becker Dkt. 9159, 1299-1302; *See* Goodrich F 164; *See also* Dkt. 9159 CX 168B *In Camera*; Dkt. 9159 CX 559).

452. In addition, fluctuations in the price of PVC resin are likely to have very little impact on the demand for vinyl siding because the cost of the PVC resin is only a very small portion of the total price of the installed siding product to the homeowner. To convert PVC resin to siding, the resin is first blended with a variety of additives and ingredients, such as titanium dioxide, impact modifiers, heat stabilizers, lubricants, and waxes, to form a compound (Belt Dkt. 9159, 1995; Becker Dkt. 9159, 1300-01; Goodrich F 163; Goodrich, slip op. at 74). [##] (Belt Dkt. 9159, 1995-96; Dkt. 9159 RX 90Z80 *In Camera*, Goodrich F 163). [##][29] (Goodrich F 163; *See* Belt Dkt. 9159, 2026-27 *In Camera*; Dkt. 9159 CX 756Z59). [##] (Belt Dkt. 9159, 2017-28 *In Camera*, 1998; Dkt. 9159 CX 756 Z 59; Goodrich F.163). [##] (Belt Dkt. 9159, 2040-41 *In Camera*; Goodrich F 163). [##] (Belt Dkt. 9159, 2041 *In Camera*; Goodrich F 163). Thus, PVC

[29] Most siding is sold on the basis of "squares", *i.e.*, 100 square feet (Belt 1995, 2004; Goodrich F 163 & n.37 at 50).

resin cost share is an insignificant percentage of the total installed cost of vinyl siding products (*See* Goodrich, slip op. at 74).

453. [##] (Belt Dkt. 9159, 2039 *In Camera*; Goodrich F 164). [##] (Belt Dkt. 9159, 2039-40 *In Camera*; Goodrich F 164; *See also* Belt Dkt. 9159, 2037-39 *In Camera*). [##] (Dkt. 9159 CX 168B *In Camera*; *See* generally Dkt. 9159 CX 590 *In Camera*).

(5) Bottles

454. [##] (Dkt. 9159 CX 158A; Goodrich F 169) [##] (Goodrich F 169; *See* Disch Dkt. 9159, 664; Dkt. 9159 RX 206A *In Camera*; Dkt. 9159 RX 145L, Z35 *In Camera*; Friedman JX l, 161). [##] (Dkt. 9159 CX 158A-B; Dkt. 9159 CX 92X; Dkt. 9159 RX 145Z35 *In Camera*; Goodrich F 169; *See* Commission Physical Exhibits 1&2). Food-contact applications account for the remaining 25% for products such as cooking oil, vinegar, and mouthwash (Dkt. 9159 CX 158A-B; Goodrich F 169; *See* Commission Physical Exhibit 3).

455. [##] (Friedman CX 191B ¶ 5 *In Camera*; Disch Dkt. 9159, 665-67; Becker Dkt. 9159, 1317; Friedman JX 1, 114-15, 122-23; Dkt. 9159 CX 92X; Dkt. 9159 CX 158C; Goodrich F 170).

456. [##] (Disch Dkt. 9159, 667; Becker Dkt. 9159, 1318; Friedman JX l, 123; Dkt. 9159 CX 157U *In Camera*; Goodrich F 171).

457. [##] (*See* Dkt. 9159 CX 158A; Dkt. 9159 CX 581K-L *In Camera*; Goodrich F 171). The BATF banned PVC as a liquor packaging material in 1975, and the FDA proposed a ban on PVC in all food-contact applications (Dkt. 9159 CX 158A; Goodrich F 171). [##] (*See* H. Wheeler Dkt. 9159, 1732-33; Dkt. 9159 CX 158A: Dkt. 9159 CX 581K-L *In Camera*; Dkt. 9159 CX 541K-L *In Camera*; Dkt. 9159 CX 157J *In Camera*; Goodrich F 171), [##] (Dkt. 9159 RX 145Z35 *In Camera*; Dkt. 9159 CX 581K *In Camera*; Goodrich F 171). In addition, public opinion resulting from regulations concerning the use of PVC in food-contact bottles is likely to continue to play a role as a demand factor for some time (Dkt. 9159 CX 45¶ -R; Goodrich F 171).

458. [##] (Friedman JX 1, 123-24, 147-48; Becker Dkt. 9159, 1317-18; Dkt. 9159 CX 300Z9 *In Camera*; Goodrich F 172). [##] (Dkt. 9159 CX 92X; *See also* Dkt. 9159 CX 541K-L *In Camera*).

[##] (Becker Dkt. 9159, 1317; Dkt. 9159 CX 541L *In Camera*). [##] (Dkt. 9159 CX 157U-V *In Camera*; *See* Goodrich F 173). [##] (Dkt. 9159 CX 157U-V *In Camera*; *See* Goodrich F 173). [##] (CX 109 *In Camera*). [##] (CX 120N *In Camera*).

459. [##] (Dkt. 9159 CX 158C; Dkt. 9159 CX 157V *In Camera*; *See* Goodrich F 174). [##] (Dkt. 9159 CX 158C; Dkt. 9159 CX 157U *In Camera*; Goodrich F 174). [##] (Becker Dkt. 9159, 1318; Dkt. 9159 CX 157U-V *In Camera*; Dkt. 9159 CX 158C; Goodrich F 174). [##] (Dkt. 9159 CX 158C; Dkt. 9159 CX 581F-G, H, K-L *In Camera*; Goodrich F 174).

460. [##] (CX 117A *In Camera*; *See* RX 150A *In Camera*). Thus, because of these advantages of PVC over PET, the demand for PVC relative to PVC is relatively inelastic.

461. Thus, demand for mass and suspension PVC homopolymer (in the bottle applications where it is used) is relatively insensitive to fluctuations in the price of PVC resin (Friedman JX 1, 118-21; Becker Dkt. 9159, 1319-20; Goodrich, slip op. at 73 & n.163; Goodrich F 177-78). One reason for this is that PVC is selected as a bottle material primarily on the basis of preferences for its physical properties (Dkt. 9159 CX 158B; Friedman JX l, 116, 122-23; *See* Goodrich F 177). [##] (CX 120Q *In Camera*). [##] (Friedman CX 191B ¶ 5 *In Camera*). [##] (117A *In Camera*; CX 109 *In Camera*; RX 150A *In Camera*).

462. In addition, the unique demands made by PVC bottle manufacturers on PVC as a material to achieve its combined physical characteristics result in the addition of many ingredients such as impact modifiers, to produce the needed PVC bottle compound. As a result, PVC resin accounts for only a small portion, no more than 30% to 50%, of the cost of the PVC compound used to fabricate bottles (Becker Dkt. 9159, 1318-19; Friedman JX 1, 115; *See* Goodrich F 178). The process of fabricating the bottle adds more value and further reduces the significance of the cost share of the PVC resin in the final product to about 20% (Friedman JX 1, 116; *See* Goodrich F 178; Becker Dkt. 9159, 1319-20). Thus, fluctuations in the mass and suspension PVC homopolymer resin price alone have but a minimal effect on the total price of the finished bottle (Friedman JX l, 118-121; *See* Goodrich F 177).

463. Finally, the ban by the BATF and the proposed ban by the FDA on the use of PVC as a material in food-contact bottle applications have had a profound effect on the demand for PVC in these applications for reasons wholly unrelated to changes in the price of PVC resin.

464. Thus, the demand for mass and suspension PVC homopolymer resin used in bottle applications is relatively inelastic (Friedman JX 1, 116, 118-21). [##] (Friedman CX 191B ¶ 5 *In Camera*). Thus, evidence in this record relating to the perceptions of those involved in the production of PVC bottles to the effect that the degree of competition between PVC and other materials is limited (evidence which was not available in Goodrich), shows that the demand for PVC in bottles is more inelastic than the Commission found in Goodrich (Goodrich, slip op. at 75).

(6) Windows

465. [##] (Goodrich F 179) [##][30] [##] [31] [##] (*See* Belt Dkt. 9159, 2053, 2065; Dkt. 9159 RX 145Z23, Z57 *In Camera*; Dkt. 9159 CX 591I *In Camera*; Dkt. 9159 CX 92Y; Dkt. 9159 RX 90Z73 *In Camera*; Goodrich F.180). [##] (Belt Dkt. 9159, 2050-51, 2057 *In Camera*; *See* Commission Physical Exhibits 5 & 15; Goodrich F 184 & n.39 at 56).

466. [##] (*See* Belt Dkt. 9159, 1977, 2052, Dkt. 9159 CX 92Y; Dkt. 9159 RX 90G *In Camera*; Dkt. 9159 RX 145Z23 *In Camera*; Goodrich F 180). [##] (Belt Dkt. 9159, 2052-53; Dkt. 9159 RX 145Z23 *In Camera*; Goodrich F 180).

467. [##] (Belt Dkt. 9159, 2047-48; RX 67D *In Camera*; Dkt. 9159 CX 92Y; Goodrich F 181). Windows can be the greatest source of heat loss in a home, apart from the attic (Belt Dkt. 9159, 2047;

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[30] Profile extrusions are rigid or flexible PVC resin compounds extruded into a particular shape and finished with downstream processes (*See, e.g.*, Disch 667-69; Belt 2049; Weber 1807; *See also* Commission Physical Exhibit 4). [##] (*See, e.g.*, Disch 667-69; Dkt. 9159 CX 92Y; Dkt. 9159 CX 45V; Dkt. 9159 RX 90Z73 *In Camera*; Dkt. 9159 RX 145Z57 *In Camera*).

[31] [##] (*See* Dkt. 9159 RX 145Z57 *In Camera*; Dkt. 9159 RX 90Z73 *In Camera*). [##] (*See* Dkt. 9159 CX 45V; Dkt. 9159 RX 145Z57 *In Camera*).

Goodrich F 181), and heightened energy-consciousness has created a strong demand for vinyl replacement windows to improve thermal efficiency, particularly in older homes (Belt Dkt. 9159 2047, 2051-52; Goodrich F 181). [##] (RX 67D *In Camera*; Dkt. 9159 CX 92Y; Dkt. 9159 CX 45V; *See* Goodrich F 182).

468. [##] (Dkt. 9159 CX 300Z8 *In Camera*; Goodrich F 182). [##] (RX 67D *In Camera*; Dkt. 9159 CX 45V; Dkt. 9159 CX 300Z8 *In Camera*; Goodrich F 182). [##] (RX 67D *In Camera*; Belt Dkt. 9159, 2062 *In Camera*; Dkt. 9159 CX 300Z8 *In Camera*; Dkt. 9159 CX 145Z23 *In Camera*; Goodrich F 182).

469. [##] (*See* Dkt. 9159 RX 90G, Z60 *In Camera*; Dkt. 9159 RX 837A-B *In Camera*; Goodrich F 183), [##] (Belt Dkt. 9159, 2062 *In Camera*; Dkt. 9159 CX 756Z118; Goodrich F 183),[32] [##] (Belt Dkt. 9159, 2062 *In Camera*; Dkt. 9159 CX 756Z118; Goodrich F 183). [##] (Belt Dkt. 9159, 2062 *In Camera*; *See* Goodrich F 183).

470. [##] (*See* Belt Dkt. 9159, 2057-61 *In Camera*; Dkt. 9159 CX 756Z118; Dkt. 9159 RX 90Z80 *In Camera*; Goodrich, slip op. at 13 & n.164, 74; Goodrich F 184). [##] (Belt Dkt. 9159, 2058 *In Camera*; Goodrich F 184). [##] (Belt Dkt. 9159, 2059-60 *In Camera*; Goodrich F 184). [##] (Belt Dkt. 9159, 2059-61 *In Camera*; Dkt. 9159 CX 756Z118; Goodrich F 184).

471. As a result of the strong demand for the superior properties of vinyl in a replacement window product, and because PVC resin cost is an insignificant factor in the price of an installed vinyl window to the ultimate purchaser, demand for mass and suspension PVC homopolymer resin in vinyl replacement windows is highly inelastic with respect to changes in the price of PVC resin (Belt Dkt. 9159, 2062-63; Goodrich, slip op. at 73 & n.164 *See* Goodrich F 184).

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[32] Vinyl replacement window fabricators are often the same distributor-dealers that handle other building products, such as vinyl siding (Belt 2050-51, 2054-55; Dkt. 9159 CX 756Z113, Z118-120). The vast majority of replacement windows are installed by home improvement contractors who buy directly from the fabricators (Belt 2054-55; Dkt. 9159 CX 756Z113).

(7) Medical applications

472. [##] (Dkt. 9159 RX 145Z32 *In Camera*; Goodrich F 189), [##] (Dkt. 9159 RX 206A *In Camera*; Goodrich F 189). [##] (Dkt. 9159 RX 145Z30-231 *In Camera* Disch Dkt. 9159 676-77; Becker Dkt. 9159, 1309-12; Goodrich F 189; *See* Commission Physical Exhibits 10 & 11). [##] (Dkt. 9159 RX 145Z30-Z31 *In Camera*; Goodrich F 189). PVC also has FDA approval for medical applications (Disch Dkt. 9159, 676; Goodrich F 189). Even if another material were technically suitable for medical applications, it could not be used until all the necessary regulatory approvals had been obtained, a process which can take years (Disch Dkt. 9159, 678). As a result, the demand for mass and suspension PVC homopolymer in medical applications is highly insensitive to changes in the price of PVC resin (Disch Dkt. 9159, 677; Becker Dkt. 9159, 1312; Goodrich, slip op. at 74; Goodrich F 189).

(8) Calendered products

473. Much of the remaining consumption of mass and suspension PVC homopolymer resin is accounted for by a wide variety of rigid and flexible calendered products[33] (*See* Dkt. 9159 CX 45W-Y, Z-Z2, Z3-Z4; Dkt. 9159 CX 428Z100; Dkt. 9159 RX 1325Z65-Z86; Disch Dkt. 9159, 663; Goodrich F 190). End use applications for rigid calendered PVC sheet include decorative laminates and credit card stock (H. Wheeler Dkt. 9159, 1728, 1753; Dkt. 9159 RX 1325Z85-Z86; Goodrich F 190). [##] (Donnelly CX 176E-F ¶ 6 *In Camera*; H. Wheeler Dkt. 9159, 1727-28; Becker Dkt. 9159, 1323-14; DiLiddo Dkt. 9159, 3375-79; Dkt. 9159 CX 45W-Y, Z-Z2, Z3-Z4; Goodrich F 190; *See* Commission Physical Exhibits 16 & 17).

474. The versatility of mass and suspension PVC homopolymer resin as a material is well-illustrated by the broad range of calendered products in which it finds application. The wide use of PVC resin is

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[33] A calendered product is produced by a fabrication technique known as "calendering" in which large heated rolls are used to produce wide sheets of PVC material, which is later turned into a finished product (Becker 1312-13; DiLiddo 3376-77; Goodrich F 190 & n.40 at 58).

possible because, with the addition of compound additives and ingredients, it can be flexible or rigid, strong, tear-resistant, and easy to fabricate and color. PVC also has good printability properties (Becker Dkt. 9159, 1268, 1313-14; DiLiddo Dkt. 9159, 3376-77; Goodrich F 190; *See also* Disch Dkt. 9159, 665). Overall demand for vinyl calendered products is influenced primarily by the general state of economic activity, *i.e.*, the level of demand essentially moves as GNP moves, as opposed to changes in the price of PVC resin (H. Wheeler Dkt. 9159, 1754 Goodrich F 190).

475. [##] (*See* Dkt. 9159 CX 300Z9 *In Camera*; Goodrich F 191). [##] (Dkt. 9159 CX 300Z9 *In Camera*). As stated by Mr. Rodney Becker, former Sales and Marketing Manager for Diamond: "I think there was a time in the mid-seventies when most automotive upholstery was vinyl. That was a typical use . . . , whereas today if you buy a car, most people specify fabric as opposed to vinyl because fabric is more comfortable in the hot weather" (Becker Dkt. 9159, 1267; *See* Goodrich F 191). [##] (*See, e.g.*, Dkt. 9159 CX 45W-X: furniture upholstery, Z-Z2: apparel; Goodrich F 190-91; Donnelly CX 176E-F ¶ 6 *In Camera*), [##] (Becker Dkt. 9159, 1314; Goodrich F 191). [##] (Donnelly CX 176E ¶6).

476. [##] (*See, e.g.*, DiLiddo Dkt. 9159, 3376-79; Goodrich, slip op. at 73-74 & n.165; Goodrich F 193; Donnelly CX 176E-F ¶ 6 *In Camera*). For example, a typical shower curtain could have as much as 25 parts of plasticizer in it per 100 parts of PVC resin, *i.e.*, in a shower curtain weighing approximately 2 pounds, about ½ pound would be plasticizer and about 1½ pounds would be PVC resin by composition (DiLiddo Dkt. 9159, 3377-78; Goodrich F 193). At a PVC resin price of $.30 per pound, the shower curtain might contain $.45 worth of PVC resin. The retail price of vinyl shower curtains obviously varies with quality, design, packaging, and other factors. To illustrate the disparity between a possible retail price for a finished vinyl shower curtain and the cost of its PVC resin content, Commission Physical Exhibit 16, a vinyl shower curtain, carries a retail price of $7.99 (DiLiddo Dkt. 9159, 3378; Goodrich, slip op. at 74; Goodrich F 193). Similarly, a vinyl shower cap weighing approximately 4 ounces might contain 3 ounces of PVC resin, amounting (at a PVC resin price of $.30 per pound) to less than $.08 worth of PVC resin in a vinyl shower cap that might retail for, say,

$1.79 (DiLiddo Dkt. 9159, 3379; Goodrich, slip op. at 74; Goodrich F 193; *See* Commission Physical Exhibit 17).

477. Because the overall demand for PVC calendered products is influenced primarily by the general level of economic activity and by individual tastes and preferences, and because the cost product price can be insignificant, the demand for mass and suspension PVC homopolymer resin in the production of calendered products is relatively inelastic with respect to changes in the price of PVC resin (Becker Dkt. 9159, 1314-15; H. Wheeler Dkt. 9159, 1754).

d. The record shows that overall demand for mass and suspension PVC homopolymer is inelastic

478. The record shows that the demand for mass and suspension PVC homopolymer overall is inelastic with respect to changes in price (Kaserman Dkt. 9159, 2378-79; Goodrich, slip op. at 73-75).

479. The demand for mass and suspension PVC homopolymer is inelastic because mass and suspension PVC resins offer a unique package of performance properties. An Air Products document concludes that "PVC's unique properties insulate it from changes in relative price" (Dkt. 9159 RX 34Z2). The document further notes that energy price changes are overshadowed by PVC performance properties affecting PVC use (Dkt. 9159 RX 34Z1). [##] (Klass Dkt. 9159, 4117-19; *See also* DiLiddo Dkt. 9159, 3106-07; Dkt. 9159 CX 40Z3 *In Camera*; Dkt. 9159 CX 428E).

480. [##] (Dkt. 9159 CX 64V; Dkt. 9159 CX 51H *In Camera*; *See also* Dkt. 9159 CX 13L *In Camera*; Dkt. 9159 CX 14F, H, K *In Camera*), [##] (Dkt. 9159 CX 97C *In Camera*; *See also* Dkt. 9159 RX 1151: (Dkt. 9159 CX 186G *In Camera*; *See also* DiLiddo Dkt. 9159 3408-11: 10% PVC resin price increase for 1 year would cause little switching away from PVC and would be profitable).

481. Industry members recognize that alternative materials do not place a substantial constraint on the price of mass and suspension PVC homopolymer resin. Mr. Becker stated that, for the mass and suspension PVC homopolymer market overall, there was very little price sensitivity (Becker Dkt. 9159, 1325-26; *See* Goodrich, slip op. at 73-75 & n.167). [##] (Dkt. 9159 CX 297Z1-Z2 *In Camera*; Goodrich, slip op. at 75 & n.167; *See also* Weber Dkt. 9159,

1810-11). Mr. Schaefer stated that PVC is not a price elastic market (Schaefer Dkt. 9159, 1141; Goodrich, slip op. at 73-75 & n.168). [##] (Dkt. 9159 CX 295Z53-Z54 *In Camera*).

482. [##] (*See, e.g.*, DiLiddo Dkt. 9159, 3408-11; Dkt. 9159 CX 135D *In Camera*).

483. [##] (H. Wheeler Dkt. 9159, 1753-54; DiLiddo Dkt. 9159, 3255; Dkt. 9159 CX 297Z1-Z2 *In Camera*; Dkt. 9159 CX 298P; Dkt. 9159 CX 147B).

484. Industry members do not perceive a threat of displacement of mass and suspension PVC homopolymer by other products. Following its major strategy study in 1979, Goodrich concluded that "[d]espite a great deal of searching, we were unable to find any major threats to PVC" (Dkt. 9159 CX 53H). [##] (Dkt. 9159 CX 512C *In Camera*; *See also* Weber Dkt. 9159 1809-10; Dkt. 9159 CX 64V; Dkt. 9159 CX 200N *In Camera*; Dkt. 9159 RX 132C). The absence of competitive threats reflects the fact that other materials do not operate as close substitutes for mass and suspension PVC homopolymer.

485. Mass and suspension PVC homopolymer producers pay little attention to the prices of other materials in setting their prices for mass and suspension PVC homopolymer resin (McMath Dkt. 9159, 1913, 1926-27, 1930-35; Arp Dkt. 9159, 3558-59; Weber Dkt. 9159, 1810-11). The analysis of other materials that does take place is primarily in the nature of market research, used to identify potential new applications and project long-term demand growth. [##] (*See, e.g.*, DiLiddo Dkt. 9159, 3123-24, 3259-62; Dkt. 9159 RX 145A-Z62 *In Camera*; Dkt. 9159 RX 166A-R *In Camera*).

486. [##] (Schaefer Dkt. 9159, 1143; Disch Dkt. 9159, 714; Liao Dkt. 9159, 1544; *See* Dkt. 9159 CX 35A; Dkt. 9159 CX 575 *In Camera*; Dkt. 9159 RX 1015 *In Camera*). Overall, customers of mass and suspension PVC homopolymer are not significantly concerned about competition from other materials (Weber Dkt. 9159, 1810-11). This attitude reflects not only a lack of concern about competition from other materials but also indicates that demand for mass and suspension PVC homopolymer is inelastic.

487. Based upon his review of the record of Dkt. 9159 and the record compiled in the Commission's investigation of Occidental's acquisition of Tenneco Polymers up until April 1986, Dr. Kaserman

concluded that the demand for mass and suspension PVC homopolymer is inelastic (Kaserman Dkt. 9159, 2373-74; Kaserman JX 1, 254-70; *cf.* Klass Dkt. 9159, 4267).

3. Suspension PVC copolymer

a. *Introduction*

488. As demonstrated, *infra,* the fact that suspension PVC copolymer is a product market means that demand for suspension PVC copolymer is sufficiently inelastic so that firms could profit if they coordinated their actions and engaged in collusion. In other words, if suspension PVC copolymer firms increased price by a small but significant and nontransitory amount, the increase in profits due to the higher price would more than offset the decrease in profits due to lower sales. However, demand for suspension PVC copolymer is more inelastic than is sufficient for a finding that suspension PVC copolymer is a product market. Demand for suspension PVC copolymer is inelastic with respect to changes in price (Kaserman JX 1, 345 ln. 2-6; Kaserman Dkt. 9159, 2381). And respondents' economic expert, Dr. Barry Harris agrees with the assessment that the demand for suspension PVC copolymer is inelastic (Harris JX 1, 858 ln. 19-24).

489. On analysis, it is seen that the price elasticity of demand for suspension PVC copolymer is very low. First, there is very limited substitutability between suspension PVC copolymer and other input products, including suspension PVC homopolymer, in the manufacture of final products normally made from suspension PVC copolymer (Kaserman Dkt. 9159, 2376-77; Kaserman JX 1, 258 ln. 2-13). Second, the cost share of suspension PVC copolymer resin is only a portion of the cost of suspension PVC copolymer end-use products, and very often the proportion is low (Kaserman Dkt. 9159, 2375). Third, the elasticity of demand for final products made from suspension PVC copolymer is low (Kaserman Dkt. 9159, 2373-75). Because there is very limited substitutability between suspension PVC copolymer and other input products in the manufacture of final products, the price elasticity of demand for suspension PVC copolymer is necessarily lower than the price elasticity of demand for

the final products (Kaserman Dkt. 9159, 2377; *See* Klass Dkt. 9159, 4267). The price elasticity of demand for suspension PVC copolymer resin is significantly less than the price elasticity of demand for the final products because of the low cost share of suspension PVC copolymer in many final products.

b. *There is limited substitutability of other inputs for suspension PVC copolymer*

490. There is very limited substitution for suspension PVC copolymer resin in its major end-use applications, vinyl floor tile and records (*See* Goodrich, slip op. at 72; Kaserman Dkt. 9159, 2376-77). Generally, suspension PVC copolymer resin is the primary raw material input and imparts essential properties to the product (*See* Goodrich, slip op. at 72). [##] (*See* Goodrich, slip op. at 72; Weimar CX 192C ¶ 5 *In Camera*; Silver CX 190B *In Camera*; Marcus CX 209B ¶ 4 *In Camera*). Thus, substitution to either non-PVC materials or to PVC resins other than suspension copolymer resins in these end-use applications is limited.

c. *The cost share of suspension PVC copolymer in its end-use products is low*

491. Suspension PVC copolymer resins account for only a small portion of the cost of the finished products made from these resins (*See* Goodrich, slip op. at 72-74, 73 n.164). Value is added to the PVC resin at several stages in the production of the final PVC end product. First, all suspension PVC copolymer resins are compounded before they are processed (Disch Dkt. 9159, 655-56). Compounding involves mixing the resin with various additives, which may include heat and light stabilizers, impact modifiers, plasticizers, and pigments (Disch Dkt. 9159, 656-57). Second, suspension PVC copolymer compounds are converted into fabricated products through either a calendering or compression-molding production process (Disch Dkt. 9159, 661-662). Once again, the value added varies with each of the copolymer products. The low cost share of suspension PVC copolymer resin in PVC end use products means that the demand for suspension PVC copolymer resin is significantly less elastic than the

demand for the products themselves (*See* Kaserman Dkt. 9159, 2375-78).

d. *The price elasticity of demand for suspension PVC copolymer end-use products is low*

492. As shown in the record, suspension PVC copolymer resin is used to make primarily two different major end-use products, vinyl floor tile and long-playing (LP) phonograph records. To a lesser degree, it is used in some calendered sheet applications, although this is a small and declining end-use application.

493. Suspension PVC copolymer products have specific properties that distinguish them from products made from other materials. As a result, suspension PVC copolymer products are often chosen on the basis of their properties, and not on the basis of changes in the price of the product. Second, where suspension PVC copolymer products are chosen because they offer a cost savings to the purchaser, the cost savings are often so substantial that the PVC product would still be far less expensive than alternative products, even if suspension PVC copolymer resin prices rose by a small but significant amount. Thus, customers would likely continue to purchase the PVC product even if suspension PVC copolymer resin prices would rise by a small but significant amount.

e. *The price elasticity of demand for suspension PVC copolymer in vinyl floor tile is low*

494. [##] (*See* Dkt. 9159 RX 145Z51 *In Camera*; Dkt. 9159 RX 90Z73 *In Camera*; Dkt. 9159 CX 591I *In Camera*; Dkt. 9159 CX 45P; *See also* Disch 672). [##] (Dkt. 9159 CX 300Z9 *In Camera*; Dkt. 9159 CX 450; *See* Commission Physical Exhibit 8).

495. [##] (Weimar CX 192B 4 *In Camera*; JX 3, PX 9 at 34 ln. 9-35 ln. 23; JX 3, PX 136 at 57 ln. 2-7). Copolymer resin, which can be blended with other ingredients and melts at relatively low temperatures, "wets out" the filler material (Weimar JX 1, 31 ln. 21-32 ln. 1; Barlet JX 1, 56 ln. 22-57 ln. 7). Suspension PVC copolymer resin is thus a necessary raw material in the manufacture of vinyl composition tile.

496. Suspension PVC homopolymer does not melt as easily as does copolymer. At lower temperatures, therefore, it does not "wet out" the filler, and thus does not provide the same binding properties. As a result, the substitution of more than small amounts of homopolymer for copolymer in the vinyl composition tile production process would require that more PVC and less filler be used, or that the PVC be blended for longer periods of time at substantially higher temperatures. In either case, the manufacturing cost of the tile is likely to be substantially higher (Weimar JX 1, 32 ln. 9-33 ln. 9; Barlet JX 1, 58 ln. 13-59 ln. 2; *See* JX 3, PX 136 at 57 ln. 23-58 ln. 10; JX 3, JX 9 at 35 ln. 24-36 ln. 17; JX 3, PX 8 at 24 ln. 6-25 ln. 5).

497. Some vinyl composition or resilient tile manufacturers use small amounts of homopolymer in their products. Armstrong, the largest manufacturer of vinyl composition or resilient tile, uses some homopolymer in its flooring products. It uses a much more significant amount of copolymer (Barlet JX l, 58 ln. 5-12). Armstrong has added homopolymer to its tile products in order to obtain certain desirable properties in the tile, not to obtain a lower production cost (Barlet JX l, 77 ln. 15-18). Indeed, because using homopolymer resin would require more production effort, in terms of the amount of heat required and the length of the mixing times, it would slow down the production process and reduce the rate of output of the flooring plant, potentially resulting in significantly higher overall production costs (Barlet JX l, 58 ln. 5 - 59 ln. 2, 62 ln. 7-21; *See* JX 3, PX 136 57 ln. 23 - 58 ln. 10). Thus, Armstrong is at the limit in terms of the amount of suspension PVC homopolymer that it can use in its production of vinyl composition tile (Barlet JX l, 58 ln. 5-19). [##] (Barlet JX 1, 62 ln. 22-25, 73 ln. 7-13 *In Camera*).

498. [##] (Marcus CX 209B ¶ 4 *In Camera*).

499. [##] (Rawlins CX 197B-C ¶ 4 *In Camera*; Rawlins RX 248B-C ¶ 5 *In Camera*). [##] (Rawlins CX 197B ¶ 4 *In Camera*; Rawlins RX 248B-C ¶ 5 *In Camera*). [##] (Rawlins CX 197B-C ¶ 4 *In Camera*).

500. [##] (Rawlins RX 248C ¶ 6-7 *In Camera*). Mr. Barlet similarly testified that Armstrong has done and continues to do research regarding its tile products, and that, among the many possible developments in its products, there could one day be changes in the composition of its tile products (Barlet JX l, 78 ln.

5-19 ln. 1). [##] (Weimar CX 192B ¶ 4 *In Camera*; Barlet JX l, 62 ln. 22-25; Rawlins CX 197B ¶ 3 *In Camera*).

501. [##] (Weimar JX 1, 32 ln. 3-5; Weimar CX 192C ¶ 5 *In Camera*; Barlet JX l, 62 ln. 22-25, 73 ln. 7-13 *In Camera*; Rawlins CX 197B-C ¶ 4 *In Camera*; JX 3, PX 136 at 60 ln. 21-61 ln. 10).

502. Today, nearly all floor tiles are made out of vinyl, although a small amount of asphalt tile is still produced (Goodrich F 165; Disch Dkt. 9159, 673; Dkt. 9159 CX 450). [##] (Goodrich F 166; Disch Dkt. 9159, 673; Dkt. 9159 CX 300Z9 *In Camera*). [##] (JX 3, PX 4 F 166; Weimar CX 192F-G ¶ 15 *In Camera*, CX 192G-H ¶ 17 *In Camera*; Dkt. 9159 CX 300Z9 *In Camera*; Dkt. 9159 RX 51C *In Camera*). [##] (compare JX l, Barlet 66 ln. 15-21 with Barlet JX l, 60 ln. 7-14), [##] (Weimar CX 192G-H ¶ 17 *In Camera*). [##] (Weimar CX 192G-H ¶ 17 *In Camera*).

503. [##] (Goodrich F 167). [##] (Goodrich F 167; Dkt. 9159 CX 450P; Dkt. 9159 CX 756Z76; Dkt. 9159 RX 51C *In Camera*; JX 3, PX 136 at 105 ln. 13-22). [##] (Disch Dkt. 9159, 673; Dkt. 9159 RX 145Z49 *In Camera*; Dkt. 9159 CX 300Z9 *In Camera*). [##] (Weimar CX 192F-H ¶ 15-17 *In Camera*). [##] (Dkt. 9159 CX 300Z9 *In Camera*). While carpeting has aesthetic advantages over vinyl tile, it is not as good a product for kitchens, bathrooms, and other hard use areas in the home (Goodrich F 167; Dkt. 9159 CX 756Z76).

504. The price of suspension PVC copolymer resin as a component of the cost of a finished floor tile is relatively small. About 15% to 20% of the composition of a vinyl floor tile is accounted for by PVC resin content. The rest of the tile consists of fillers, calcium carbonate, and other ingredients (Goodrich F 168; Disch Dkt. 9159, 672). Colors are added, and designs and patterns are embossed or engraved on the tile, which further increases the value of the tile product relative to the cost of PVC resin (Disch Dkt. 9159, 672-73). As explained by Mr. Disch: "The price of the resin going into the tile is about 40 cents a pound. It is 15 percent, 20 percent, you are talking 6 to 8 cents of resin within a volume of tile" (Disch Dkt. 9159, 673; Barlet JX 1, 60 ln. 7-23; Weimar JX 1, 35 ln. 3-16).

505. Because of the limited potential for substitution of suspension PVC homopolymer for suspension PVC copolymer in vinyl floor tiles, because vinyl floor tiles are selected primarily on the basis of

individual tastes and preferences, and because the cost of PVC resin is a small factor in the price of a finished vinyl tile product, the demand for suspension PVC copolymer resin in floor tiles is inelastic (*See* Goodrich, slip op. at 74; Weimar JX 1, 42 ln. 1-4; JX 3, PX 8 at 29 ln. 7-ln. 14; JX 3, PX 136 at 75 ln. 23 - 76 ln. 3).

f. *The price elasticity of demand for suspension PVC copolymer in LP records is low*

506. Phonograph records account for a large percentage of United States suspension PVC copolymer consumption (JX 3, PX 8 at 18 ln. 1-5). Phonograph records are produced by the compression-molding of suspension PVC copolymer resin (Disch Dkt. 9159, 678; *See* Dkt. 9159 Commission Physical Exhibit 13).

507. [##] (Goodrich F 186; Hill CX 183E ¶ 13 *In Camera*; Dkt. 9159 CX 45Z4). [##] (Goodrich F 186, 187; Hill CX 183E ¶ 13 *In Camera* JX 3, PX 8 at 13 ln. 6-21; JX 3, JX 9 at 33 ln. 15-22; JX 3, PX 11 at 678 ln. 2-16; JX 3, PX 136 at 56 ln. 18-23; Disch Dkt. 9159, 678; Dkt. 9159 CX 300Z10 *In Camera*). [##] (Hill CX 183E ¶ 14 *In Camera*; JX 3, PX 8 at 13 ln. 6-21; JX 3, JX 9 at 37 ln. 25-38 ln. 7; JX 3, PX 11 at 678 ln. 17-679 ln. 1; JX 3, PX 136 at 56 ln. 24 - 57 ln. 1; *See also* CX 119S-T *In Camera*; Silver CX 190B *In Camera*). Polystyrene has sometimes been used in low-priced applications, such as children's records, where sound quality is not an important factor (Goodrich F 187; Disch Dkt. 9159, 678; Dkt. 9159 CX 45Z4). [##] (Goodrich F 187; CX 119S-T *In Camera*; Hill CX 183E ¶ 14 *In Camera*). Thus, for example, Mr. Schaefer of Occidental has testified that, to his knowledge, there are no substitutes for suspension PVC copolymer resin in record-pressing (JX 3, PX 136 at 56 ln. 24 - 57 ln. 1).

508. Because of the need to use suspension PVC copolymer resin in the manufacture of records, significant increases in the price of copolymer resin would not cause record pressers to shift, in their production processes, from copolymer to either homopolymer or polystyrene (JX 3, PX 136 at 56 ln. 24-57 ln. 1; JX 3, PX 8 at 22 ln. 25-23 ln. 25; JX 3, JX 9 at 42 ln. 17-25).

509. [##] (JX 3, PX 8 at 26 ln. 15-27 ln. 11; JX 3, JX 9 at 40 ln. 20-41 ln. 8; Schaefer JX 3, PX 11 at 678 ln. 10-16; JX 3, PX 136 at

65 ln. 25-66 ln. 9; Disch Dkt. 9159, 678). [##] (Hill CX 183E-F ¶ 15 *In Camera*; JX 3, PX 8 at 27 ln. 1-7). [##] (Hill CX 183E-F ¶ 15 *In Camera*; JX 3, PX 8 at 27 ln. 1-11). [##] (Hill CX 183E-F ¶ 15 *In Camera*).

510. [##] (Hill CX 183F ¶ 16 *In Camera*; JX 3, PX 8 at 18 ln. 16-22; JX 3, JX 9 at 43 ln. 1-7). [##] (Hill CX 183F ¶ 16 *In Camera*). Because it is such a small component of the cost of a record, however, an increase in the price of copolymer resin would not have any substantial effect on the demand for records relative to other PVC sound reproduction products (JX 3, PX 8 at 28 ln. 21-29 ln. 6; JX 3, JX 9 at 42 ln. 12-43 ln. 11; Schaefer JX 3, PX 11 at 679 ln. 2-5; JX 3, PX 136 at 75 ln. 23-76 ln. 3; Disch Dkt. 9159, 679). Thus, as the Commission concluded in Goodrich, the demand for suspension PVC copolymer resin in records is definitely inelastic (*See* Goodrich, slip op. at 74).

g. *Summary of the elasticity of suspension PVC copolymer end products*

511. In the two major applications in which it is used, suspension PVC copolymer resin provides distinct performance properties that are important factors affecting its selection as a material, and that tend to make demand for copolymer in these end-use products relatively price inelastic (Kaserman Dkt. 9159, 2373-74; *See* Goodrich, slip op. at 72). The record also shows that purchasers of the finished products in which suspension PVC copolymer is used tend to select products largely on the basis of non-price considerations such as individual tastes and preferences. In applications where finished products are selected largely on the basis of considerations other than price, changes in suspension PVC copolymer resin prices do not impact the volume of suspension PVC copolymer consumed, and demand for suspension PVC copolymer in these applications is therefore price inelastic. Finally, in records and floor tile, copolymer resin provides such a substantial cost advantage over alternative materials and the cost of the resin is such a small component of the total finished product price, that changes in the price of the resin have little or no impact on the volume of finished products. As a result, the price of suspension PVC copolymer resin can be raised significantly with no resulting substantial threat of

substitution. Thus, demand for end-use products made from suspension PVC copolymer resin is relatively price inelastic (Kaserman Dkt. 9159, 2313-75).

h. *The record shows that overall demand for suspension PVC copolymer is inelastic*

512. The record shows that the demand for suspension PVC copolymer overall is inelastic with respect to changes in price. Both complaint counsel's and respondents' economic experts have so concluded (Kaserman JX 1, 261 ln. 21 - 262 ln. 2; Harris JX 1, 858 ln. 19 - 859 ln. 2).

513. Industry members recognize that the existence of alternative materials does place a substantial constraint on the price of suspension PVC copolymer resin.

514. Occidental recognized, at the time of the acquisition, that the reduction in the number of suppliers of suspension PVC copolymer resin had the potential to significantly increase profits (JX 3, PX 12).

515. [##] (H. Wheeler Dkt. 9159, 1753-54; DiLiddo Dkt. 9159, 3255; Dkt. 9159 CX 297Z1-Z2 *In Camera*; Dkt. 9159 CX 298P; Dkt. 9159 CX 147B).

516. Suspension PVC copolymer producers pay little attention to the prices of other materials in setting their prices for suspension PVC copolymer resin (JX 3, PX 8 at 31 ln. 21 - 32 ln. 2; JX 3, JX 9 at 26 ln. 14-20; Flammer CX 184E ¶ 9).

i. *Conclusion*

517. Accordingly, it must be found that the demand for suspension PVC copolymer is inelastic. Because suspension PVC copolymer is an intermediate product, the elasticity of demand is a function of: (1) the ability of users of the PVC resin (*i.e.*, fabricators) to substitute other inputs for PVC; (2) the cost share of suspension PVC copolymer resin in the end products in which it is used; and (3) the extent to which users of suspension PVC copolymer products switch to products made from alternative materials in response to changes in the price of PVC copolymer products. The record shows that: (1)

there is no ability of suspension PVC copolymer resin users to employ other materials as an input; (2) the cost share of suspension PVC copolymer is only a relatively small portion of the cost of the products in which it is used; and (3) products made of alternative materials are not close substitutes for suspension PVC copolymer end-use products. As a result of (3), the demand for suspension PVC copolymer end-use products is inelastic. As a result of (1) and (2), the demand for suspension PVC copolymer resin is even less elastic than its end-use products.

518. The fact that demand for suspension PVC copolymer is highly inelastic means that, if industry members collude and raise prices, they would substantially increase their level of profitability. Accordingly, the low price elasticity of demand for suspension PVC copolymer provides producers with both the incentive and the ability to exercise market power.

519. As the record demonstrates, suspension PVC copolymer firms could exercise market power in various ways without significantly affecting the demand for suspension PVC copolymer. Firms could raise prices by a small but significant amount (5-10%) above prices presently in effect, with essentially no product substitutions occurring. And, in fact, firms could raise prices substantially higher than that, before the degree of substitution would make further price increases unprofitable.

4. Dispersion PVC resin

a. *Introduction*

520. [##] (Kaserman JX 1, 345; JX 3, PX 136 at 67, 75-76; van Haaren CX 187E ¶ 15 *In Camera*; Boulay CX 189D ¶ 10-11 *In Camera* JX 3, PX 8 at 38-39; JX 3, JX 9 at 55). The price inelasticity of dispersion PVC resin demand provides further incentive for producers to collude (Kaserman JX 1, 260, 270, 345; Kaserman Dkt. 9159, 2353-55, 2381).

521. Because dispersion PVC is an intermediate (or input) product, the price elasticity of demand for dispersion PVC may be assessed by examining: (1) the ease of substitutability between dispersion PVC and other inputs in the production of the final

products; (2) the cost share of dispersion PVC in the production of the final products; and (3) the price elasticity of demand for the final products produced from dispersion PVC (*See* Kaserman JX 1, 260, 270; Goodrich slip op. at 72; Kaserman Dkt. 9159, 2370-71).

b. *There is limited substitutability of other inputs for dispersion PVC*

522. [##] (JX 3, PX 8 at 33, 39-40; Boulay CX 189B-C ¶3-5 *In Camera*; van Haaren CX 187B-C ¶ 6-7 *In Camera*).

523. [##] (*Id.*). [##] (*See, e.g.*, Hill CX 183F-G ¶ 17 *In Camera*; Flammer CX 184B-F; ¶4-8, 10; Boyer CX 185B-F ¶ 3-9, 11). Thus, substitution of other materials, including PVC resins other than dispersion PVC in most end-use applications is severely limited.

c. *The cost share of dispersion PVC in its end-use products is low*

524. [##] (*See* Lore JX 1, 180, 183-84; Mason JX 1, 194-95; Boulay CX 189B ¶ 3-5 *In Camera*; JX 3, PX 8 at 39-40, 95-96; JX 3, PX 136 67, 75-76).

525. Value is added to the dispersion PVC resin by the addition of blending PVC resin, plasticizers, stabilizers, and additives before processing (*See, e.g.*, Boyer CX 185B-D ¶ 3-8). [##] (Lore JX 1, 177, 179; Mason JX 1, 192; Barlet JX 1, 62-64; JX 3, JX 9 at 15, 97-98, 104-05. *See* Hill CX 183F-G *In Camera* ¶ 17).

526. Generally, the dispersion PVC resin is blended with a small portion of blending PVC resin, a specialty suspension PVC resin, to impart the necessary properties for each end-use product.

527. Various methods of applying dispersion PVC resin to an end product add further value to the end product. For instance, dispersion PVC resin can be applied to sheet floors and vinyl backed carpet tile by knife coating or reverse roll coating (*See* JX 3, PX 9 at 97-98; Mason JX 1, 192). Reverse roll coating is generally the preferred method for applying vinyl dispersion PVC to cans and sealants (*See* Lore JX 1, 177, 179). Molding applications, including dip molding or rotational molding, use a dispersion PVC paste plastisol or organisol to produce products such as beach balls, tool handles, and dish drainers. Slush molding is also a method of applying a dispersion PVC resin formulation to a molded form (*See*

Lore JX l, 179; JX 3, JX 9 at 104-05). Each of these dispersion PVC fabrication processes adds value to the final product. These necessary steps for processing dispersion PVC pastes or emulsions insure that the cost share of the dispersion PVC in the final product remains low.

528. The low cost share of dispersion PVC resin in dispersion PVC end use products means that the demand for dispersion PVC resin is significantly less elastic than the demand for the end products themselves (*See* Kaserman Dkt. 9159, 2375-78).

d. *The price elasticity of demand for dispersion PVC resin end products is low*

529. [##] (*See, e.g.*, JX 3, PX 138; Baker CX 205A-B ¶ l-2; van Haaren CX 187A-B ¶ 2 *In Camera*; JX 3, PX 8 at 38-45; Barlet JX 1, 66 ln.22-67 1n.10; Beveridge JX l, 80-81; Lore JX l, 177-80; Mason JX l, 192, 194-95; Boulay CX 189A-B ¶ l-3 *In Camera*).

530. Dispersion PVC products generally have specific properties that distinguish them from products made from other materials. As a result, dispersion PVC products are often chosen on the basis of their properties and not on the basis of changes in the price of the product. Second, where dispersion PVC products are chosen because they offer a cost savings to the purchaser, the cost savings are sufficiently substantial that the dispersion PVC product would still be less expensive than alternative products, even if dispersion PVC resin prices rose by a small but significant amount. And the record shows that customers would continue to purchase dispersion PVC products even if dispersion PVC prices would rise by a small but significant amount.

e. *Vinyl resilient sheet flooring*

531. Consumers choose flooring for kitchens based on personal preferences. One of the more widely used coverings in a kitchen is vinyl resilient sheet flooring, made with dispersion PVC resin. Vinyl resilient sheet flooring accounts for about 33% to 40% of the consumption of dispersion PVC resin (JX 3, PX 138; Kaserman JX l, 268; JX 3, PX 8 at 39-40).

532. [##] (*See* van Haaren CX 187C ¶ 7 *In Camera*). A 5-percent increase in the price of dispersion PVC resin would not lead consumers to substitute other flooring products or purchase fewer sheet floors (JX 3, PX 8 at 39). Therefore, the elasticity of demand for vinyl resilient sheet flooring remains low because consumers choose it because of superior properties and personal preference.

533. Additionally, the vinyl dispersion PVC sheet floor is sold to wholesalers at a cost of approximately $3.50 to $9.50 a square yard (Barlet JX l, 66). The value of the dispersion PVC in this formulation accounts for no more than 10% of the value of the vinyl sheet floor. Many sheet floors sell for a price of between $12 and $25 a square yard (JX 3, PX 8, 38-40). [##] (*See* Barlet JX l, 66 1n. 22-67 ln. 8, 68; Kaserman JX l, 268 ln. 15-20; JX 3, PX 8 at 38 ln. 10-39 ln. 14; van Haaren CX 187C-D ¶ 7, 9-10 *In Camera*; Beveridge JX l, 80-81). Therefore, a 5-percent increase in the price of dispersion PVC would increase the cost of a vinyl sheet floor by far less than 0.5%, and have essentially no effect on the level of consumption of dispersion PVC in vinyl sheet floors (JX 3, PX 8 at 39).

f. *Molding end-use segments*

534. Major molding end-use segments for dispersion PVC face a low elasticity of demand (Kaserman JX l, 266 ln. 19-267 ln. 15; 268 ln. 15-20). Can coatings, seals, bottlecap closures, and adhesives and sealants account for about 50% of the dispersion PVC consumed in molding applications, or about 16% of all dispersion PVC consumed in the United States. Vinyl automotive products account for about 7% of all dispersion PVC consumed in the United States (Kaserman JX l, 266 ln. 19-267 ln. 15; 268 ln. 15-20; *See* JX 3, PX 6 at 44 ln. 2-18, 45 ln. 18-21; JX 3, JX 9 at 95 ln. 8-10; JX 3, PX 138).

(1) Automotive applications

535. [##] (Boulay CX 189B-C ¶ 3-5 *In Camera*). [##] (Boulay CX 189D ¶ 11 *In Camera*; Goodrich F 192; Becker 1267-68).

536. [##] (Boulay CX 189D ¶11 *In Camera*). [##] (*Id.*). [##] (Boulay CX 189D ¶ 11 *In Camera*).

537. [##] (Boulay CX 189B ¶ 3 *In Camera*). [##] (*Id.*). [##] (*Id.*). [##] (Boulay CX 1898, C, D ¶ 3, 6, 11 *In Camera*; *See* Kaserman JX 1, 268 ln. 15-20).

(2) Vinyl dispersion coating

538. Vinyl dispersion coating principally consists of dispersion PVC resin, but contains additives such as pigments, stabilizers, and solvents (Lore JX l, 177, 179-80). Vinyl dispersion coating, used for coating cans or sealing gaskets inside bottlecaps, offers the attractive feature of costing less money than substitute plastic resins, and creating less air pollution than potential substitute materials (Lore JX 1, 180, 183-84; *See* JX 3, JX 9 at 103-04).

539. Vinyl dispersion coating costs approximately $12 a gallon, of which only $3 to $4 consists of the cost of dispersion PVC resin (Lore JX l, 183-84). Vinyl dispersion coating has found a niche where it is strongly preferred by purchasers (Lore JX l, 180).

540. Therefore, a 5-percent increase in the price of dispersion PVC resin would lead to a price increase of between $.15 and $.20 a gallon for vinyl dispersion PVC coating (Lore JX l, 183 ln. 16-184 ln. 4, 184 ln. 24-185 ln. 14). This small increase is not likely to affect the amount of finished cans or sealants or vinyl coated bottlecaps sold, and will not affect the level of demand for dispersion PVC in vinyl dispersion coatings (Lore JX l, 180, 182, 183 ln. 16-184 ln. 4, 184 ln. 24-185 ln. 14; *See* Kaserman JX 1, 268 ln. 13-20.).

g. *Vinyl backed carpet tile*

541. Vinyl backed carpet tile, produced through a roll coating process, accounts for consumption of about 14 million pounds of dispersion PVC annually, or over 10 percent of dispersion PVC resin used in all coating applications (JX 3, PX 138; Mason JX l, 192). Vinyl backing for carpet tiles, accounts for approximately 3.2% of all dispersion PVC consumed in the United States (JX 3, PX 138, Kaserman JX l, 268).

542. Vinyl backed carpet tile is used in commercial applications, such as the flooring for offices. The unique physical properties of vinyl-backed carpet tile allow it to retain a stable share of the

commercial flooring market (Mason JX 1, 192; JX 3, JX 9 at 95; JX 3, PX 8 at 35). The dispersion PVC resin accounts for about 20% of the cost of the vinyl-backing used for carpet tile (Mason JX 1, 194-95). Fixed proportions of the dispersion PVC resin formulation are required to maintain the essential properties needed for dispersion PVC-based carpet tiles.

543. Because vinyl backing costs about $3.50 to $4.75 a square yard, a 10-percent increase in the price of dispersion PVC resin would raise costs only 3.5 cents to 5 cents a square yard (Mason JX 1, 194-95). Because of the additional value added in transforming the vinyl-backing into finished carpet tile, the corresponding increase in the price of finished vinyl-backed carpet tile would proportionately be substantially less than the increase in the vinyl-backing.

544. Consequently, a 10-percent increase in the price of dispersion PVC would lead to very little loss of sales to alternative carpet tiles, because of the preferred physical characteristics and the low cost share accounted for by dispersion PVC resin in vinyl-backed carpet tile. Therefore, demand in this end-use segment would be relatively insensitive to price changes (Mason JX l, 192-94, 195 ln. 23-196 ln. l; Kaserman 268 ln. 13-20).

h. *Coated fabrics*

545. Coated fabrics accounted for almost 25% of dispersion PVC resin consumption prior to the acquisition (Kaserman JX l, 266 ln. 19-267 ln. 15; JX 3, PX 8 at 43 ln. 16-23). The coated fabric business in the United States has been declining, however, due to a shift away from coated fabrics in automobiles and to imports of apparel products (Goodrich F 192; Becker Dkt. 9159, 1267-68; JX 3, PX 8 at 39-40, 95). Therefore, less dispersion PVC is presently being used in fabric coating (JX 3, PX 8 at 39-40, 95; JX 3, PX 9 at 94). The market for vinyl-backed carpet tile coating applications previously discussed, has not declined.

546. Industry observers acknowledge that the price of dispersion PVC resin has had no impact on the level of imports of finished apparel goods entering this country from the Far East (JX 3, PX 8 at 95; JX 3, JX 9 at 94), and has had no impact on customers' selection of cloth seats over vinyl in new automobiles (Goodrich F 192; Becker

Dkt. 9159, 1267-68). Mr. Disch observed that "large modern capacity has been built overseas to produce coated fabrics, Far East and other places, so I think there is that urgency to move it here" (JX 3, PX 8 at 95). Therefore, a 10-percent increase or decrease in the price of dispersion PVC would not likely affect the level of imports of finished, imported goods (JX 3, PX 8 at 95, 39-40; *See* JX 3, JX 9 at 103).

i. *Overall assessment*

547. Dr. Kaserman observed that: (1) Customers of dispersion PVC cannot vary the proportions of dispersion PVC resin or substitute other raw materials for dispersion PVC; (2) there are few fabricated substitute products to make significant inroads into the use of dispersion PVC-based products; and (3) the cost share of dispersion PVC resin does not account for more than 30% of the cost of any of the dispersion PVC end-uses (Kaserman JX 1, 267 ln. 16-269 ln. 18). Therefore, Dr. Kaserman concluded, a small but sustained nontransitory price increase of 5-percent will probably not affect the demand for dispersion PVC based end products (Kaserman JX 1, 267 ln. 16-269 ln. 18).

548. Due to the inability of most users of dispersion PVC resin to substitute other raw materials for dispersion PVC, the low elasticity of demand for dispersion PVC based finished goods, the inability of other fabricated products to make significant inroads into the sale of dispersion based PVC end products, and the small cost share of finished dispersion based PVC end products accounted for by dispersion PVC resin, a 5-percent price increase is unlikely to significantly affect the level of demand for dispersion PVC finished products, and would have little effect on the level of demand for dispersion PVC (JX 3, PX 136 at 67, 75-76; Kaserman JX 1, 267 ln. 16-269 ln. 18; *See* JX 3, JX 9 at 103).

B. The Homogeneity of PVC Resins Facilitates Price Coordination in Each of the Relevant PVC Markets

549. In Goodrich, the Commission found, in contrast to VCM, that mass and suspension PVC resins are "relatively heterogeneous"[34] (Goodrich, slip op. at 113). The Commission concluded, on the basis of the record in Goodrich, that the higher degree of heterogeneity of PVC, together with other factors, could make collusion more difficult at the marginal level of moderate concentration presented in Goodrich.

550. Economists generally classify products as either homogeneous or differentiated (Kaserman Dkt. 9159, 2410). If a product is relatively homogeneous, the purchasers of the product view the output of the different firms as being equivalent (Kaserman Dkt. 9159, 2410). They do not value the output of one firm much higher than they value the output of another firm. If the product is differentiated, one firm's output has a much higher value to the consumer than another firm's output (Kaserman Dkt. 9159, 2410). Product homogeneity may also be affected by the extent to which products change over time, the degree to which pricing is complicated by different transportation charges to customers, or the degree to which production is customized (*See* Scherer, *Industrial Market Structure and Economic Performance*, 200-01 (1980)).

551. It is easier for firms to coordinate their actions when a homogeneous product is involved. If a product is relatively homogeneous, suppliers need to coordinate on fewer dimensions. Because all firms' products are alike, it would be easier to reach agreement on a collusive price. Furthermore, by simplifying coordination, product homogeneity contributes to the likelihood that

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[34] Two Commissioners agreed with the Initial Decision's finding, however, that, within well recognized grades, mass and suspension PVC is a homogeneous product, noting: "PVC is boringly homogeneous." Goodrich, separate statement of Commissioners Azcuenaga and Bailey, concurring in part and dissenting in part, at 7. That mass and suspension PVC was found by the Commission to be "considerably more heterogeneous" than VCM (Goodrich, slip op. at 66; *See* concurring & dissenting statement at 7), is hardly surprising given the extraordinarily degree of homogeneity of VCM. Dr. Kaserman observed that VCM is the quintessential homogeneous product (Kasserman Dkt. 9159, 2413-18).

firms will be able to maintain a collusive arrangement (Kaserman Dkt. 9159, 2411-12). As the Commission noted in Goodrich, "maintaining a consensus becomes more difficult when it must cover full lines of products of varying qualities, because a firm can disguise its efforts to cheat more easily" (Goodrich, slip op. at 65).

552. No product is perfectly homogeneous in all respects (Kaserman Dkt. 9159, 2412-13). And, a product does not have to be perfectly homogeneous for collusion to occur (Kaserman Dkt. 9159, 2412). The issue is whether the product is relatively homogeneous on the continuum from perfect homogeneity to complete heterogeneity (Kaserman Dkt. 9159, 2412-13).

553. The *DOJ Merger Guidelines* note that there is no objective index or empirical basis for drawing fine distinctions among cases (*DOJ Merger Guidelines* ¶ 4493.411 at 6879-16). Accordingly, except in extreme instances, the factor of product homogeneity or relative heterogeneity is accorded little weight under the *Guidelines* (*Id.*).

554. Mass and suspension PVC resins are sold in different well-established grades, distinguished by recognized differences in particle size, molecular weight, and purity (Goodrich F 85; Disch Dkt. 9159, 632, 634-35; Becker Dkt. 9159, 1255-57). In the purchase of mass and suspension PVC resins, buyers select the grade of resin appropriate to specific production processes and end-use products (Goodrich F 85; Goodrich, slip op. at 67; Disch Dkt. 9159, 634; DS Admission 166, Dkt. 9159 CX 6H).

555. The fact that PVC resins may be sold in a number of grades does not, however, significantly reduce its homogeneity (Kaserman Dkt. 9159, 2415-17). The use of grades has less significance for heterogeneity when, as in the mass and suspension PVC market, they arise from differing requirements by classes of buyers, rather than differences among sellers for the business of any particular buyer (Kaserman Dkt. 9159, 2415-17).

556. Within grades, mass and suspension PVC resins are relatively homogeneous products (Kaserman Dkt. 9159, 2413-17). Mr. Schaefer explained that customers mainly purchased on the basis of price:

> JUDGE HOWDER: Are sales made solely on the basis of price? Are there any other considerations such as delivery or some type of customer loyalty?
>
> THE WITNESS: There isn't much of it, I am afraid. There is a price for a quality and that is why we talk about the pipe price for that quality. For general purpose quality or film quality, the prices are different, but it is difficult, let's say, to get any kind of a premium at a given quality level. Now, other things, terms and conditions they are a factor to my mind. They are really just another form of price because there is a cost of money there you can relate right back to the selling price.
>
> JUDGE HOWDER: For example, you have your salesmen making these calls. Do they do so on a regular basis to regular customers?
>
> THE WITNESS: Yes, they do.
>
> JUDGE HOWDER: For example, promise to keep their inventories filled with the proper pipe sizes, this kind of thing and sort of look after their interests?
>
> THE WITNESS: They do. And there is a degree of customer loyalty in this business but I would characterize it more as one that will give you an opportunity to meet the price in most cases rather than a willingness to pay a premium.

(Schaefer Dkt. 9159, 1202-03).

557. As the Commission recognized in Goodrich, most mass and suspension PVC resin grades, such as pipe and general purpose grades, are considered "commodity" products (Goodrich, slip op. at 66; Goodrich F 87; Dkt. 9159, 725; Dkt. 9159 CX 406Z6). Commodity grade resins amount to approximately 75 percent or more of mass and suspension PVC sales (Goodrich, slip op. at 66-67; Goodrich F 87; compare Weber Dkt. 9159, 1795 (75%) and Klass Dkt. 9159, 4055 (increasing dependence on pipe)). The commodity grades are considered to be "me-too" products, with no real claims that one supplier's resin is better than another supplier's resin (Goodrich slip op. at 67; Goodrich F 87; Disch Dkt. 9159, 719, 725; *See also* Becker Dkt. 9159, 1331). Customers will switch suppliers because of small differences in price (Goodrich F87, *See* Disch Dkt. 9159, 707). No supplier can maintain a premium price for its grade over those of other suppliers (Goodrich, slip op. at 67; Goodrich F87; JX 3, PX 6 at 105 ln. 1-13; Becker Dkt. 9159, 1264-65; Schaefer Dkt. 9159, 1139, 1202-03). Occidental recognizes that "[p]rice is the

primary selling tool for suspension resins" (JX 3, PX 13 at 452734). Even Dr. Klass, respondents' economic expert in Goodrich, concluded that commodity grade resins are close to being physically homogeneous (Klass Dkt. 9159, 5363).

558. Some mass and suspension PVC resin grades, such as medical grade resins, are called "specialty" grades in the industry (Goodrich F 88; Becker Dkt. 9159, 1263; H. Wheeler Dkt. 9159, 1750-51). [##] (JX 3, PX 47; JX 3, PX 48; *See* DiLiddo Dkt. 9159, 3374-75; Dkt. 9159 RX 152Z6 *In Camera*). [##] (DiLiddo Dkt. 9159, 3374-75; *See also* Dkt. 9159 RX 152Z6 *In Camera*). ("Specialty" PVC resins are specialty chemicals in a limited sense"). Suppliers are not able to maintain a price premium over the price of a similar grade resin of competing suppliers (Goodrich F 88; JX 3, PX 8, 118 ln. 25-119 ln. 2; Becker Dkt. 9159, 1264-65; H. Wheeler Dkt. 9159, 1750-51).

559. Moreover, mass and suspension PVC resins have become more homogeneous since the close of the record in Goodrich, and are becoming increasingly homogeneous over time. There has been a trend for mass and suspension PVC producers to reduce the number of grades they offer for sale (JX 3, PX 11 635 ln. 10 - 636 ln. 1, 647 ln. 15 - 648 ln. 4). Some firms produce only one grade (JX 3, PX 11, 635 ln. 10-20).

560. Suspension PVC copolymer resins are sold in primarily two grades for its major end-use markets, *i.e.* record grade and flooring grade. Record grade copolymer resin commands a premium over flooring grade (JX 3, PX 9 at 23 ln. 14-24, 18 ln. 15-22). This premium is based primarily on the more stringent quality requirements of purchasers of record grade resin (*Id.*).

561. Suspension PVC copolymer resin is considered to be a commodity product, because there are little differences among competitive products, and because products are available from a number of different suppliers (Beveridge JX 1, 85 ln. 8-10; JX 3, PX 6, 104 ln. 14 - 105 ln. 13; JX 3, PX 7, 13 ln. 7 - 14 ln. 15; JX 3, PX 9, 32 ln. 15-21; JX 3, PX 8, 10 ln. 24 - 11 ln. 12; JX 3, PX 48). Although copolymer resin is sold in two different grades, there is, within grade, little difference among the products offered by different producers in terms of price, and in terms of physical and chemical properties (JX 3, PX 6, 105 ln. 1-6; JX 3, PX 8, 10 ln. 24 - 11 ln. 12,

118 ln. 12-17; JX 3, PX 48). No supplier can maintain a price premium for its grade over an equivalent grade from competing suppliers (JX 3, PX 6 at 105 ln. 7-13; JX 3, PX 9 at 32 ln. 15-21; JX 3, PX 8 at 10 ln. 24 - 11 ln. 12; JX 3, PX 7 at 14 ln. 1-5).

562. Dispersion PVC resins are sold in a number of grades, depending primarily on the requirements needed for various production processes and end-use products (JX 3, PX 9 at 88 ln. 3-15; JX 3, PX 32). General purpose grade dispersion PVC resin accounts for approximately half of all dispersion resin sales (JX 3, PX 7 at 13 ln. 7-18), and the other grades will differ depending upon the end-use in which they are needed (*Id.*).

563. Dispersion PVC resins have also been characterized as commodity products (JX 3, PX 6 at 104 ln. 14 - 105 ln. 13; JX 3, PX 7, 13 ln. 7 - 14 ln. 15). As in the case of mass and suspension PVC resins and suspension PVC copolymer resins, dispersion PVC resin, although it is sold in different grades, is relatively homogeneous within grade (JX 3, PX 32). There is little difference among the products offered by different producers in terms of price, and in terms of chemical and physical properties. No supplier can command a price premium for its dispersion PVC resin over an equivalent grade product of another supplier (Beveridge JX 1, 89 ln. 24 - 90 ln. 2; JX 3, PX 6 at 41 ln. 21 - 42 ln. 7; JX 3, PX 8 at 10 ln. 24 - 11 ln. 12; JX 3, PX 7 at 14 ln. 1-5). Producers selling dispersion PVC for use in a particular end-use application generally charge the same price (JX 3, PX 6 at- 41 ln. 21 - 42 ln. 7; JX 3, PX 32). Within an end-use, customers will tend to switch among approved suppliers in response to small differences in price (Mason JX 1, 202 ln. 25 - 203 ln. 4). Thus, although dispersion PVC resins are less homogeneous in nature than mass and suspension PVC resins or suspension PVC copolymer resins, dispersion PVC resin is itself a relatively homogeneous product (JX 3, PX 8 at 10 ln. 24 - 11 ln. 12). In any event, to the extent that dispersion PVC resin is the least homogeneous product among the three relevant product markets, it is likely that, because of the highly concentrated nature of this market, producers would have little trouble overcoming obstacles to coordination that product variations may present (*cf.* Goodrich, slip op. at 77).

564. In Goodrich, the Commission stated that the "crucial point about heterogeneity is that it substantially complicates the determi-

nation and enforcement of consensus prices" (Goodrich, slip op. at 68, n.151). As the Commission noted "[i]nstead of establishing a single price for a single homogeneous product, firms must establish and maintain a whole series of prices for a whole series of product grades" (*Id.; See DOJ Merger Guidelines* ¶ 4493.411, at 6879-16).

565. As the Commission has stated, however, "anticompetitive conduct can and has occurred with respect to only certain variables in the overall competitive landscape even when competition remains with respect to other variables" (*Hospital Corp. of America*, 106 FTC 361, 508 (1985)). In HCA, the Commission noted that competitors could collude on different aspects of the hospital services market such as, for example, radiology, or could collude to restrict credit terms (*HCA*, 106 FTC at 507-08).

566. Similarly, within each of the relevant markets, producers could collude on certain grades of resin, or could collude on other aspects of competition, such as plant expansions, credit terms or service levels. The Commission therefore, reaffirmed in Goodrich that "'agreements as to all aspects of competition are not necessary for effective collusion to take place and to have a negative impact on competition.' *HCA*, 106 FTC at 508; *accord Catalano, Inc. v. Target Sales, Inc.*, 446 U.S. 648-650 (1980) (agreement to refuse to extend credit *per se* illegal)" (Goodrich, slip op. at 70 n.155).

567. [##] (Alberti CX 199B ¶ 2 *In Camera*). [##] (Disch RX 258D-E ¶ 11 *In Camera*; Disch RX 258I-J ¶ 23 *In Camera*; Disch RX 262B ¶ 5 *In Camera*). [##] (RX 258Z83 *In Camera*). [##] (Clark RX 254A-C ¶ 5-8 *In Camera*).

568. Moreover, there are indications in the record that collusion as to certain grades of resin could well be successful in the relevant markets. Mass and suspension PVC resin is primarily sold as pipe-grade, and as a limited number of other commodity grades (CX 85; CX 86; CX 87; CX 88; CX 89; CX 90; CX 92; CX 93A). These resin grades, which together account for the large majority of mass and suspension PVC resin sales, are each sold at one market price (*See, e.g.,* CX 92). Because these resin grades account for the large majority of mass and suspension PVC resin sales, public price announcements are generally limited to the price of these grades (*Id.*). As a result, mass and suspension PVC producers need not regularly maintain and coordinate a schedule of several different

prices for different grades. Instead, producers need only coordinate on the pricing of a limited number of commodity grade resins. Indeed, coordination on the price of only one grade of mass and suspension PVC resin, *i.e.*, pipe-grade resin, would be quite profitable for mass and suspension PVC producers, given that this end-use application is the single largest end use of mass and suspension PVC resin, accounting for over 40% of mass and suspension PVC demand (Goodrich, slip op. at 18; CX 43E). These factors facilitate the coordination of pricing among mass and suspension PVC producers.

569. [##] (RX 95 *In Camera*; JX 3, PX 9, 26 ln. 14-20). As Mr. Stevens, Director of Marketing for Tenneco, testified, "the suspension market is driven strictly by pipe demand" (JX 3, PX 9 at 26 ln. 19-20; *accord* Klass Dkt. 9159, 4062-63). As the price of pipe-grade resin increases, the prices of other grades of resin increase to a level incrementally greater than the price of pipe-grade resin (*See* CX 92; CX 93A; RX 293B; RX 297B; RX 300B; RX 301B; RX 303C, RX 305B-C, RX 306C; RX 310D).

570. Thus, mass and suspension PVC producers need not maintain a complicated schedule of prices for their resins. For example, Georgia-Pacific (now Georgia-Gulf) issued a schedule of prices for 18 different numbered mass and suspension PVC resins, with the distinct numbers designating resins with specified inherent viscosities (CX 93B). The company maintained a total of only three different prices for the 18 different resins, however, with pipe-grade resin the lowest priced resin, general purpose-grade resin priced one cent higher and film-grade priced an additional one cent above (*See also* JX 3, PX 27; CX 217A; JX 3, PX 26; JX 3, PX 37). [##] (*See, e.g.*, Dkt. 9159 RX 922A *In Camera*; Dkt. 9159 RX 924A *In Camera*; Dkt. 9159 RX 925A *In Camera*; Dkt. 9159 RX 926A *In Camera*).

571. [##] (RX 197M *In Camera*). [##] (RX 197M *In Camera*). [##] (RX 1S *In Camera*), [##] (RX 1T, 1V *In Camera*). Moreover, the higher profits associated with coordinated pricing across the commodity segment of the overall mass and suspension PVC market would not, because of the higher cost of producing specialty resins in small reactors, be defeated through competition from specialty resins (*See* HCA, 106 FTC at 508).

572. [##] (*See* CX 4A-Z518 *In Camera*) [##] This situation is directly analogous to the situation in HCA, where the Commission found that, because of limited gains in areas other than the area affected by the collusive agreement, such cheating would not dissolve the profits to be garnered from collusion (*HCA*, 106 FTC at 507-08). Here, because the pipe customer would be distinct from the specialty grade customer, there would be no increased sales to pipe-grade customers through offering a lower price for specialty resins, while at the same time colluding on pipe-grade prices.

573. [##] (Troug CX 202A-B ¶ 1-3 *In Camera*).

574. Suppliers sometimes provide technical service in conjunction with the sale of PVC (Goodrich F 89; Becker Dkt. 9159, 1331-32). Service is relatively more significant in the sale of specialty grades than commodity grades (Goodrich F89; Goodrich, slip op. at 66-67; Becker Dkt. 9159, 1330-31; Weber Dkt. 9159, 1794-96). For the mass and suspension PVC market and suspension PVC copolymer markets as a whole, service is relatively unimportant (Goodrich F89; Schaefer Dkt. 9159, 1202-03; Kaserman Dkt. 9159, 2413-14; Dkt. 9159 CX 199U). It is likely that relatively more service is provided in the sale of dispersion PVC, but even in that market, the provision of service is relatively unimportant and does not allow for one supplier to maintain a premium for its products (JX 3, PX 13 at 452717; Beveridge JX 1, 89 ln. 24 - 90 ln. 2; JX 3, PX 6 at 41 ln. 21 - 42 ln. 7; JX 3, PX 8 at 10 ln. 24 - 11 ln. 12; JX 3, PX 7 at 14 ln. 1-5). The providing of service has only a minor effect on differentiating among suppliers in the United States. It may cause a customer to prefer to continue with its regular supplier and give that supplier a chance to meet competitve offers (Goodrich F 89; Becker Dkt. 9159, 1330-32; Schaefer Dkt. 9159, 1202-03). However, a customer will still switch suppliers for relatively small differences in price (Becker Dkt. 9159, 1330-32; Schaefer Dkt. 9159, 1202-03).

575. The Commission expressly rejected the respondents' "commercial heterogeneity" argument, observing that factors such as differences in sales terms among producers, including, price, credit terms, method of delivery, and contract length relate to industry performance rather than structure (Goodrich, slip op. at 70 n.155).

576. The PVC industry is not undergoing significant process or product technological change. Thus, there is no basis for concluding that it is heterogeneous in this fashion (*See* Goodrich, slip op. at 69).

577. [##] (*See, e.g.*, Dkt 9159 RX 243A *In Camera*), [##] (*See, e.g.*, Dkt 9159 CX 578A-C *In Camera*; Dkt. 9159 RX 914; Dkt. 9159 RX 915 *In Camera*; Dkt. 9159 RX 916 *In Camera*; Dkt. 9159 RX 926 *In Camera*) [##] (*See, e.g.*, Dkt. 9159 RX 244 *In Camera*, Dkt. 9159 CX 184). [##] (Heath CX 178D ¶ 6 *In Camera*; JX 3, PX 7 at 153 ln. 23 - 154 ln. 14; *See* JX 3, PX 62-PX 75).

578. The Commission in Goodrich stated that transportation cost differences could make mass and suspension PVC resins a more heterogeneous product (Goodrich, slip op. at 68). As noted by the Commission, PVC resins are generally sold on a delivered price basis, although it is not clear whether the delivered prices are uniform (Goodrich, slip op. at 80; DS Admission 475; Dkt. 9159 CX 6T; Goodrich Admission 432 Dkt. 9159 CX 4Z28).

579. [##] (*See* Dkt. 9159 RX 922A *In Camera*; Dkt. 9159 RX 924A *In Camera*; Dkt. 9159 RX 925A *In Camera*; Dkt. 9159 RX 926A *In Camera*).

580. In any event, to the extent that firms have different costs in transporting resin to customers, these costs are relatively small as a percentage of the delivered price of PVC resins in each of the relevant markets, and therefore would not have a significant effect on the ability of producers in these markets to coordinate pricing (*See* Scherer, *Industrial Market Structure and Economic Performance* 201). Moreover, as discussed, *infra*, overall transportation cost differences among mass and suspension PVC producers have narrowed substantially since the time of the Goodrich case, as PVC producers have closed West Coast and North East PVC plants and concentrated capacity expansions in the Gulf Coast.

581. [##] (Dkt. 9159 CX 304G *In Camera*; Dkt. 9159 CX 317G *In Camera*; Dkt. 9159 CX 182Z9-10 *In Camera*; Dkt. 9159 CX 301E *In Camera*; Dkt. 9159 CX 318H *In Camera*; Dkt. 9159 CX 320D *In Camera*; Dkt. 9159 RX 15; Dkt. 9159 CX 4Z106-27). PVC resins are also sold through brokers (*See* H. Wheeler Dkt. 9159, 1758-59; Dkt. 9159 CX 536A). These transactions include specialty grades (Dkt. 9159 RX 15). These kinds of transactions are possible only where differences among suppliers' products are minimal and, therefore,

show that mass and suspension PVC is a relatively homogeneous product. These arrangements show that neither producers nor consumers consider the differences among products of different producers to be important.

582. [##] (Goodrich F90; Eades Dkt. 9159 1461; Dkt. 9159 CX 518F *In Camera*; Dkt. 9159 RX 34T; Dkt. 9159 RX 501A; Dkt. 9159 RX 54B *In Camera*), [##] (Dkt. 9159 CX 519F *In Camera*; Dkt. 9159 RX 54B *In Camera*), where buyers will switch suppliers over small differences in prices (DiLiddo Dkt. 9159, 3372 [one fourth of a cent]). Mr. Bailey, PVC Product Manager for Occidental, testified that he "would characterize almost all grades of PVC as commodities and that would include homopolymer suspension, copolymer suspension and dispersion" (JX 3, PX 6 at 104 ln. 14-25). Similarly, Goodrich recognizes the PVC "industry" to be a commodity business. Purchasers of PVC resins in each of the relevant markets generally select the lowest priced resin grade suitable for a particular processing or end-use requirement (Goodrich F 90; DS Admission 177, Dkt. 9159 CX 6H).

583. Thus, the variations discussed above would not, in any of the relevant markets, prevent coordinated, collusive pricing by producers that would result in the accumulation of substantial profits.

C. The Similar Costs of PVC Producers Facilitate Anticompetitive Conduct In Each of the Relevant Markets

584. On the basis of the record in Goodrich, the Commission concluded that "PVC production costs vary significantly among producers." The Commission agreed with the findings in the Initial Decision, but concluded that the presence of a substantial amount of small reactor capacity in the mass and suspension PVC market, as well as differences in PVC transportation costs among firms located in different parts of the country, resulted in cost differences among mass and suspension PVC producers that would tend to make it more difficult to reach a collusive consensus price, at least at the existing level of industry concentration (Goodrich, slip op. at 77-81). Thus, given the weak presumption of anticompetitive effects based upon the concentration data, the Commission found the evidence of cost

differences, together with other factors, sufficient to rebut the presumption (Goodrich, slip op. at 112-13).

585. If firms in a market have similar costs they will be more likely to be able to agree on and maintain a profit maximizing collusive price (Kaserman Dkt. 9159, 2404-05). As the Commission noted in Goodrich, differences in cost functions can make it more difficult to "develop a collusive consensus price," (Goodrich, slip op. at 77), although at increased levels of concentration, "cost differences nevertheless may not prevent firms from accepting price or output levels somewhat different from their optimal levels" (*Id.*).

586. Firms in a market need not have identical costs for collusion to become likely (Kaserman Dkt. 9159, 2405). The question is whether firms' costs are similar (Kaserman Dkt. 9159, 2405).

587. A firm's costs are a function of the technology it uses, the price the firm pays for its inputs and the cost of transporting PVC to purchasers (Goodrich, slip op. at 77-78; *See* Kaserman Dkt. 9159, 2405-06). The technology determines the relationship between input quantities and output quantities; it determines the quantities of inputs necessary to produce a given amount of output (Kaserman Dkt. 9159, 2406). Total cost is a function of the quantities of inputs and the price of those inputs (Kaserman Dkt. 9159, 2406).

588. [##] (*See* Dkt. 9159 CX 246 *In Camera*).

589. In each of the relevant PVC markets, firms today have similar costs of converting VCM into mass or suspension PVC. Firms also have similar costs for VCM (Goodrich, slip op. at 78, n.174).

590. In addition, as the Commission recognized in Goodrich, differences in the cost of transporting PVC to customers would be a factor that could contribute to differences in production costs among PVC producers (Goodrich, slip op. at 80-81).

591. As discussed *infra*, the record developed since the Goodrich case reveals that transportation costs are in fact only a small part of the cost of the delivered price of PVC, so that differences in the cost of transporting PVC do not result in significant cost differences among PVC producers.

592. As recognized in Goodrich, firms in the mass and suspension PVC market have access to similar PVC manufacturing technology (Goodrich F 195; *Id.* at 93; Goodrich, slip op. at 78; Kaserman Dkt. 9159, 2406, 2409). The technology is available, there

are no significant patents that would give one firm a significant cost advantage over another (Goodrich F 195; Goodrich, slip op. at 78; Klass Dkt. 9159, 4074-75; Kaserman Dkt. 9159, 2409; Schaefer Dkt. 9159, 1212; DiLiddo Dkt. 9159, 3288-89). Thus, "PVC firms have access to similar cost positions and potentials" (Klass Dkt. 9159, 5488-89).

593. [##] (Goodrich F 196; *cf.* Dkt. 9159 CX 54Z10 *In Camera*). [##] (Goodrich F 197; DiLiddo Dkt. 9159, 3395; Dkt. 9159 CX 54Z10 *In Camera*). VCM is used in a fixed proportion to the amount of PVC produced (Disch Dkt. 9159, 643).

594. PVC is manufactured in the United States today in both large and small reactor plants (Disch Dkt. 9159, 638-640). Small reactors range in size from 2,000 to 5,000 gallons (Schaefer Dkt. 9159, 1213). Large reactors range in size from approximately 18,000 to 40,000 gallons (Disch Dkt. 9159, 638-40; Schaefer Dkt. 9159, 1213-1214). Firms have been building large reactor plants in the United States since the early, 1970's (Goodrich F 198; Disch Dkt. 9159, 641). As the Commission recognized in Goodrich, today large reactor plants are the dominant technology, particularly for mass and suspension PVC (Goodrich, slip op. at 78-79).

595. The Commission found, on the basis of the record in Goodrich, that about two-thirds of mass and suspension PVC capacity was large reactor capacity (Goodrich, slip op. at 79). This estimate is likely to be low today. Many of the small reactor plants identified by the Commission in Goodrich have been shut down, indeed because of their high operating costs relative to large reactor plants. As the Commission noted in Goodrich, Diamond Shamrock closed its Deer Park plants after the acquisition (Goodrich, slip op. at 54).

596. Since the close of the record in Goodrich, the Goodrich Long Beach, California, plant has been shut down, as has Borden's Leominster, Massachusetts, plant and Tenneco's Flemington, New Jersey, plant. Formosa is replacing its small reactor capacity at Delaware City, Delaware, with large reactor capacity at Baton Rouge, Louisiana (CX 165A). [##] (JX 3, PX 13 at 452733; RX 197M *In Camera*). Similarly, the Commission recognized in Goodrich that "[n]o new small reactor plants have been built in the United States since the late 1960's" (Goodrich, slip op. at 79, n.178).

597. Large reactor plants generally are used for commodity grades of mass and suspension PVC (Goodrich, slip op. at 79; Disch Dkt. 9159, 638-40; *cf.* DiLiddo Dkt. 9159, 3397-98). The use of small reactor plants is confined to making special purpose grades of mass and suspension PVC resin, and to making suspension PVC copolymer resin and dispersion PVC resin (Goodrich, slip op. at 79). Within the spectrum of large reactor plants, costs are similar (Goodrich F 199; JX 3, PX 8 at 77 ln. 7-10; Disch Dkt. 9159, 645; Schaefer Dkt. 9159, 1149). [##] (Goodrich F 199; CX 52N *In Camera*; Klass Dkt. 9159, 4212, 5488-89).

598. Similarly, the wide use of similar small reactor technology among firms in the suspension PVC copolymer market and the dispersion PVC market, respectively, increases the similarity of costs among firms in those markets (*cf.* JX 3, PX 8 at 73 ln. 22 - 74 ln. 6, 77 ln. 7-10).

599. [##] (RX 197M *In Camera*). As a result, "[t]hose still in operation are competing only in specialty niches" (JX 3, PX 13 at 452734). [##] (RX 197M *In Camera* [7-12 cents higher]).

600. [##] (RX 143Q-R *In Camera*; CX 3B, 3D, 3J, 3K *In Camera*; RX 177Z9 *In Camera*; RX 144H-J *In Camera*). As discussed *supra*, suspension PVC copolymer does not, as a rule, compete in end-use applications with suspension PVC homopolymer. It is therefore, on the demand side, a separate product market.

601. [##] (RX 197M *In Camera*).

602. [##] (Dkt. 9159 RX 1168 *In Camera*; *See also* CX 52N *In Camera*).

603. Because there are currently no rapid advances in PVC manufacturing technology, it is unlikely that one firm has a significant technological advantage over another.

604. Because VCM is a highly homogeneous product (Goodrich, slip op. at 68-69), it is likely that VCM purchasers pay similar prices for VCM (Goodrich F 203; *cf.* Kaserman Dkt. 9159, 2410).

605. As the Commission discussed in Goodrich, PVC producers have similar costs for acquiring and transporting VCM (Goodrich, slip op. at 78, n.174).

606. If one appropriately values the costs of VCM for firms that are integrated backward from PVC into VCM, then it is clear that all PVC firms pay similar prices for their VCM feedstock (Goodrich F

203; Kaserman Dkt. 9159, 2406-08). The appropriate economic value for the integrated firm to transfer VCM is the firm's opportunity costs (Goodrich F 203; Kaserman Dkt. 9159, 2407). While firms may expectedly keep their books using accounting costs (Kaserman Dkt. 9159, 2807-08), in making economic decisions they presumably take into account the opportunity costs of those decisions (Klass Dkt. 9159, 4559-61, 5319). Opportunity cost is the value of the product in the next best alternative use (Kaserman Dkt. 9159, 2407). The appropriate economic value of VCM for an integrated firm is, therefore, the amount at which the firm could sell it if it did not consume it internally (Kaserman Dkt. 9159, 2407). Thus, firms vertically integrated into VCM should have no product cost advantage over nonintegrated firms.

607. If vertically integrated firms have access to lower cost VCM, one would expect that integrated firms would drive non-integrated firms out of business during a time of excess capacity (Kaserman Dkt. 9159, 2815). "If costs were clearly lower for vertically integrated firms one would expect that nonintegrated firms would have quite a time surviving" (Klass Dkt. 9159, 5337). However, this has not been shown to have occurred.

608. Thus, in the mass and suspension PVC market, integrated and nonintegrated firms have similar costs for their VCM feedstocks (Goodrich, slip op. at 78, n.174).

609. [##] (Dkt. 9159 RX 57Z128), [##] (Disch Dkt. 9159, 701-02; Dkt. 9159 CX 199Z34), [##] (Disch Dkt. 9159, 645; Schaefer Dkt. 9159, 1149; Dkt. 9159 RX 57Z128 *In Camera*).

610. Thus, because PVC producers in each of the relevant markets have access to similar technology and similar raw materials, they have manufacturing costs that tend to be similar (Goodrich ID at 93; JX 3, PX 8 at 77 ln. 2-10).

611. The Commission also cited possible differences in transportation costs for shipping PVC resin to customers as a factor that would lead to differences in costs among PVC producers, and would therefore complicate efforts at coordinated pricing (Goodrich, slip op. at 80-81). The Commission noted that, although PVC resin is generally sold on a delivered price basis, which would eliminate price differences based on location, it was unclear from the record whether the delivered prices were actually uniform (Goodrich, slip op. at 80).

612. [##] (CX 54 *In Camera*). [##] (*Id.*). [##] (CX 54 *In Camera*).

613. [##] (CX 137Z45 *In Camera*). [##] (*Id.*). This pattern is not surprising, given the need for a greater level of customer service associated with specialty resin sales, so that producers of these resins locate close to the fabricator customers (Goodrich, slip op. at 67, n.49). High-volume commodity resins, in contrast, are sold with little other service provided, so that producers locate these plants close to the raw material supply (Goodrich, slip op. at 67). Consequently, costs are similar among commodity grade mass and suspension PVC producers, and costs are similar among specialty grade PVC producers.

614. [##] (*See* Dkt. 9159 RX 1204G *In Camera*), [##]

615. [##] (*See* CX 54 *In Camera*).

616. [##] (CX 137Z45 *In Camera*). [##] (*Id.*). [##] (Dkt. 9159 RX 924A *In Camera*; Dkt. 9159 RX 925A *In Camera*; Dkt. 9159 RX 926A *In Camera*).

617. Because of the higher prices prevailing in the dispersion PVC and suspension PVC copolymer markets, transportation costs account for an even smaller percentage of these relatively high priced products than for mass and suspension PVC homopolymer. Moreover, the high level of concentration in both of these markets, suggests that transportation cost differences would not affect the ability of dispersion PVC producers or suspension PVC copolymer producers to develop a price consensus (*See* Goodrich, slip op. at 77).

618. Thus, examination of the issues raised by the Commission in Goodrich, in light of subsequent developments and new evidence in this record, indicates that production costs among producers in each of the relevant markets are in fact relatively similar and are becoming increasingly so, and that whatever cost differences do exist would not be sufficient to prevent a collusive arrangement among producers.

D. Numerous Small Buyers in Each of the Relevant Markets Increase the Likelihood of Collusion

619. As the Commission found in Goodrich, mass and suspension PVC purchasers could not constrain the exercise of market power by mass and suspension PVC producers (Goodrich, slip op.

at 84). There are a large number of small buyers who make regular, frequent and small purchases in the mass and suspension PVC market (Goodrich, slip op. at 84-85; Goodrich F 216; Goodrich, ID at 93), and in the dispersion PVC market (JX 3, PX 6 at 63 ln. 4-6; JX 3, PX 8 at 111 ln. 19-200; JX 3, PX 9 at 51 ln. 4-21; JX 3, PX 28 at 1-5). And in the suspension PVC copolymer market, where there are fewer buyers, the buyers have no leverage (JX 3, PX 136 at 119 ln. 12-24; Schaefer 595 ln. 4 - 596 ln. 12). The concentration level among suspension PVC copolymer producers, relative to purchasers, is substantially higher than it was in the VCM market in Goodrich (*See* Goodrich, slip op. at 85). The large number of buyers relative to sellers in each of these PVC markets facilitates the likelihood of collusion (Kaserman Dkt. 9159, 2419-21).

620. In addition, buyers in each of the relevant markets tend to purchase from more than one supplier at any given time, which increases the ability of suppliers to monitor competitive activity (JX 3, PX 6 at 62 ln. 15-24; JX 3, PX 11 at 728 ln. 7-22; JX 3, PX 10 at 1140 ln. 21-24; JX 3, PX 8 at 112 ln. 9-15, 116 ln. 6 - 118 ln. 11; JX 3, PX 9 at 86 ln. 20 - 88 ln. 1). Finally, buyers in each of the relevant markets tend to order resin relatively frequently, *i.e.*, on a weekly or monthly basis, in volumes that tend to be regular and small (Goodrich, slip op. at 86-87; Goodrich F 218, n.47; Beveridge JX l, 93 ln. 4-6; JX 3, PX 11 at 684 ln. 25 - 685 ln. 10; JX 3, PX 9 at 47 ln. 9 - 48 ln. 4; Goodrich F 218 & n.47). Accordingly, the number and size of buyers, and the frequency and regularity of small orders in the relevant markets, reduces the incentives and ability of the remaining firms in the markets to cheat on a collusive arrangement (Goodrich, slip op. at 88).

621. The number and size distribution of buyers and orders in a market influence the incentives to cheat on a collusive agreement (Kaserman Dkt. 9159, 2418-19). If a market is characterized by a large number of small buyers or by a large number of small orders, then the incentive for a seller involved in a collusive agreement to discount the price on a given order is not great, because the increment to total sales is relatively small. Conversely, a seller would have to discount secretly to a large number of buyers or on a large number of orders to increase sales by a significant amount, thus increasing the likelihood that its cheating would be detected by the other firms in

the collusive group. Therefore, the larger the number of buyers or the larger the number of orders in a market, the less likely it is that firms in a collusive group will be tempted to cheat, as it is more likely the cheating will be detected (Goodrich, slip op. at 85-86; Kaserman Dkt. 9159, 2419).

622. Currently there are over 2,000 buyers of mass and suspension PVC resin in the United States (Goodrich F 216; Disch Dkt. 9159, 681; *See also* Eades Dkt. 9159, 1505; Dkt. 9159 CX 53J-K; Dkt. 9159 CX 64 P, 5). In contrast, there are only eleven active producers of mass and suspension PVC resin. The number of buyers of mass and suspension PVC resin is thus considerably larger than the number of sellers in the market.

623. The majority of mass and suspension PVC resin buyers are relatively small in terms of annual volume purchased as a percentage of the total domestic PVC market (Goodrich, slip op. at 86-87; *See* Dkt. 9159 CX 53J-K; Disch Dkt. 9159, 681). [##] (Dkt. 9159 CX 58K *In Camera;* Goodrich F 216); [##] (Goodrich, slip op. at 84; Dkt. 9159 CX 64S; Goodrich F 216). [##] (Goodrich, slip op. at 84-85; Dkt. 9159 CX 58K *In Camera*; Dkt. 9159 CX 64S; Goodrich F 216). While the respective percentages of the total mass and suspension PVC market accounted for by resin sales into the various end-use applications has changed slightly over time (Goodrich, slip op. at 85; *See, e.g.*, Disch Dkt. 9159, 663-64), the annual volumes purchased by the majority of mass and suspension PVC resin buyers still account for only a fraction of the total PVC market. Approximately 40% of mass and suspension PVC resins are sold into pipe applications (Goodrich, slip op. at 85; Disch Dkt. 9159, 663). There are over 100 PVC pipe producers in the United States today (Goodrich, slip op. at 85; *See* Disch Dkt. 9159, 683; Yu Dkt. 9159, 2091-92, 2161-62).

624. The top four buyers of mass and suspension PVC resin today are PVC pipe producers, and have been identified as Carlon (a Division of Indian Head Corporation), Certain Teed Corporation, Formosa Plastics Corporation U.S.A. (J-M Manufacturing Co.), and Simpson Timber Co. (Goodrich F 217; Disch Dkt. 9159, 682; Yu Dkt. 9159, 2089, 2092; *See also* Dkt. 9159 CX 53J). It is estimated that these top four companies consume 60% of the total amount of PVC resin used annually in PVC pipe production (Disch Dkt. 9159,

683; Goodrich F 217; *See also* Goodrich, slip op. at 85; Dkt. 9159 CX 756Z40-Z41). The annual volumes purchased by the remaining PVC pipe producers range downward from these four top firms to companies that consume at the 10 million pound level annually, and to regional PVC pipe producers (*See* Disch Dkt. 9159, 683; Yu Dkt. 9159, 2160-62; *See also* Dkt. 9159 CX 756Z40).

625. The annual volume purchased by the firm that is probably the largest single PVC resin buyer, Carlon, is estimated at 250 to 300 million pounds per year (Disch Dkt. 9159, 682; *See also* Dkt. 9159 CX 53J). [##] (*See* JX 3, PX 140 "Table 22" *In Camera*).

626. [##] (Dkt. 9159 682), [##] (*See* JX 3, PX 140 "Table 22" *In Camera*).

627. [##] (Dkt. 9159 CX 303J *In Camera*; Dkt. 9159 CX 308H-I, *In Camera*; *See also* Belt 1991-93 *In Camera*; Yu Dkt. 9159, 2171; Disch Dkt. 9159, 682). [##] (Dkt. 9159 CX 303J *In Camera*), [##]

628. Total consumption of mass and suspension PVC resin by J-M Manufacturing Co., the pipe producing affiliate of Formosa Plastics (Yu Dkt. 9159, 2089), can be estimated at approximately 189 million pounds in 1983 (Yu Dkt. 9159, 2091: 80%, by PVC resin content, of 231 million pounds of domestic PVC pipe sales plus 5 million pounds in export sales), amounting to approximately 3% of the total mass and suspension PVC market. However, actual external purchases are lower, since Formosa Plastics produces some of the PVC consumed by J-M (Liao Dkt. 9159, 1535; Yu Dkt. 9159, 2171).

629. It is estimated that there are close to 200 buyers of dispersion PVC resin in the United States (JX 3, PX 8 at 111 ln. 19-20; JX 3, PX 6 at 63 ln. 4-6). [##] (JX 3, PX140 "Table 12" *In Camera*).

630. It has been estimated that the five or six largest dispersion PVC customers combined account for approximately 50% of the total purchases of dispersion PVC (JX 3, PX 8 at 112, 114). The largest of these companies, Armstrong, accounts for approximately 15% of total industry purchases. The smallest, Becton Dickinson, accounts for approximately 3% (*Id.*).

631. The number of suspension PVC copolymer purchasers is estimated at 20, five times the number of producers (JX 3, PX 8 at 111 ln. 16-18; JX 3, PX 6 at 62 ln. 8-11; JX 3, PX 28). [##] (*See* JX 3, PX 140, "Table 17" *In Camera*). The ratio of purchasers to

producers is higher in this case than it was in the VCM market in Goodrich (compare Goodrich, slip op. at 85).

632. [##] (Disch CX 219F *In Camera*; Disch JX 3, PX 8 at 114). [##] (Disch CX 219F *In Camera*). [##] (*Id.*). [##] (JX 3, PX 8 114 ln. 1; *See* CX 219C-F *In Camera*).

633. Individual mass and suspension PVC resin suppliers have many customers (*See, e.g.*, Disch Dkt. 9159, 681 -- Tenneco has 100 to 150 suspension PVC customers; Weber Dkt. 9159, 1787-88 -- Diamond Shamrock had approximately 100; DiLiddo Dkt. 9159, 3371 -- Goodrich has several hundred). [##] (Dkt. 9159 CX 474A-Z60 *In Camera*).

634. Similarly, dispersion PVC suppliers generally have many customers. Occidental customer files indicate that Occidental sells dispersion resin to approximately 80 customers per month (JX 3, PX 28). Mr. Stevens of Tenneco noted that the company had 25-30 "active term" customers (JX 3, PX 9 at 51). Similarly, Occidental files show that Occidental has at least 15 customers for suspension PVC copolymer resin (JX 3, PX 28).

635. Mass and suspension PVC resin buyers typically split their total purchases among two or more sellers (Goodrich F 218, n.46; *See* Disch Dkt. 9159, 728; Schaefer Dkt. 9159, 1140; Becker Dkt. 9159, 1336-37; McMath 1897-98; Yu Dkt. 9159, 2171; DiLiddo Dkt. 9159, 3371-72). [##] (Dkt. 9159 CX 68 *In Camera*). J-M Manufacturing Co., Inc., the PVC pipe producing affiliate of Formosa Plastics, has also had up to five PVC resin suppliers (Yu Dkt. 9159, 2171).

636. [##] (JX 3, PX 6 at 62; JX 3, PX 8 at 112; *See* CX 4F *In Camera*; CX 4N *In Camera*; CX 4Z *In Camera*; CX 4Z14 *In Camera*; CX 4Z15 *In Camera*; CX 4Z38 *In Camera*; CX 4Z55 *In Camera*; CX 4Z59 *In Camera*; CX 4Z60 *In Camera*; CX 4Z63 *In Camera*; CX 4Z81 *In Camera*; CX 4Z85 *In Camera;* CX 4Z94 *In Camera*).

637. As a result, a seller that might be engaging in a collusive agreement in either the mass and suspension PVC market, the dispersion PVC market, or the suspension PVC copolymer market would only have a fraction of a given buyer's business on which to cheat in order to gain additional sales. To the extent that the potential increment to total sales would thus be relatively small, this factor

tends to diminish the incentive to cheat on a collusive agreement (Kaserman Dkt. 9159, 2419-20).

638. Mass and suspension PVC resin orders are not usually placed for annual volumes. Rather, orders are generally placed on a monthly, and sometimes daily, basis (Goodrich, slip op. at 86-87; Goodrich F 218, n.47; Weber Dkt. 9159, 1803-04; Disch Dkt. 9159, 683-85; DiLiddo Dkt. 9159, 3371-72). Similarly, many dispersion PVC resin orders are placed on a monthly or weekly basis (Beveridge JX 1, 93 ln. 4-6; JX 3, PX 28). [##] (Dkt. 9159 RX 945A-O *In Camera*). These factors further diminish the incentive to cheat on a given order (Kaserman Dkt. 9159, 2420-21).

639. [##] (Beveridge JX l, 93 ln. 4-6; JX 3, PX 9 at 47 ln. 9 - 48 ln. 4; Weimar CX 192F ¶ 14 *In Camera*). [##] (Weimar CX 192F ¶ 14 *In Camera*). Mr. Beveridge testified similarly as to Armstrong's purchases of dispersion PVC resin and suspension PVC copolymer (Beveridge JX l, 93 ln. 4-6).

640. Even if a seller would be tempted to cheat on a given PVC resin order by cutting price, there is substantial uncertainty that the seller will invariably gain additional sales and thereby profit by cheating, due to the ongoing customer-supplier relationships that characterize the PVC markets. The buyer to which a discounted price might be offered would be likely to contact a current seller and offer that seller an opportunity to meet the competing offer (Goodrich, slip op. at 87-88; *See, e.g.*, Weber Dkt. 9159, 1798-99; Schaefer Dkt. 9159, 1203). Thus, a seller tempted to cheat on a collusive agreement would risk detection for potential gain that is substantially uncertain, and the collusive group as a whole would lose to the extent that the price of PVC resin in the marketplace is subsequently lowered because the collusive agreement falls apart (Goodrich, slip op. at 85-86; Kaserman Dkt. 9159, 2774-80).

641. As a result, in order to gain a given increment in sales by cheating, a seller would have to discount secretly to a large number of buyers which would increase the likelihood that the cheating would be detected by the other firms in the collusive group (Kaserman Dkt. 9159, 2419). Thus, the large number of buyers in each of the relevant markets facilitates the detection of cheating by increasing the flow of information in the marketplace regarding competitive activity (Goodrich, slip op. at 86).

642. It is recognized in the PVC industry that the large number of small buyers reduces customer leverage. Dr. DiLiddo of Goodrich observed that buyer concentration in the mass and suspension PVC resin market is low enough that buyers have little leverage over price:

> We also looked at the [PVC resin] customer base and found that it was very attractive. This customer base is attractive because it is readily identifiable, small enough to be reached by a manageable and economic sales force, yet not so concentrated that one or two customers can put enormous pressure on the suppliers to lower price. The biggest customer in the PVC business (Carlon) accounts for less than 7 percent of the total market. Yet three hundred customers account for some 80 percent of the total market. There are only about 1,000 customers in the United States that buy a carload or more of PVC per year.

(Dkt. 9159 CX 53J-K; Goodrich F 216). Mr. Schaefer of Occidental testified similarly that purchasers of suspension PVC copolymer resin have little leverage (JX 3, PX 136 ln. 12-24; Schaefer JX 1, 595 ln. 4-596 ln. 12).

E. The High Degree of Repeat Sales in Each of the Relevant Markets Facilitates the Detection of Cheating

643. The relevant PVC markets are all characterized by a high degree of repeat sales (Goodrich, slip op. at 87-88; Goodrich F 216, F 219; Goodrich ID at 94; Kaserman Dkt. 9159, 2422-23; Kaserman JX l, 347-348; Friedman JX l, 132 ln. 2-8; Beveridge JX l, 91 ln. 2-7; JX 3, PX 8 at 116 ln. 6 - 118 ln. 11; JX 3, PX 9 at 86 ln. 20 - 87 ln. l; *See also* Klass Dkt. 9159, 4389). The high degree of repeat sales in each of the relevant markets makes collusion more likely in each of these markets (Kaserman Dkt. 9159, 2421-22; Kaserman JX l, 347-348).

644. Collusion is more likely in markets where customers tend to purchase from the same suppliers over the course of time. If firms in an industry, characterized by a high probability of repeat sales, are engaging in a collusive agreement, and if a firm cheats on the agreement by cutting price to gain sales, other firms can infer from an a normal loss of long-standing customers that someone is cheating. A high probability of repeat sales thus facilitates the policing of a collusive agreement, thereby increasing its stability and the

likelihood of its occurrence (Kaserman Dkt. 9159, 2421-22; Kaserman JX 1, 347-48; *See also* Klass Dkt. 9159, 4389).

645. [##] (Goodrich, slip op. at 86; Goodrich F 219; DiLiddo Dkt. 9159, 3253; Weber Dkt. 9159, 1790; Disch Dkt. 9159, 683-85; *See, e.g.*, Dkt. 9159 CX 151A *In Camera*; Dkt. 9159 CX 152A *In Camera*; Dkt. 9159 CX 156B *In Camera*; Dkt. 9159 CX 72A *In Camera*; Dkt. 9159 CX 73F *In Camera*; Dkt. 9159 CX 76A *In Camera*; Dkt. 9159 CX 77A *In Camera*; Dkt. 9159 CX 80A *In Camera*; Dkt. 9159 CX 81A-D *In Camera*; Dkt. 9159 CX 85A *In Camera*; Dkt. 9159 CX 89A *In Camera*; Dkt. 9159 RX 53B *In Camera*).

646. [##] (Goodrich, slip op. at 88; Goodrich F 219; DiLiddo Dkt. 9159, 3253-54; Disch Dkt. 9159, 685-86; Dkt. 9159 RX 53B *In Camera*).[35] These ongoing, noncontractual customer relationships, described by Dr. DiLiddo of Goodrich as "a handshake type of relationship, one in which we typically would sell to that customer and the customer would typically order from us based on current market conditions," operate in a way that, "when a customer needs resin, they would normally place their order with us or at least part of their business would normally come to us even though we don't have a contract" (DiLiddo Dkt. 9159, 3254).

647. A large percentage of suspension PVC copolymer and dispersion PVC resin sales are also made under contract or in the context of ongoing customer-supplier relationships (Beveridge JX 1, 91 ln. 8-16; JX 3, PX 8 at 115 ln. 2-10, 116 ln. 12-19; JX 3, PX 9 at 79 ln. 14-24, 86 ln. 20 - 87 ln. 13).

648. [##] (Goodrich, slip op. at 88; Yu Dkt. 9159, 2159; DiLiddo Dkt. 9159, 3371-72; H. Wheeler Dkt. 9159, 1747-48; Beveridge JX 1, 84 ln. 16-25, 88 ln. 24 - 89 ln. 10; van Haaren CX 187D ¶ 14 *In Camera*; Dellevigne CX 188C-D ¶ 10 *In Camera*; Boulay CX 189C ¶ 7 *In Camera*). Thus, there would be hesitancy on the part of a customer to switch suppliers if competitive prices were the same (Goodrich, slip op. at 88).

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[35] Noncontractual PVC resin sales can occur as ongoing relationships, or as spot sales (*See, e.g.*, DiLiddo Dkt. 9159, 3253-54). To the extent that export sales tend to be spot sales (*See* DiLiddo 3274), an even greater percentage of domestic sales are characterized by ongoing relationships.

649. [##] (Goodrich, slip op. at 87-88; Goodrich F 237; Friedman JX 1, 134 ln. 1-8; JX 3, PX 6 at 150 ln. 16 - 151 ln. 3; JX 3, PX 8 at 114 ln. 22 - 116 ln. 11; JX 3, PX 9 at 82 ln. 1-25; Disch Dkt. 9159, 683-85; Schaefer Dkt. 9159, 1136-37, 1203; Weber Dkt. 9159, 1790, 1791-94; H. Wheeler Dkt. 9159, 1749; DiLiddo Dkt. 9159, 3254-55; Dkt. 9159 CX 464; Dkt. 9159 CX 466; *See* JX 3, PX 61; JX 3, PX 62; JX 3, PX 64; JX 3, PX 70; JX 3, PX 111; JX 3, PX 112; JX 3, PX 114; JX 3, PX 93 at 103582; JX 3, PX 94 at 226942; Dkt. 9159 CX 29B *In Camera*; Dkt. 9159 CX 84C, E, G *In Camera*). [##] (*See* CX 112A-B *In Camera*; CX 113A-B *In Camera*; Dkt. 9159 CX 78B-C, G, K *In Camera*; Dkt. 9159 CX 80B *In Camera*; Dkt. 9159 CX 73G *In Camera*).

650. The fact that buyers give their PVC suppliers the opportunity to meet competing offers is another indication that they would prefer to continue to purchase the resin from a given supplier (Kaserman Dkt. 9159, 2423).

651. [##] (JX 3, PX 8 at 116 ln. 20-22; JX 3, PX 6 at 62 ln. 25 - 63 ln. 3; Schaefer Dkt. 9159, 1135; Becker Dkt. 9159, 1248-49; H. Wheeler Dkt. 9159, 1747-48; McMath Dkt. 9159, 1897-98, 1901-02 *In Camera*; DiLiddo Dkt. 9159, 3124-28; *See* generally CX 4 *In Camera*). PVC salesmen frequently have access to their customers' facilities, can observe competitors' railcars at the site, and have knowledge of the customers' level of business (Weber Dkt. 9159, 1797-98; Becker Dkt. 9159, 1248-49). This information assists suppliers in detecting the competitive activity of other PVC resin suppliers.

F. The Ready Availability of Price Information Facilitates Collusion in the Relevant Markets

652. The Commission found in Goodrich that the transaction characteristics of the mass and suspension PVC market "increase the likelihood of anticompetitive effects from the acquisition in that market" (Goodrich, slip op. at 88).

653. In particular, the Commission found that contract clauses and ongoing customer-supplier relationships, together with the frequency and size of most transactions, allowed suppliers regularly

to obtain reliable price information in the market (Goodrich, slip op. at 87-88; Goodrich F 211-15, 219-21; Goodrich ID at 93-94).

654. Record evidence in this case, as discussed infra, confirms that reliable price information is available to PVC producers in each of the relevant markets.

G. Price Protection Classes in Each of the Relevant PVC Markets Reduce the Incentive To Cheat on a Collusive Agreement

655. Most contracts in each of the relevant PVC markets contain two forms of price protection clauses: meeting competition clauses and clauses requiring advance notice of price increases (Goodrich, slip op. at 86; Goodrich F 237-38; Goodrich ID at 94). These clauses facilitate collusion by reducing the incentive to cheat on a collusive agreement (Goodrich, slip op. at 86) .

656. "Price protection" clauses include most-favored-nations clauses, and meeting competition clauses (also known as meet-or-release clauses) (Goodrich F 237; *See* Klass Dkt. 9159, 5695, 5704). They also include clauses requiring advance notice of price changes. As a matter of economic theory, these price protection clauses can facilitate collusion by reducing the potential gain from cheating on a collusive arrangement (*See* Klass Dkt. 9159, 5695-5704).

657. Most contracts in the PVC industry contain meeting competition clauses (Goodrich, slip op. at 87; Goodrich F 211, F 237). Furthermore, in most supplier-customer relationships without written contracts, customers bring competitive offers to other suppliers in the same way as would occur under a meeting competition clause (Goodrich, slip op. at 87-88; Goodrich F 237).

658. The existence of meeting competition clauses deters cheating because it encourages the customer to transmit information regarding a competitive offer to its regular supplier. Thus, the clause leads to detection of discounts (Goodrich, slip op. at 87; *See* Kaserman Dkt. 9159, 2394-96; *See also* Hirschleifer, *Price Theory and Applications*, 309-311 (1984); Salop, "Practices That (Credibly) Facilitate Oligopoly Coordination," *New Developments in the Analysis of Market Structure* 280 (Stiglitz, ed. 1986).

659. Most contracts in the PVC industry contain clauses requiring advance notice of price increases (*e.g.,* 30 days) (Goodrich