IN THE MATTER OF

THE B.F. GOODRICH COMPANY, ET AL.

FINAL ORDER, OPINION, ETC., IN REGARD TO ALLEGED VIOLATION OF SEC. 7 OF THE CLAYTON ACT AND SEC. 5 OF THE FEDERAL TRADE COMMISSION ACT

Docket 9159. Complaint, Jan. 4, 1982—Final Order, Mar. 15, 1988

This final order requires Goodrich, a corporation with its principal place of business in Akron, Ohio, to divest the vinyl cloride monomer (VCM) plant, in La Porte, Texas, at no minimum price, to a Commission-approved acquirer and also to provide all supporting material to the acquirer. Diamond Shamrock Chemicals Company is prohibited from interfering with the divestiture and, for five years, must continue to supply all utilities, services, and supplies to the acquirer. In addition, Goodrich must, for 10 years, receive FTC approval before acquiring any interest in any producer of VCM located in the United States. The Commission also dismissed part of the complaint concerning the polyvinyl chloride (PVC) market.

Appearances

For the Commission: *Rhett Krulla.*

For the respondents: *Tom D. Smith, Jones, Day, Reavis & Pogue,* Washington, D.C.

COMPLAINT

The Federal Trade Commission, having reason to believe that respondents, The B.F. Goodrich Company, Diamond Shamrock Corporation and Diamond Shamrock Plastics Corporation, corporations subject to the jurisdiction of the Federal Trade Commission, have entered into an agreement, described in paragraph 11 herein, that, if consummated, would violate the provisions of Section 7 of the Clayton Act, as amended (15 U.S.C. 18), and Section 5 of the Federal Trade Commission Act, as amended (15 U.S.C. 45); that said agreement and the actions of respondents to implement that agreement constitute violations of Section 5 of the Federal Trade Commission Act, as amended (15 U.S.C. 45); and it appearing to the Commission that a proceeding in respect thereof would be in the public interest, the Commission hereby issues its complaint, pursuant to Section 11 of the Clayton Act (15 U.S.C. 21) and Section 5(b) of the Federal Trade Commission Act (15 U.S.C. 45(b)), stating its charges as follows:

I. DEFINITIONS

1. For purposes of this complaint, the following definitions shall apply: [2]

a. *"Polyvinyl chloride"* or *"PVC"* means any vinyl chloride homopolymer with the repeating unit $CH_2=CHCl$, and any copolymers of vinyl chloride with varying amounts of other chemicals, including vinyl acetate, ethylene, propylene, vinylidene chloride, or acrylates;

b. *"Bulk and suspension PVC"* includes PVC produced by the bulk or mass process, in which vinyl chloride is polymerized without the addition of other liquids; and PVC produced by the suspension process, in which vinyl chloride monomer droplets are suspended in an aqueous system.

c. *"Dispersion PVC"* includes PVC produced by the emulsion or dispersion process;

d. *"Vinyl chloride monomer"* or *"VCM"*, is a gaseous, reactive, acyclic intermediate chemical, used principally in the manufacture of PVC. VCM, also called chloroethylene or monochloroethylene, has a chemical identity $CH_2=CHCl$.

II. THE B.F. GOODRICH COMPANY

2. Respondent, The B.F. Goodrich Company ("Goodrich"), is, and at all times relevant herein, has been a corporation organized, existing, and doing business under and by virtue of the laws of New York, with its principal place of business in Akron, Ohio.

3. For the year ending December 31, 1980, Goodrich's net sales were approximately $3.08 billion, and its net income was approximately $61.7 million. As of December 31, 1981, Goodrich's bulk and suspension PVC and VCM production capacities were approximately 1.345 billion pounds and 1 billion pounds per year, respectively.

4. Goodrich is a multinational company engaged in the manufacture and sale of a broad line of chemical, plastic, rubber, and other products which are distributed in over [3] 100 countries throughout the world.

5. Goodrich is, and at all times relevant herein has been, engaged in commerce as "commerce" is defined in Section 1 of the Clayton Act, as amended, 15 U.S.C. 12, and is a corporation whose business is in or affecting commerce as "commerce" is defined in Section 4 of the Federal Trade Commission Act, as amended, 15 U.S.C. 44.

III. DIAMOND SHAMROCK CORPORATION

6. Respondent, Diamond Shamrock Corporation ("Diamond Shamrock") is, and at all times relevant herein has been, a corporation organized, existing, and doing business under and by virtue of the

laws of Delaware, with its principal office and headquarters in Dallas, Texas.

7. For the calendar year ending December 31, 1980, Diamond Shamrock's sales and operating revenues were approximately $3.143 billion, and its net income was approximately $201 million. As of December 31, 1981, Diamond Shamrock's bulk and suspension PVC and VCM production capacities were approximately 510 million pounds and 1 billion pounds per year, respectively.

8. Diamond Shamrock is a diversified international corporation involved in the exploration and production of natural gas and crude oil, the refining and marketing of petroleum products, and the production of coal, chemicals, plastics, and technology.

9. Diamond Shamrock is, and at all times relevant herein has been, engaged in commerce as "commerce" is defined in Section 1 of the Clayton Act, as amended, 15 U.S.C. 12, and is a corporation whose business is in or affecting commerce as "commerce" is defined in Section 4 of the Federal Trade Commission Act, as amended, 15 U.S.C. 44. [4]

IV. DIAMOND SHAMROCK PLASTICS CORPORATION

10. Diamond Shamrock Plastics Corporation ("DSPC") was established by Diamond Shamrock in 1980 in order to facilitate divestiture of Diamond Shamrock's Plastics Division. Upon establishment of DSPC as a wholly-owned subsidiary, Diamond Shamrock transferred all of its PVC and VCM assets and business to DSPC and has continued to conduct these businesses through DSPC. Diamond has subsequently restructured DSPC to include only those assets it has agreed to transfer to Goodrich. Diamond Shamrock will establish a new corporation to hold the remaining PVC assets and business of the company pending their disposition by Diamond Shamrock.

V. THE ACQUISITION

11. Under the terms of the agreement between Goodrich and Diamond Shamrock, on or about December 31, 1981, Goodrich will acquire from Diamond Shamrock all the stock of DSPC for $131 million. Pursuant to Diamond Shamrock's agreement with Goodrich, prior to its acquisition by Goodrich, DSPC has been restructured to include a one-billion pound-per-year capacity VCM plant at La Porte Texas, and a 280 million pound-per-year capacity suspension PVC plant (plant No. 5) at Deer Park, Texas, selected research and development equipment, process and application equipment, and personnel and other assets required to operate those plants. Consummation of the transaction is subject to the execution of agreements between Goodrich and Diamond Shamrock concerning feedstock supplies.

VI. TRADE AND COMMERCE

12. For purposes of this complaint, the relevant lines of commerce are VCM, bulk and suspension PVC, dispersion PVC and any submarket thereof. [5]

13. For purposes of this complaint, the relevant geographic market is the United States as a whole, and any submarket thereof.

14. In 1980, approximately 6.47 billion pounds of VCM were produced in the United States. The VCM market is concentrated. In 1981, the two leading manufacturers accounted for approximately 37.9 percent of industry nameplate (design) capacity, the four leading manufacturers accounted for 58.4 percent; and the eight leading manufacturers accounted for 92.1 percent.

15. Goodrich and Diamond Shamrock are tied as the third leading manufacturer of VCM, each holding 10.3 percent of industry nameplate capacity in 1981.

16. Goodrich and Diamond Shamrock are direct, substantial, and actual horizontal competitors in the VCM market.

17. Barriers to entry into the VCM market are significant and substantial.

18. In 1980, approximately 4.88 billion pounds of bulk and suspension PVC were produced in the United States.

19. The bulk and suspension PVC market is moderately concentrated. In 1981, the two leading manufacturers accounted for approximately 29.3 percent of industry nameplate capacity, the four leading manufacturers accounted for 48.0 percent, and the eight leading manufacturers accounted for 78.9 percent.

20. Goodrich is the leading producer of bulk and suspension PVC, with approximately 17.4 percent of industry nameplate capacity in 1981.

21. Goodrich has grown through acquisition in the bulk and suspension PVC market. In 1979, Goodrich acquired a 200 million pound-per-year bulk and suspension PVC plant in Plaquemine, Louisiana, from The Goodyear Tire and Rubber Company. At [6] the time of this acquisition, Goodrich held 15.5 percent of industry capacity. The acquired plant gave Goodrich an additional 3.1 percent of industry capacity.

22. Diamond Shamrock is the sixth leading producer of bulk and suspension PVC with approximately 6.6 percent of industry nameplate capacity and 8.9 percent of practical production capacity in the market in 1981. Pursuant to the transaction, approximately half of Diamond Shamrock's production capacity will be transferred to Goodrich, raising its market share to approximately 20.8 percent of industry nameplate capacity.

23. Goodrich and Diamond Shamrock are direct, substantial, actual, horizontal competitors in the bulk and suspension PVC market.

24. Barriers to entry into the bulk and suspension PVC market are significant.

25. In 1979, approximately 496 million pounds of dispersion PVC were produced in the United States.

26. The dispersion PVC market is highly concentrated. In 1980, the two leading manufacturers accounted for approximately 51.7 percent of industry nameplate capacity, the four leading manufacturers accounted for 78.3 percent, and the eight leading manufacturers accounted for 100 percent.

27. Goodrich is the leading producer of dispersion PVC with approximately 26.6 percent of industry nameplate capacity in 1980.

28. Diamond Shamrock is the fourth leading producer of dispersion PVC with approximately 11.8 percent of industry nameplate capacity in the market in 1980. Following the transaction with Goodrich, Diamond Shamrock is likely to shut down or sell its dispersion PVC plant facilities. These facilities are not currently included in the Goodrich acquisition. [7]

29. Goodrich and Diamond Shamrock are direct, substantial, actual, horizontal competitors in the dispersion PVC market.

30. Barriers to entry into the dispersion PVC market are significant.

VII. EFFECTS OF THE ACQUISITION

31. The effect of the aforesaid acquisition may be substantially to lessen competition or to tend to create a monopoly in the relevant lines of commerce in violation of Section 7 of the Clayton Act, as amended, 15 U.S.C. 18, and Section 5 of the Federal Trade Commission Act, as amended, 15 U.S.C. 45, in the following ways, among others:

a. It will eliminate actual competition between Goodrich and Diamond Shamrock in the relevant lines of commerce;

b. It will increase concentration in the relevant lines of commerce and reduce the number of firms competing in those markets. In the VCM market, two-firm concentration will increase from approximately 37.9 percent to 42.6 percent and four-firm concentration will increase from approximately 58.4 percent to 68.7 percent. In the bulk and suspension PVC market, two-firm concentration will increase from approximately 29.3 percent to 32.9 percent and four-firm concentration will rise from approximately 48.0 percent to 51.7 percent.

32. Diamond Shamrock may also be eliminated as a competitor in the production and distribution of dispersion PVC which is a separate

line of commerce from bulk and suspension PVC as defined above. Although Diamond Shamrock's dispersion PVC capacity will not be transferred to Goodrich under the terms of the agreement described in paragraph 11 herein, by virtue of that agreement, Diamond Shamrock may exit this [8] market as a substantial competitor.

VIII. VIOLATIONS CHARGED

33. The steps taken to consummate the acquisition of the stock and assets of DSPC by Goodrich from Diamond Shamrock, as set forth in paragraph 11 herein, and the agreements pursuant to which that acquisition is to be effected, constitute violations of Section 5 of the Federal Trade Commission Act, as amended, 15 U.S.C. 45.

34. The proposed acquisition of the stock and assets of DSPC by Goodrich from Diamond Shamrock, as set forth in paragraph 11 herein, if consummated, would violate Section 7 of the Clayton Act, as amended, 15 U.S.C. 18, and would violate Section 5 of the Federal Trade Commission Act, as amended, 15 U.S.C. 45.

INITIAL DECISION BY

THOMAS F. HOWDER, ADMINISTRATIVE LAW JUDGE

SEPTEMBER 20, 1985

PRELIMINARY STATEMENT

The Commission issued its complaint in this proceeding on January 4, 1982, charging that the acquisition of Diamond Shamrock Plastics Corporation ("DSPC") by The B.F. Goodrich Company ("Goodrich") from Diamond Shamrock Chemicals Company ("Diamond Shamrock" or "Diamond") (formerly Diamond Shamrock Corporation) violated Section 7 of the Clayton Act, 15 U.S.C. 18; and that both the acquisition and the concomitant agreement and steps taken to consummate the transaction violated Section 5 of the Federal Trade Commission Act, 15 U.S.C. 45.

The complaint alleged that the effect of the challenged acquisition would be to eliminate actual competition between Goodrich and Diamond and increase the levels of concentration in two product markets, *viz.*, bulk and suspension polyvinyl chloride ("PVC"),[1] and vinyl chloride monomer ("VCM").[2]

[1] Unless otherwise indicated herein, the initials "PVC" will refer to "bulk and suspension" PVC, not to other formulations of PVC.

[2] The complaint also alleged violation in a third market, *viz.*, "dispersion" PVC. However, complaint counsel elected not to pursue this allegation and no evidence was offered concerning it (see complaint counsel's trial brief, p. 2, n. 2).

Following extensive discovery, and various prehearing conferences, adjudicative hearings commenced on November 24, 1984 and continued at intervals until March 22, 1985. The evidentiary record was closed on March 26, 1985. The parties have submitted detailed proposed findings and briefs in support of their respective positions.

Any motions not heretofore or herein specifically ruled upon, either directly or by the necessary effect of the conclusions in this decision, are hereby denied.

This proceeding is before me upon the complaint, answers, testimony and other evidence, and the proposed findings of fact and conclusions of law filed by counsel supporting the complaint and by counsel for respondents. The proposed findings of fact, conclusions and arguments of the parties have been considered, and those findings not adopted either in the form proposed or in [3] substance are rejected as not supported by the evidence or as involving immaterial issues not necesssary for this decision.[3]

Having heard and observed the witnesses, and after having reviewed the entire record in this proceeding, I make the following findings:

FINDINGS OF FACT

I. THE RESPONDENTS

A. The B.F. Goodrich Company

1. Respondent Goodrich, the acquiring company, is a New York corporation headquartered in Akron, Ohio. [ ] (Complaint ¶ 3; Goodrich Answer ¶ 3; CX 8B; CX 109E *in camera;* RX 192Z–58 *in camera;* RX 312A). For the year ending December 31, 1980, Goodrich had net sales of approximately $3.08 billion, with net income of approximately $61.7 million. Its total assets at that time were listed at approximately $2.2 billion (Complaint ¶ 3; Goodrich Answer ¶ 3; CX 8Z–30, 31).

2. [ ] (CX 4Z–73; CX 22 *in camera,* CX 23A; CX 299P–S *in camera*). [ ] (CX 23A; CX 336C *in camera;* CX 662D *in camera*).

3. At the time of the acquisition, Goodrich owned and operated a

[3] Certain abbreviations, including the following, are used in this decision:
CX - Commission's exhibit
CPF - Complaint counsel's proposed finding
RX - Respondents' exhibit
RPF - Respondents' proposed finding
The transcript of testimony is usually referred to with the last name of the witness and the page number or numbers upon which the testimony appears.

VCM plant at Calvert City, Kentucky. [ ] (CX 4Z–73; CX 109Z–3 *in camera;* DiLiddo 3353). [4]

B. Diamond Shamrock Chemicals Company

4. Respondent Diamond Shamrock, the seller of the acquired company, is a Delaware corporation headquartered in Dallas, Texas. It is a diversified international company involved in the exploration and production of natural gas and crude oil, the refining and marketing of petroleum products, the production of coal, chemicals and plastics, and the development of technology (Complaint ¶ 7; Diamond Answer ¶ 7; CX 104Z). For the year ending December 31, 1980, Diamond's sales and operating revenues were approximately $3.143 billion, with net income of approximately $201 million. Its total assets at that time were listed at approximately $2.8 billion (*ibid.;* CX 401B; CX 401Z–12).

5. At the time of the acquisition, Diamond Shamrock conducted the major portion of its PVC operations at Deer Park, Texas. This consisted of several suspension production facilities designated Plants # 1, # 3, # 4, # 4X and # 5, and one dispersion resin unit designated Plant # 2 (CX 371H-I; CX 418B). [ ] (Schaefer 1070–71; Becker 1253; CX 11B *in camera;* CX 351Q,U; CX 511B *in camera*). The combined annual nameplate capacity at Deer Park amounted to approximately 500 million pounds per year (CX 371I). [ ] (CX 11C *in camera;* CX 367A *in camera;* CX 371L; CX 418B; CX 511B *in camera;* Diamond Adm. 23–24; CX 6Z–9).[4]

6. Located adjacent to the Deer Park complex was Diamond Shamrock's Independence VCM facility at LaPorte, Texas. [ ] (Diamond Adm. 1 and 274; CX 6A and 6L; CX 295Z–44, 45 *in camera;* CX 11B *in camera;* CX 405Z; CX 414A).

C. Diamond Shamrock Plastics Corporation

7. Diamond Shamrock Plastics Corporation ("DSPC") was organized as a wholly-owned subsidiary by Diamond Shamrock in 1980 as a successor to Diamond Shamrock's Plastics Division. [5] [ ] (Diamond Adm. 308; CX 6M; CX 30Z–18; CX 367A *in camera*).

8. [ ] (Complaint ¶ 10; Answer of Diamond Shamrock ¶ 10; Goodrich Adm. 298–99; CX 4Z–12; Diamond Adm. 333–34; CX 6N; CX 295Z–94 *in camera*). [ ] (Goodrich Adm. 25; CX 4E; Arp 3502; CX 295Z–85 *in camera;* CX 11D *in camera*). [ ] (CX 3Z–583 *in camera*).

[4] In addition, Diamond Shamrock held a [__] percent interest in a [__] million pounds-per-year bulk PVC plant in Alberta, Canada, through a joint venture with Alberta Gas Trunkline Company, Ltd. (CX 401Z–38; CX 300Z–11–13 *in camera;* CX 371A).

II. JURISDICTION

9. The question of jurisdiction is not in dispute. Both respondents Goodrich and Diamond Shamrock filed answers admitting to being subject to the jurisdiction of the Federal Trade Commission. In addition, both corporations admitted to having engaged in commerce and to being corporations whose business is in or affecting commerce within the meaning of the relevant statutes cited in the complaint (Complaint, Introductory Paragraph and ¶¶ 5, 9; Introductory Paragraphs of both Answers; Goodrich Answer ¶ 5; Diamond Answer ¶ 9).

III. THE ACQUISITION

10. [ ] (Goodrich Adm. 297–98; CX 4Z–12; Diamond Adm. 332; CX 66N *in camera;* DiLiddo 3203; CX 2Z–17,18 *in camera;* CX 11N *in camera;* CX 452).

11. [ ] (CX 2C,R *in camera;* CX 3Z–586–97 *in camera*).

12. [ ] (DiLiddo 3206–07; Schaefer 1113–14, 1175–76; Arp 3498–99; CX 2Z–10,11 *in camera;* CX 2Z–326–32 *in camera;* CX 555A *in camera*), [ ] (CX 2Z–5,6 *in camera*), [ ] (CX 3Z–285–333 *in camera*), [ ] (CX 2Z–107–18 *in camera*), [ ] (CX 2Z–326–32 *in camera*). **[6]**

13. [ ] (Schaefer 1177; CX 2Z–333–63 *in camera* and CX 2Z–374–412 *in camera*); (DiLiddo 3205–07; Schaefer 1113–16; CX 3Z–226–44 *in camera;* CX 561 *in camera*). [ ] (CX 3Z–217–23 *in camera;* CX 414Z–7; CX 453), [ ] (CX 2Z–420–587 *in camera*).

14. [ ] (Schaefer 1183; CX 300Z–25 *in camera;* CX 353J *in camera;* CX 555A *in camera*). [ ] (CX 300Z–24 *in camera*). [ ] (Schaefer 1118–19; CX 555D *in camera*). [ ] (CX 555A *in camera*). Diamond permanently closed these remaining plants in December 1983 (CX 455).

IV. RELEVANT GEOGRAPHIC MARKET

15. The parties have stipulated that the United States as a whole is the relevant geographic market within which to evaluate the likely competitive impact of the challenged acquisition (CPF 4.06, 21.01).

V. RELEVANT PRODUCT MARKET

16. The parties have also stipulated that bulk and suspension PVC is a relevant product market within which to evaluate the likely competitive impact of the acquisition (CX 4J–K; CX 6D,Z–37). The parties, however, disagree as to whether VCM constitutes a relevant market. For purposes of this decision, however, VCM has been treated as a relevant market.

A. Bulk and suspension PVC

17. Stated simply, PVC is a thermoplastic resin derived basically from the chemicals ethylene and chlorine. These chemicals are first converted into ethylene dichloride ("EDC"), from which the product VCM is manufactured by a cracking [7] process. The VCM molecules are thereafter linked together by a polymerization process to form PVC. PVC resin is manufactured in the form of white powder granules (Disch 626; McMath 1894; CX 427H).

18. [ ] (see Becker 1269–73, 1276, 1303, 1307–11, 1316–17, 1324; Eades 1464–65; Liao 1540; H. Wheeler 1727–28, 1752–53; Weber 1806–08; McMath 1895–96; Belt 1988; Yu 2093–94; RX 140Z–26 *in camera;* RX 287E-F; RX 938 *in camera*).[5]

1. PVC manufacturing processes

19. All PVC is produced by a polymerization process which links VCM molecules together in a vessel commonly referred to as a reactor, under specific temperatures in the presence of catalysts (CX 427I-K; see Disch 642; RX 125T-U; RX 218D). Reactors range in size from less than 2,500 gallons to about 50,000 gallons (see Disch 638, 640; Schaefer 1071; RX 305).

20. Within the broad category of PVC resins there are essentially three types; (1) suspension resins, (2) dispersion (or emulsion) resins, and (3) bulk (or mass) resins (CX 30G; CX 427I-K).

21. Suspension resins are produced by a polymerization process which adds suspension agents to VCM. This results in the formation of relatively large particles of PVC, and permits a low energy consumptive process to be used in the drying stage (Disch 617–29; RX 125U-W). Suspension resins account for about 85 percent of all PVC manufactured in the United States (Disch 627–28; CX 30G; RX 125T).

22. Dispersion resins are produced by a polymerization process known as emulsion polymerization, during which emulsifying, rather than suspension, agents are added to VCM to prevent the coalesence of polymer particles (Disch 630; RX 125W- [8] Y). As a result, very small particles of PVC are formed, and an expensive, energy intensive spray process must be used in the drying stage (Disch 630). [ ] (CX 518G *in camera*). As noted *supra,* n. 2, dispersion resins are not at issue in this proceeding.

23. Bulk resins are produced by a process which differs from the manufacture of suspension and dispersion resins, in that the VCM is

[5] A number of manufacturing methods are used in the production of bulk and suspension PVC end-use fabricated products. The extrusion process consists of forcing PVC resin through a die. In calendering, the resin is pressed between rolls or plates to form thin sheets. Various kinds of molding can also be employed, including injection molding for pipe fittings, compression molding for phonograph records, and blow molding for bottles (CX 427M; CX 642Z–23).

polymerized without the addition of other liquids (Disch 629; RX 125Y). Bulk polymerization consists of a two-stage process, which yields a resin comparable to suspension resin in appearance and characteristics. However, the final product is considered purer because of the absence of emulsifiers or suspension agents (CX 50V-W; CX 427K). Consequently, bulk polymerization is important for end-use applications where greater optical clarity is desired, such as in the case of packaging materials (Disch 631; see CX 427L).[6]

24. Within a general range of applications, PVC resins produced by either bulk or suspension polymerization are interchangeable. Either process can produce resins of varying molecular weight, density, particle size, and porosity. The major distinction, as noted, is purity (Disch 631–36; CX 12A).

25. Within the wide range of bulk and suspension resins, there are numerous types or grades. While there may be some disagreement as to how the various grades should be classified, industry members generally divide them into three broad categories: pipe and extrusion grade resins, general purpose grade resins, and film or specialty grade resins (Schaefer 1121; Becker 1262–63; McMath 1893).

26. The end use for a particular resin determines what molecular weight or density is required (H. Wheeler 1726–27; CX 427H). Low molecular weight resins are used to produce bottles, flooring, certain types of film, pipe, pipe fittings and other products formed by injection molding. Medium molecular weight resins are used to produce sheet, film and coated fabrics. [ ] (H. Wheeler 1726–27; McMath 1911–12, 1920; RX 266B-E *in camera*). [9]

2. PVC history

27. [ ] (CX 200M *in camera*). [ ] (DiLiddo 3106; CX 92G; CX 40Z–2 *in camera*).

28. The initial real growth and development of bulk and suspension PVC occurred in the 1950's and 1960's, as flexible (plasticized) PVC resin found end-use markets in wire and cable, calendered sheet, and specialty applications. [ ] (RX 639H *in camera;* see DiLiddo 3106–08).

29. [ ] (RX 639H *in camera*). [ ] (RX 639H,P *in camera*). As demand for bulk and suspension PVC resin shifted toward large volume, commodity grade end-use applications, PVC manufacturers began to install large reactors of from [__] to [__] gallon capacity to service this demand. [ ] (Disch 641, 648–653; CX 374G,Q *in camera;* CX 405R; CX 420F; CX 428Z–12).

[6] Mr. Disch of Tenneco referred in his testimony to a fourth PVC manufacturing process called solution, in which "[r]ather than water or some other medium, they use various solvents and solutions as the medium." He testified that this was "a very specialized area," accounting for less than 1 percent of U.S. capacity, with the world's only solution facility located in the U.S. (Disch 630–31).

B. VCM

30. The manufacturer of PVC depends upon a single critical feedstock—VCM—described in the Complaint as a "gaseous, reactive, acrylic intermediate chemical" (Complaint, ¶ 1.d., Goodrich Adm. 39, CX 4G; CX 427H).

31. With minor exceptions, VCM's only use is in the manufacture of PVC. [ ] (DiLiddo 3301; L. Wheeler 918–19; CX 46A; CX 200M *in camera;* CX 376L *in camera;* CX 404Z–15; CX 427W; CX 642Z–7).

32. VCM is produced by thermally cracking purified EDC at high temperatures (Wheeler 918–26; Keinholz 756–58); the EDC having been produced in a VCM plant by two related processes: oxyhydrochlorination of ethylene and direct chlorination of ethylene. [ ] **[10]** (Goodrich Adm. 44–45; CX 4G; Diamond Shamrock Adm. 44–45; CX 6C; L. Wheeler 917, CX 18A; CX 355B *in camera;* CX 427I).[7]

VI. PVC QUANTITATIVE ANALYSIS

A. U.S. PVC producers

33. At the time of the acquisition in January 1982, there were seventeen producers of bulk and suspension PVC in the United States.[8] [ ] (CX 664U; CX 661Z–14 *in camera*).

34. [ ] (CX 662D *in camera*), [ ] (CX 662F *in camera*). [ ] (CX 661Z–16 *in camera;* **[11]** CX 664R *in camera*). [ ] (CX 664C,J,R *in camera*).

35. Diamond Shamrock ranked [__] in industry nameplate capacity and [__] in industry practical production capacity at the time of the acquisition. [ ] (CX 662D *in camera;* CX 662F *in camera*). The Deer Park, Texas Plant #5, the one acquired by Goodrich, represented [__] percent of 1982 industry nameplate capacity and [__] percent

[7] Initially, VCM was produced by the hydrochlorination of acetylene (CX 40Q *in camera;* CX 39T *in camera;* CX 200H *in camera*). Prior to 1960, virtually all VCM in the United States was made using acetylene as the primary feedstock (RX 57U *in camera*). However, acetylene supply became inadequate to support the growing demand for VCM following World War II. As a result, the VCM industry began shifting to ethylene-based technology during the 1950's, when development in the petrochemical industry provided a plentiful ethylene supply (CX 40R *in camera;* CX 39U *in camera;* CX 200I *in camera;* RX 57U *in camera*). In 1963, Goodrich developed the "oxyhydrochlorination" process, which, by utilizing the byproduct from the primary production stage, completely eliminated acetylene from the VCM process (CX 40R *in camera;* CX 39U *in camera;* CX 92G). Today, ethylene-based technology, with its subsequent refinements, continues to be the VCM production technology of choice world-wide (CX 40R *in camera;* CX 39U *in camera*). All VCM plants that have been built since the late 1960's have employed the ethylene technology (see, *e.g.*, RX 57W-X *in camera;* Goodrich Adm. 43, CX 4G; Diamond Shamrock Adm. 43, CX 6C).

[8] These seventeen producers were: The B.F. Goodrich Company, Tenneco Polymers, Inc., Georgia-Pacific Corporation, Shintech Incorporated, Occidental Chemical Corporation, Diamond Shamrock Chemicals Co., Conoco, Inc., Borden, Inc., Air Products & Chemicals, Inc., CertainTeed Corporation, Formosa Plastics Corporation, Stauffer Chemical Company, The General Tire & Rubber Co., Ethyl Corporation, Great American Chemical Corp., Keysor-Century Corporation, and Pantasote, Inc.

of industry practical production capacity.[9] [ ] (CX 661Z–16 *in camera;* CX 664B *in camera*).

36. Tenneco Polymers, Inc. ranked [__] among bulk and suspension PVC producers in both industry nameplate and practical production capacities at the time of the acquisition. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 6640,U *in camera*).

37. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 664Q *in camera*).

38. Shintech Incorporated ranked [__] in practical production capacity and [__] in nameplate capacity immediately prior to the acquisition. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 664T *in camera*). **[12]**

39. In January 1982, Conoco, Inc., ranked [__] in industry nameplate capacity and [__] in industry practical production capacity. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 664P *in camera*).

40. [ ] (CX 662D *in camera*). [ ] (CX 313A-Q *in camera;* CX 662F *in camera*). [ ] (CX 664S *in camera*).

41. (CX 662D,F *in camera*). In 1981, Borden also ranked [__] in bulk and suspension PVC production, with a market share of [__] percent (CX 661Z–28 *in camera;* CX 664P *in camera*).

42. Air Products and Chemicals, Inc., ranked [__] in the production of bulk and suspension PVC by all measurements in January 1982. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 664"O" *in camera*).

43. CertainTeed Corporation was the [__] ranking PVC producer in all categories of measurement prior to the acquisition. [ ] (CX 662D,F *in camera*). [ ] (CX 661Z–28 *in camera;* CX 664 *in camera*).

44. Formosa Plastics Corporation ranked [__] in PVC production capacity in January 1982. At the time of the acquisition Formosa accounted, respectively, for [__] percent and [__] percent of PVC nameplate and practical production capacities (CX 662D,F *in camera*). In 1981, Formosa ranked [__] in the production of PVC with a market share of [__] percent (CX 661Z–28 *in camera;* CX 664Q *in camera*). [ ] (CX 662D,F *in camera*). **[13]**

45. Prior to the shutdown of its Long Beach, California suspension PVC plant in March 1982, Stauffer Chemical Company ranked [__] in 1982 nameplate and practical production capacity, with a market share by these respective measurements of [__] and [__] percent (see CX 318A–Q *in camera;* CX 662D-F *in camera*). Stauffer ranked [__] in

[9] Viewed as a stand alone entity, Diamond's PVC Plant # 5 would have ranked as the [__] largest firm in the bulk and suspension PVC industry in both nameplate and practical production capacity. And Diamond's remaining Deer Park PVC operations would have ranked [__] in nameplate capacity with a market share of [__] percent and [__] in practical production capacity with a market share of [__] percent (CX 662D,F *in camera*).

1981 bulk and suspension PVC production, holding a market share of [__] percent (CX 661Z–28 *in camera;* CX 664T *in camera*).

46. At the time of the acquisition, General Tire & Rubber Company (renamed "GenCorp") ranked [__] in nameplate capacity with a market share of [__] percent, and [__] in practical production capacity with a market share of [__] percent (CX 662D,F *in camera*). The 1981 figures place GenCorp [__] in PVC production, with a market share of [__] percent (CX 661Z–28 *in camera;* CX 664I *in camera*).

47. Ethyl Corporation ("Ethyl") was the [__] ranking PVC producer measured by industry nameplate capacity with a market share of [__] percent prior to the acquisition (CX 662D *in camera*). Ethyl and Stauffer both ranked [__] in PVC practical production capacity for the same period, each accounting for [__] percent of the market (CX 662F *in camera*). In 1981, Ethyl ranked [__] in actual PVC production, with a market share of [__] percent (CX 661Z–28 *in camera*).

48. At the time of the acquisition, Pantasote accounted for less than [__] percent of PVC industry capacity (CX 662D,F *in camera*). During the year prior to the acquisition Pantasote ranked [__] in bulk and suspension PVC production with a market share of [__] percent (CX 661Z–28 *in camera;* CX 664S *in camera*).

As for Talleyrand, Great American Chemical Corporation and Keysor-Century Corporation, each accounted for less than [__] percent of the bulk and suspension PVC market in 1981 (CX 661Z–28 *in camera*). In September 1981, Talleyrand ceased production and exited the market (CX 319B). Great American and Keysor-Century individually accounted for less than [__] percent of 1982 bulk and suspension industry capacity (CX 662D,F *in camera*).

B. Concentration in the bulk and suspension PVC market

1. The effect of the acquisition on concentration

49. Goodrich's acquisition of Diamond Shamrock's Deer Park, Texas, suspension PVC Plant # 5 resulted in an increase in concentration in the bulk and suspension PVC market. Measured by the Herfindahl-Hirschman Index ("HHI"), nameplate capacity increased by 113 points to a level of 1,098, while the practical production HHI rose 112 points to a level of 1,079 (CPF 5.27–.28). **[14]**

50. By virtue of the acquisition, four-firm concentration in PVC nameplate capacity rose 4.0 percent to a level of 54.2 percent, rounded to the nearest decimal (CPF 5.27). Four-firm concentration in PVC practical production capacity also increased, rising 4.3 percent to a level of 53.5 percent (CPF 5.28).

51. As for eight-firm concentration figures, in nameplate capacity the acquisition increased concentration by 0.8 percent, to a level of

82.4 percent (CPF 5.27), while there was no change in the practical production capacity figure of 81.5 percent (CPF 5.28).

52. Goodrich's leading position in the PVC market was enhanced by virtue of the acquisition. Its share of PVC nameplate capacity increased from [__] percent to [__] percent, and its share of practical production capacity rose from [__] percent to [__] percent (CPF 5.27–.28).

53. Because actual production figures attributable to Plant # 5—apart from Diamond's overall output—could not be identified in the record, changes in concentration calculated on that basis were not included in the proposed findings. However, a comparison of 1981 and 1982 market shares in actual PVC production shows that Goodrich's market share increased from [__] percent to [__] percent, while Diamond Shamrock's share of industry production fell from [__] percent to [__] percent (CX 661Z–16 *in camera;* CX 664P,R *in camera*). Four-firm concentration also increased between 1981 and 1982, rising from [__] percent to [__] percent (CX 661Z–16 *in camera*).[10] And the Herfindahl Index rose 221 points to 1131 (CX 661Z–16 *in camera*).

2. Concentration trends

54. The record shows an overall increase in concentration in the bulk and suspension PVC market over the past several years. From 1977 to 1985, nameplate capacity HHI increased from 720 in 1977, to 1203 in 1985 (see table at CPF 5.69). In this period, eight-firm concentration also increased from [__] percent in 1977 to [__] percent in 1985. Four-firm concentration increased from [__] percent in 1977 to [__] percent in 1985, while the two-firm figures are [__] percent and [__] percent. Practical production capacity and actual production data reflect similar increases in concentration over the same time period (see CX 664M,N *in camera*). **[15]**

55. It appears that from 1970 to 1975, entries offset exits in the PVC business. Between 1974 and 1975, Georgia Pacific, Formosa, Certain-Teed and Shintech (a joint venture between Shin-Ebi of Japan and Robintech) began production of bulk and suspension PVC (CPF 5.69; CX 344B). [ ] (CX 321B *in camera;* CX 357A *in camera;* CX 359F; CPF 5.69). In addition, several PVC producers sold their manufacturing facilities to newcomers and exited the industry during this period (CX 442B-C). In 1970, Airco, Inc. sold its Chemical and Plastics Division to Air Products & Chemicals, Inc. (CX 323A). And in 1973, Allied Chemicals Corporation sold its polyvinyl chloride manufacturing facility to Robintech Incorporated (CX 325A). By 1975, there were

[10] Two-firm concentration increased from [__] percent in 1981 to [__] percent in 1982; eight-firm figures are [__] percent in 1981 and [__] percent in 1982 (CX 661Z–16 *in camera*).

22 producers of bulk and suspension PVC, an increase from 19 in 1971 (CPF 5.69).

56. *De novo* entry has not occurred in PVC production since 1975. [ ] (CX 317C *in camera;* CX 307B *in camera;* CX 318A,D *in camera;* CX 300Z–6 *in camera;* see 306B *in camera*). [ ] (CX 326C *in camera*). [ ] (CX 326C *in camera*). [ ] (CX 319A,B; CX 326C *in camera*). [ ] (CX 317C *in camera*). [ ] (CX 41A, *in camera;* CX 53W *in camera*). [ ] (CX 307B *in camera*). The following year, Stauffer Chemical Company sold its Delaware City, Delaware PVC plant to Formosa Plastics Corporation. [ ] (CX 318A,D *in camera*). [ ] (CX 300Z–6 *in camera;* see CX 306B *in camera*). (see CX 116 *in camera;* CX 561 *in camera*).

57. Since 1975, several firms have shut down their facilities and left the PVC business. Union Carbide exited the PVC market in 1977, following a destructive explosion at its plant (CX 43B; CX 108Q). [ ] **[16]** (CX 322A,C *in camera*). Two years later, GenCorp and Pantasote, Inc. both closed their respective PVC plants and left the industry (CX 388; H. Wheeler 1720–21; see H. Wheeler 1774).

58. Since the Goodrich acquisition in January 1982, the number of firms engaged in the production of bulk and suspension PVC has declined from 17 to 11 (CPF 5.67).

VII. PVC QUALITATIVE ANALYSIS

A. Entry considerations

59. Complaint counsel's economic expert speaks of "entry conditions," rather than "entry barriers,"[11] describing these as "anything that exists in the industry" which will (1) delay entry in response to the existence of supracompetitive profits; (2) reduce the magnitude of the entry response; and (3) reduce the probability of entry (Kaserman 2311). In this connection, Dr. Kaserman identified "five basic factors" which ought to be considered (Kaserman 2314–15). Each is addressed, *infra.*

1. Minimum efficient scale plant

60. According to a number of industry witnesses, the minimum efficient scale for PVC manufacturing plants is in the 300–600 million pounds-per-year range. Mr. Disch of Tenneco estimated the minimum efficient scale to be at least 300 million pounds, but noted the presence of further scale economies in plants larger than that (Disch 644). Mr.

[11] Apparently, there is agreement by the expert economists on both sides that there are no "Stigler type" entry barriers in the PVC industry (Kaserman 2828, 2831–32; Klass 4423). According to the testimony, a Stiglerian entry barrier is generally considered to be a production cost which must be borne by a company seeking to enter an industry, but not borne by an industry participant (Kaserman 2312, 2833; Klass 4424). For example, a Stiglerian barrier exists where incumbent firms have exclusive access to a particular productive raw material, or a prohibitive patent advantage (Kaserman 2832–33).

Schaefer, formerly of Diamond, testified that the minimum size was 300 million, with expansion potential to 500–600 million pounds (Schaefer 1132).[12] Goodrich believed that there were scale economies in a 550 million pounds-per-year facility beyond those inherent in a 300 million pound plant (DiLiddo 3345). The estimate of ICI's Dr. Eades was approximately 500 million pounds (Eades 1462–[17] 63). Mr. Howard Wheeler of GenCorp was of the opinion that the minimum efficient scale for a bulk or suspension PVC plant was 600 million pounds-per-year, but that 750 to 900 million pounds would be perferable (H. Wheeler 1734–35).

61. Apart from the above testimony, the record shows that in 1983 the Borden and Formosa companies each completed construction of new plants with nameplate capacities of [__] and [__] million pounds, respectively (CX 302G *in camera;* CX 308E). And the planned Goodrich suspension PVC facility at Convent, Louisiana was designed to have a [__] million pounds per year capacity (DiLiddo 3345; CX 38 *in camera*).

62. [ ] (CX 14F *in camera;* CX 515). Today there are a number of plants in the industry with a nameplate capacity larger than [__] million pounds: Georgia Gulf ([__] million pounds) (CX 301D *in camera*); Tenneco ([__] million pounds) (Disch 637); Formosa Plastics ([__] million pounds) (CX 308E); Shintech (two plants, with total capacity of [__] billion pounds) (compare CX 317B,C *in camera* and McMath 1892).

2. Sunk costs

63. Complaint counsel's economic expert, Dr. Kaserman, identified "sunk costs" as costs incurred upon entering an industry which cannot be retrieved upon leaving that industry (Kaserman 2321–22). In assessing the magnitude or significance of sunk costs in the PVC industry, it must be realized that bulk and suspension PVC plants are specialized, suitable only for the manufacture of PVC (Disch 686). There was testimony that it would be very difficult to convert a PVC plant to any other use, and that, in fact it might be easier to start afresh and build a new plant for such purpose (H. Wheeler 1724–25, 1744–45). Some industry witnesses placed sunk costs as being 75–80 percent of the total value of a PVC facility (H. Wheeler 1744–45; Schaefer 1219), with total costs for an efficient sized plant exceeding $100 million (Schaefer 1211–12; Diamond Adm. 450, CX 6S). There was testimony that the industry recognizes that investment in a new plant would entail considerable financial risk (DiLiddo 3134–3137),

[12] In 1981, Diamond Shamrock, in response to an HSR request, estimated the minimum size to be 300 million (CX 445).

and that, should it be necessary to close a plant, virtually the entire investment could be lost (Liao 1521–22; see DiLiddo 3396).

3. Required lead time

64. There is record evidence that the time required for planning, permitting and constructing a bulk or suspension PVC plant may be as long as [__] to [__] years (CX 15A; CX 16B, Z–10 *in camera;* CX 182I *in camera;* CX 196A *in camera;* CX 439B; CX 446C; see Diamond Adm. 445, CX 6S). [**18**]

65. As for actual construction of the plant, the time needed is approximately two years (Schaefer 1134; McMath 1940; Disch 653; see also CX 446C).

66. Prior to beginning plant construction, however, it is necessary to obtain certain environmental permits (Schaefer 1133; CX 597; CX 642; CX 643; Diamond Adm. 443, CX 6S; Goodrich Adm. 400, CX 4Z–23).[13] Securing such permits is often a costly and time-consuming process (Diamond Adm. 415, CX 6Q), [ ] [**19**] (Schaefer 1133; CX 38V *in camera;* CX 506B *in camera;* CX 592 *in camera*).[14]

67. In addition, certain engineering work must be performed even before applying for regulatory permits, since the resulting information must be presented in the permit applications (DiLiddo 3337).

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[13] Air emissions from VCM and PVC plants are subject to the restrictions of the Clean Air Act, as amended, 42 U.S.C. 7401–7642. Both plants are subject to specific air-quality standards restricting vinyl chloride emissions 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 VCM and PVC plants, as well as major expansions of existing 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 VCM and PVC resin 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 polyvinyl chloride 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 VCM and PVC manufacturing facilities hence are 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. In addition, VCM or PVC plants may also be subject to local regulations, particularly land use requirements.

[14] Such regulatory requirements were viewed by Goodrich as significantly affecting the total lead time for plant construction and the risk of new plant investment:

> Complicating the development and implementation of new processes is the long lead time required for plant expansions and constructing grass root PVC plants. This is now four to five years vs. the three years formerly required due to the increasing number of local and federal restrictions and necessary approvals. The result is R&D's time table to freeze a plant design is drastically shortened requiring front-end loading of programs and skilled prioritizing of the resources to get the job done in time to have a maximum impact. This is especially difficult with new technologies which usually require the building and operation of a pilot plant before design data for a manufacturing plant can be generated. By-passing stages in process development to meet the shorter time tables will significantly increase the risks of long costly plant start-ups and not meeting planned capacity goals.

(CX 196A *in camera;* see also CX 67Z–7 *in camera;* CX 183D *in camera*).

[ ] (DiLiddo 3337; CX 183D *in camera*). This pre-permit engineering, according to Goodrich, could take approximately six months (DiLiddo 3337). And in 1980, EPA amended its Prevention of Significant Deterioration Regulations to require that air quality near the site might have to be monitored for a period of time prior to applying for permits (40 CFR 51.24(m), 40 CFR 52.21(m)). This latter factor could add even additional time to the permit process (CX 446D; CX 574J; see also Kienholz 803–04).

68. Another factor to be considered prior to filing for permits, is selecting a site for a new facility. This, in itself, can be a "complicated" process (see DiLiddo 3335–36), involving *inter alia,* raw material and finished product logistics, community acceptance, labor supply, labor relations, political climate, and the availability of local support services (CX 574I,M-U; see also CX 193B; CX 643; CX 594A-B; RX 1061D-E; RX 1304; RX 1308). [**20**]

69. Furthermore, additional time may be needed for a new entrant to evaluate and obtain licenses for needed PVC manufacturing technology. There was testimony that this could take approximately one year (Disch 646–7; Schaefer 1133). And, since entry into the PVC industry is a major strategic decision involving substantial amounts of capital, a new entrant will more than likely have to conduct an extensive study and analysis of the market prior to making an entry decision (see CX 594A-B; CX 53A).

70. Recent entry experience evidences the length of entry lead time. Formosa Plastics began looking for a site for its PVC/VCM complex in the latter part of 1978 (Liao 1523–24). The facility "started running" in December of 1982, and did not "have full production" until the first quarter of 1983.[15]

71. Another record example is Goodrich's suspension PVC plant project at Convent, Louisiana. [ ] (DiLiddo 3335–37; CX 36S *in camera*). Prior to the July 1979 announcement, Goodrich had completed an extensive PVC/VCM strategy study over an eight-month period (DiLiddo 3334–35; CX 53A). During these eight months, Goodrich had also completed a complicated site selection process and had chosen the Convent, Louisiana site (DiLiddo 3335–36). The company was also planning to utilize its own in-house technology (DiLiddo 3336).

72. And again, in 1981, Diamond Shamrock projected the lead time for a new suspension PVC plant at Deer Park, Texas, using Diamond Shamrock technology, to be four to five years "from concept to start-up" (CX 439B).

[15] This time period does not include any strategic analyses which might have been done prior to Formosa's search for a site. Furthermore, Formosa possessed or had access to production technology (Liao 1539), and had some experience in the industry by virtue of its participation in the Rico Chemicals project (Liao 1519–22).

4. Excess capacity

73. Capacity utilization rates in the bulk and suspension PVC industry over the 15-year period 1970–1984 are shown in the tables set forth at CPF 17.03.

74. The recent period of low capacity utilization, in 1980–1982, coincided with a time of economic recession in the United States. And there was testimony that a demand for PVC in [21] industry reflected this general state of economic activity (see DiLiddo 3116–18; Eades 1471–73).

75. Various industry witnesses generally viewed the recent period of low capacity utilization as being transitory, and that utilization rates will gradually increase throughout the 1980's (Disch 691–92; Schaefer 1123, 1125; Eades 1473–74, 1480; H. Wheeler 1736–37; CX 220C).

5. Extent of vertical integration

76. [ ] (CX 667 *in camera*), [ ] (CX 667I-J *in camera*).

77. The evidentiary record contains a chart, RX 246A which depicts the various patterns of ownership integration among the industry's producers as of 1984.

78. As evidenced by RX 246A, the pattern of integration among the producers varies:

(1) Goodrich, Formosa and Georgia Gulf are fully integrated by ownership into PVC and VCM, with manufacturing facilities at each of the six stages of the PVC production chain: (1) chlorine and/or ethylene; (2) EDC; (3) VCM; (4) bulk and/or suspension PVC; (5) PVC compounding; and (6) PVC fabricating.

(2) Borden and Conoco are almost fully integrated by ownership into PVC and VCM with manufacturing facilities at five of the six production stages. However, as depicted, Borden does not produce chlorine and/or ethylene and Conoco does not have a PVC fabricating facility.

(3) The seven remaining PVC producers—Air Products, CertainTeed, Keysor-Century, Occidental, Pantasote, Shintech and Tenneco —do not produce VCM. According to the chart, their degrees of downstream integration are varied. While Air Products and Shintech do not own PVC compounding or fabricating facilities, Tenneco owns a PVC compounding, but not a PVC fabricating facility, and CertainTeed, Keysor-Century, Occidental and Pantasote own both PVC compounding and fabricating facilities. [22]

(4) Finally, the three remaining VCM producers—Shell, PPG and

DOW—have no downstream integration into any phase of PVC production and their degrees of upstream integration vary.

6. Entry and expansion experience

79. [ ] (see Kaserman 2341–44; CX 664G *in camera*).[17]

80. [ ] (CX 664G *in camera;* RX 1182A; see CX 303H *in camera;* CX 310D *in camera;* CX 355A *in camera*).

81. Industry capacity further increased from 1976 to 1978 when a number of firms, including Air Products, Borden, CertainTeed, Formosa, Goodrich, Goodyear, Conoco, Diamond, Tenneco, and Shintech expanded their PVC businesses, generally adding large reactor capacity (see Klass 4074–75; RX 1182A).

82. (CX 15A; CX 164C *in camera;* see Disch 691–92; Schaefer 1122). During this period Formosa undertook construction of a grassroots PVC plant in Point Comfort, Texas, which commenced [23] actual operations in 1983 and has a production capacity of approximately 530 million pounds per year (Liao 1533–35; CX 308E). Similarly, during 1979, Georgia Pacific, Air Products, Goodrich, Tenneco and Imex expanded their PVC production capabilities, and one year later Diamond and Georgia Pacific incrementally increased their PVC production capabilities (RX 1182A).

83. Finally, there has been new plant construction by Borden and Formosa and expansions by Conoco, Shintech and Air Products as of 1983 and 1984 (McMath 1892; DiLiddo 3285; RX 687A; RX 820A; RX 1182A).

84. There was testimony that, at present, the PVC market is burdened with excess capacity and poor financial returns (Yu 2173–75; H. Wheeler 1736; DiLiddo 3282–84). [ ] (L. Wheeler 1031–32 *in camera;* Schaefer 1211–13; DiLiddo 3285–87; see CX 513C *in camera*).

B. PVC homogeneity

85. Bulk and suspension PVC resins are produced and sold in several grades, distinguished by differences in particle size, molecular weight, and purity (Disch 632, 634–35; Becker 1255–57). These grades are designed to meet particular applications and end-use requirements of purchasers (Disch 634; Diamond Adm. 166; CX 6H).

86. Within the various grades, there appears to be little variation

[17] This assumes that the entry of Formosa Plastics is counted as of the date of its involvement in the Rico Chemical project, rather than from its acquisition of Stauffer's Delaware City facility, or construction of its own Point Comfort, Texas plant.

Formosa entered the PVC business in 1974 with the construction of its RICO plant in Puerto Rico. From 1974 through 1980 Formosa's sales never exceeded 3 percent of the market and in 1981 the RICO plant was closed (CX 664C). In that year, Formosa purchased a small PVC facility, with a nameplate capacity of 255 million pounds per year, from Stauffer Chemical, and in 1983 it completed construction of and commenced PVC production at a 530 million pound per year plant at Point Comfort, Texas (CX 664C; RX 303C).

in overall quality among PVC producers (Disch 725; RX 309Z–11), with "major PVC end use markets" being described as "not quality conscious" (RX 34S).[18]

87. [ ] (Disch 725; CX 406Z–6; *in camera*). Commodity grade resins were estimated by one industry witness to account for approximately 75 percent of bulk and suspension PVC sales (Weber 1795). There was testimony that commodity grade resins are by and large considered to be "me-too" products, with no real claims that one supplier's resin is better than another's (Disch 719, 725; see also Becker 1331). Thus, according to Tenneco's Mr. Disch, pipe customers will switch resin suppliers over small differences in price (Disch 707). And there was further **[24]** testimony that no supplier can maintain a premium price for its commodity grade over those of other suppliers (Becker 1264–65; Schaefer 1139, 1202–03).

88. [ ] (H. Wheeler 1750–51; Becker 1263–64; DiLiddo 3374–75; RX 152Z–6 *in camera*). As to these, some industry witnesses perceived certain differences in inherent physical properties (Disch 725; Becker 1331, 1333–34). While "specialty grades command a small premium over what is called the commodity rate" (H. Wheeler 1750–51), suppliers of these products are not able to maintain such premium over the prices of similar grade resins of competing producers (Becker 1264–65; H. Wheeler 1750–51).

89. Producers sometimes provide technical service in conjunction with the sale of PVC (Becker 1331–32). Such service is relatively more significant in the sale of specialty grades than commodity grades (Becker 1330–31; Weber 1794–96). In the specialty area, the providing of technical service could cause a customer to prefer to continue dealing with its regular supplier, and afford that supplier the opportunity to meet competitive offers (Becker 1330–32; Schaefer 1202–03). Nevertheless, for the bulk and suspension PVC market as a whole, service is considered relatively unimportant (Schaefer 1202–03; CX 199U).

90. [ ] (Eades 1461; CX 518F *in camera;* RX 34T; RX 54B *in camera*), where buyers will switch suppliers over small differences in prices (DiLiddo 3372). Purchasers of bulk and suspension PVC generally select the lowest price resin grade suitable for a particular processing or end-use requirement (Diamond Adm. 177; CX 6H).

91. Respondents urge, however, that the question of homogeneity in this case properly involves an analysis of what they term "commercial heterogeneity:" whether PVC resin is produced and sold on a uniform basis or according to varying terms and practices (Klass 4333–34). As to this, respondents assert that there are a number of material terms

[18] There was testimony from one industry witness that "the same resins from different suppliers are not exactly the same" (H. Wheeler 1748; see also RX 175Z–2–5 *in camera*).

and conditions which distinguish ways in which PVC is sold and purchased (DiLiddo 3250, 3252–53; see Becker 1338; H. Wheeler 1768–69; McMath 1960; RX 577S).

92. [ ] (Disch 685–86; Schaefer 1134, 1203; Becker 1338; McMath 1960; DiLiddo 3250, 3252–53; RX 144A-B *in* [**25**] *camera;* RX 177A *in camera;* RX 212B *in camera;* RX 585R; RX 1240C *in camera*).[19]

93. [ ] (Disch 685–86; Becker 1330–32; DiLiddo 3252–53; RX 259B *in camera;* RX 554C; RX 887A *in camera;* RX 1213Q-W *in camera;* RX 1240C *in camera;* see RX 212B *in camera*).

C. Demand for bulk and suspension PVC is relatively inelastic

94. Complaint counsel's economic expert, Dr. Kaserman, testified that in performing his analysis of the elasticity of demand for bulk and suspension PVC, he attached significance to the fact that PVC is an "intermediate product" rather than a consumer good. Dr. Kaserman testified that 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 (Kaserman 2370–71).

1. There are no practical substitutes for PVC resin in the manufacture of finished PVC products

95. The record indicates that there are no substitutes for bulk and suspension PVC resin in the manufacture of finished PVC goods (Kaserman 2376–77). PVC resin is the primary raw material input in the fabrication process, providing the properties necessary to give the product its fundamental form (see H. Wheeler 1751–52; Disch 661–62). Moreover, producers of PVC finished products testified that PVC manufacturing equipment cannot easily or practically process other materials (Wheeler 1751–52; Disch 663).

2. The cost share of PVC resin in many finished PVC products is low

96. Bulk and suspension PVC resins account for only a small portion of the cost of PVC finished products. Value is added to PVC resin at various points in the manufacturing process, thereby [**26**] reducing the cost share of the PVC resin in the final product. Initially, PVC resins are compounded in order to impart certain desired properties

[19] Contrast RX 267A *in camera* (60–day credit terms) with RX 895A *in camera* (45-day credit terms) and with RX 268A *in camera* (30–day credit terms).

to the product prior to its use in fabricating end products (Disch 655–56). Compounding involves infusing the resin with various additives, including heat and light stabilizers, impact modifiers, plasticizers, and pigments (Disch 656–57). The amount of value added at the compounding stage varies. Flexible compounds used in the manufacture of wire, cable, and flexible sheathing require the addition of plasticizers, and frequently contain no more than 50 to 70 percent resin by weight (Disch 658–59; DiLiddo 3377). On the other hand, rigid compounds used in the manufacture of bottles, pipes, and fittings, require expensive additives, and others contain as much as 80–95 percent resin by weight (Disch 659–60; Becker 1300). In addition, value is added to PVC compounds at the manufacturing stage through a number of production processes, including extrusion, calendering, blow-molding, injection molding, and compression molding (Disch 661–62). Once again, the value added varies with each PVC product (see CPF 8.70; CPF 8.77; CPF 8.92; CPF 8.97; CPF 8.105; CPF 8.113; CPF 8.124). Finally, PVC resin accounts for a very small portion of the total installed cost of PVC products such as pipe, siding and windows (see CPF 8.70; CPF 8.92; CPF 8.113). As a result, Dr. Kaserman concluded that the low cost share of PVC resin in PVC consumer goods indicates that the demand for bulk and suspension PVC resin in significantly less elastic than the demand for the products themselves (see Kaserman 2373–75).

3. The price elasticity of bulk and suspension PVC finished products is low

97. Bulk and suspension PVC resin is used in the manufacture of hundreds of end-use products. [ ] (see Disch 663–80; Becker 1268–1325; H. Wheeler 1727–28, 1753; CX 591G-K *in camera;* see Commission physical exhibits 1–17).

98. The record indicates that two factors account for the general inelasticity of demand for PVC end products and the relatively low substitutability of products manufactured from other materials. First, the evidence establishes that many PVC products possess unique characteristics which make them highly desirable in a variety of end-use applications (Yu 2118–29; Becker 1274–79; DiLiddo 3348–50; Disch 672–77). Consequently, PVC finished products are often selected on the basis of their distinctive properties, and not on the basis of changes in price (Yu 2188–29; Becker 1274–79; DiLiddo 3348–50; Disch 672–77). And second, a number of PVC finished products offer substantial cost savings to purchasers, comparing favorably in price with products manufactured from other materials (CPF 8.126). **[27]**

4. PVC finished end products

a. Pipe and pipe fittings

99. The production of PVC pipe accounts for approximately [__] percent of the annual consumption of bulk and suspension PVC resin (Disch 663; see also RX 145L *in camera;* Commission physical exhibit 6). PVC pipe fittings, which are used in conjunction with PVC pipe (Becker 1323–24), account for an additional 3–4 percent of PVC resin consumption (Disch 663; see Commission physical exhibit 7). PVC pipe first gained commercial prominence in the late 1960's and early 1970's (Becker 1276–78). During the period 1966–1968, the PVC pipe segment consumed approximately 134 million pounds of bulk and suspension PVC (RX 3Z–14). By 1983, however, demand has grown to about [__] million pounds (RX 165E *in camera;* see generally CX 756Z–19).

100. The record establishes that PVC pipe possesses a number of characteristics that compare favorably with pipe products manufactured from traditional materials.[20] These distinctive properties include: low cost, light weight, long lengths, ease of joining, ease of installation, corrosion resistance, smooth interior walls, and excellent flow efficiency.[21] These factors are examined in some detail, as follows:

101. In many of the applications for which it is used, there is evidence that PVC pipe is more cost-effective than alternative pipe materials (CX 591H *in camera;* CX 247A,L *in camera;* RX 958A; see also Becker 1293–94). Comparing the cost of manufacture alone, the record reflects that alternative materials cost appreciably more to produce (CX 247A,L *in camera*).

102. In addition, PVC pipe possesses qualities which make it easier to handle and less costly to install than most other pipe products. Mr. Andrew Yu of J.M. Manufacturing Company, Inc. testified that PVC pipe is substantially lighter in weight than traditional pipe materials, weighing approximately 30 percent as much as concrete pipe and 25 percent as much as ductile iron [28] (Yu 2122–23). Mr. Yu further testified that the relatively light weight of PVC pipe facilitates installation by hand labor, enabling contractors to dispense with heavy equipment required to lay ductile iron or cement pipe (Yu 2123–24; DiLiddo 3347–48). Moreover, PVC pipe is manufactured in longer lengths than pipe made from traditional materials (Yu 2123–24; Wag-

[20] Traditional pipe materials which compete with PVC pipe include: clay, asbestos cement, concrete, steel, ductile iron, copper, and aluminum (see *e.g.,* CX 244F; CX 49K).

[21] See generally CX 591H *in camera;* CX 247A, L *in camera;* RX 958A; Becker 1293–94 (PVC pipe is low in cost); Yu 2122–27, DiLiddo 3347–48; Waggoner 3632 (PVC pipe is lighter and less costly to install than most traditional pipe); Yu 2121–22; DiLiddo 3348–50; Becker 1274 (PVC pipe is resistant to corrosion from chemicals); Yu 2118–21; Becker 1276–78; Waggoner 3576 (PVC pipe has excellent flow properties).

goner 3632). As a result, PVC pipe requires fewer joints in the installation process, permitting workers to lay pipe more quickly (Yu 2125–27; Waggoner 3632). [ ] (Yu 2123–27; CX 247A *in camera*).[22]

103. In addition, PVC pipe is resistant to certain corrosive chemicals that affect other kinds of pipe. Acidic, alkaline or wet soils do not cause the external walls of PVC pipe to corrode (Yu 2121–22; DiLiddo 3348–50; Becker 1274). Similarly, PVC pipe is not susceptible to internal corrosion from sewage or other materials. Consequently, as industry witnesses testified, PVC pipe can last significantly longer than ductile iron or concrete pipe in certain end-use conditions (Yu 2121–22; DiLiddo 3348–50; Becker 1274).

104. Finally, PVC pipe reportedly has excellent flow properties. PVC pipe's generally smooth internal surface permits it to carry a greater volume of water than pipe manufactured from other materials (Yu 2188–21). For example, there was testimony that a 12–inch PVC pipe can carry as much water at a given pressure rating as a 14–inch ductile iron pipe (Yu 2118–21; Becker 1276–78). PVC's smooth interior surface reportedly also prevents the accumulation of deposits resulting from contact with water having a high mineral content (Yu 2118–21; Becker 1276–78). Traditional pipe materials, such as ductile iron, are described as to be susceptible to deposit build-up; a condition which reduces the effective diameter of the pipe, shortening its service life (Yu 2118–21; Becker 1276–78). [29]

105. However, there are certain characteristics of PVC pipe which make it unsuitable for a number of end-use applications. For example, PVC pipe lacks the requisite stiffness for use in above-ground irrigation systems (Yu 2154). Furthermore, its acceptability of PVC pipe has been questioned by building code and fire officials for use in drain, waste, and vent (DWV) and conduit applications because of a controversy over its behavior in a fire situation (see, *e.g.*, CX 45S; see Waggoner 3638). In addition, ductile iron pipe is considered superior to PVC pipe in municipal water pipe applications involving rocky or shifting soil conditions, or heavily traveled surfaces (Waggoner 3578–79). Finally, because PVC pipe is a relatively new product, potential purchasers are in no position to assess long-term performance properties (Yu 2121–22, 2131–33; DiLiddo 3350–51; Waggoner 3628–30, 3634–35). In this connection, there was testimony that pipe purchasers consider performance over time a significant factor in pipe selection

[22] There is evidence that PVC pipe can offer a price advantage on total-installed costs—a factor identified as an important consideration for pipe purchasers (DiLiddo 3348). For example, this would permit PVC electrical conduit producers to set the price of their product close to the price established for metal conduits and still offer the customer value in the form of lower labor costs for installation (RX 4V,W *in camera*). Similarly, a 1983 pipe industry study by Tenneco noted that PVC pipe had an installation cost advantage of $.50–$1.00 per foot over metal pipe in C–900 applications, a fact which "benefited" PVC in large diameters as costs become more competitive (CX 566E; see also CX 247A *in camera*).

because many applications envision pipe to be operational for many decades (Yu 2122; Waggoner 3630).

106. According to the record, the following constitute the major applications for PVC pipe: (1) municipal water pipe; (2) rural water pipe; (3) water service and distribution pipe; (4) sewer pipe; (5) drain waste, and vent pipe (DWV); (6) irrigation pipe; (7) communications duct; and (8) technical conduit (see CX 756Z–20).

1. Municipal water pipe

107. Municipal water pipe transports water from reservoirs, lakes, or rivers to local treatment facilities, and thence into water mains for distribution throughout the community. This segment of the pipe market is classified as "pressure pipe application," in that the water is conveyed through the pipe under pressure. As might be expected, pressure pipe applications require higher performance standards, which in turn affect design and cost (Yu 2096–99). Pipe produced for pressure applications must be engineered to withstand high internal and external pressures and to provide assurance of safety and longevity upon installation (*ibid.*).

108. Municipal water pipe is manufactured in a wide range of diameters. Large diameter pipes are needed to convey water from the reservoir to the treatment center and main lines, while smaller sizes are used to distribute water throughout local subdivisions (Yu 2114–15, 2116–15). Municipal water mains thus vary in size from 4 inches to approximately 36 inches in diameter (Yu 2115; see also Waggoner 3579–80; RX 3Z–35). Usually however, PVC municipal water pipe is sold in diameters of 12 inches or less (Yu 2115; Becker 1278; Waggoner 3580; see CX 377A-F). As noted, the smaller diameters of PVC municipal water pipe are used principally in subdivisions and housing developments (Yu 2112– [30] 15). The record indicates that large diameter pressure pipe represents only a [__] percentage of total PVC pipe sales (see CX 387C *in camera;* RX 165E *in camera*).

109. The municipal water pipe segment consumed approximately [__] million pounds of bulk and suspension PVC resin in 1983, accounting for [__] percent of total annual PVC resin consumption (RX 165E *in camera*).

110. PVC municipal pipe is generally purchased by the contractor chosen to install the water system (Waggoner 3574; Yu 2112). Although the contractor usually proposes the pipe material that will be used in a particular project, he is limited in this respect by the specifications drafted by the project's engineer (Waggoner 3574–75, 3584–85; Yu 2107–12). These specifications set forth the requirements of the municipality, including pipe diameters, pipe classes, installation methods, and materials that may be used on the job (Waggoner 3586).

Written specifications may designate a particular pipe material, such as ductile iron or PVC, for the entire system (Waggoner 3626). On the other hand, the specifications may call for the use of more than a single type of pipe (Waggoner 3626). Normally, municipal pipe specifications can be expected to reflect careful consideration of a number of factors such as soil conditions, terrain, and depth of the trenches to be excavated (Waggoner 3585, 3623–26). Finally, the record also suggests that specifying engineers are inclined to favor particular pipe materials based upon personal preference and prior use experience (Yu 2132–33; Waggoner 3624, 3627–29, 3631; DiLiddo 3352–53; see also CX 756–Z23).

111. The materials most commonly used in the manufacture of municipal water pipe are ductile iron, reinforced (pre-stressed) concrete, asbestos cement, and PVC (Yu 2116–17; Waggoner 3626–27, 3645–46; Becker 1275). All of these materials have distinctive performance properties which govern their selection for a particular application (see Waggoner 3617–18; Yu 2131–32; Becker 1276–78; DiLiddo 3348–53). All of the characteristics associated with PVC pipe, including flow efficiency, corrosion resistance, light weight, ease of installation, and lower installation costs come into play in the selection process.

112. For example, there was testimony that PVC municipal water pipe has smooth internal walls which resist the accumulation of deposits over time, resulting in a constant, unimpeded delivery of the water supply (Yu 2118–21; Becker 1276–77; RX 3Z–37). Thus, PVC pipe may be preferable in localities where the water to be transported has a high mineral content (see Becker 1276–77). Nevertheless, Mr. Waggoner of Griffin Pipe Products testified that competing pipe producers have devised techniques to overcome the problem of deposits (Waggoner 3577–78). He explained that ductile iron pipe manufacturers have [31] developed and for many years have utilized a cement liner which effectively insulates the interior walls of the pipe from deposit build-up (Waggoner 3577–78). In his view, therefore, the mineral deposit problem has ceased to be a significant factor (Waggoner 3577–78).

113. There was testimony that PVC municipal water pipe does not corrode in acidic, alkaline or wet soils (Becker 1274, 1276; Yu 2121–22; DiLiddo 3348–50; RX 3Z–37). Consequently, PVC pipe can be viewed as preferable to ductile iron or steel pipe in areas where soil conditions are conducive to such external corrosion (see Yu 2121–22).

114. Finally, PVC pipe was lauded in the record as frequently easier and less expensive to install than other municipal water pipe materials (Yu 2122–27; RX 3Z–36, 37). PVC pipe's light weight permits the use of hand labor in installation, thus dispensing with the necessity

for using heavy equipment (Yu 2123–24; see also RX 3Z–36–37; DiLiddo 3347).[23] In addition, PVC pipe is manufactured in longer lengths, thereby requiring fewer joints (Yu 2124–27; Waggoner 3632). And there was testimony that the processes used to join PVC pipe, *viz.*, bell joints and solvents, are superior to traditional procedures in that they are simpler and easier to execute (Yu 2126–27; Waggoner 3632; see also CX 377B). Moreover, PVC pipe can reportedly be cut more easily in the field than traditional pipe materials such as concrete or ductile iron (Yu 2126–27). However, it should be noted that the extent of any installation cost savings will vary according to the particular projects, depending upon the depth of the trench, soil conditions, and other factors (Yu 2112–14). For example, the installation of PVC pipe requires a special gravel backfill to insulate the pipe from the pressure of shifting or rocky soil (Waggoner 3578–79). According to Mr. Waggoner, the added cost of this requirement would offset the cost advantage that might otherwise obtain in installing PVC pipe (Waggoner 3651–53).

115. On the down side, it must be said that PVC pipe is less strong than other traditional pipe materials (see Waggoner 3575, 3628–29). As a result, pipe materials such as ductile iron are preferred for use in conditions which can induce breakage such as shifting or rocky soils (see Waggoner 3631). Similarly, PVC pipe would not be favored for segments of water pipeline to be placed under highly traveled roads or railroad crossings (Waggoner 3625). [**32**]

116. Moreover, PVC municipal water pipe's lack of performance history is generally perceived as a negative factor in the selection process (Yu 2122; see Waggoner 3628–30, 3634–35). PVC pipe is a relative newcomer in the municipal water pipe market, and thus lacks an established track record (Yu 2131–32; Waggoner 3626–27). The traditional pipe materials all have substantial performance histories, a factor favoring them over PVC in the selection process (Yu 2131–33; Becker 1280; DiLiddo 3352–53; see Waggoner 3624, 3629, 3634–35).[24]

Prior to 1975, PVC pipe had not received the approval of the American Waterworks Association ("AWWA"), the standard setting body looked to by municipalities in designating pipe products for water systems (CX 756Z–23; RX 3Z–37). There was evidence indicating that AWWA approval in 1975, as well as advances in technology permit-

[23] But see Waggoner 3633–34 (saving in installation cost is not significant because heavy equipment is usually already present on the job site).

[24] Mr. Waggoner of Griffin Pipe Products testified that there are ductile iron pipe systems in place, which are still functioning 70 years after installation (Waggoner 3630). He explicated that such performance history is important in major metropolitan areas, because pipe repairs involve traffic disruption (Waggoner 3630–31).

Mr. Yu of J.M. Manufacturing Company, Inc., contended that PVC pipe will endure for up to 50 years or more in alkaline or acidic soil conditions. He estimated that ductile iron pipe and concrete pipe last 20 to 25 years and 30 to 40 years respectively under similar soil conditions (Yu 2122).

ting the manufacture of PVC pipe in increasingly larger diameters, facilitated market acceptance (Becker 1276; RX 3Z–37). Nevertheless, the absence of performance history has continued to affect sales of PVC for municipal use (Yu 2122; see Waggoner 3628–30, 3634–35).

117. On balance, the evidence supports the following conclusions regarding competing alternative products in the municipal water pipe market: (1) PVC municipal water pipe has a significant cost advantage over alternative materials in the smaller diameter segments; (2) PVC pipe's cost advantage diminishes as pipe diameters increase and, (3) upon an appreciable rise in PVC resin prices, short term substitution can be expected to occur in larger diameter sizes.

118. The evidence indicates that PVC municipal water pipe has a significant cost advantage in the smaller diameters used in the municipal water pipe market (Waggoner 3580, 3635–36). As noted, PVC water pipe is sold principally for subdivisions and housing developments; applications which utilize smaller diameter pipe (Waggoner 3635–36, CX 539B). Mr. Waggoner described the [33] price advantage of PVC pipe over ductile iron[25] pipe with respect to a range of pipe diameters:

Q. Would it be fair to say that PVC pipe has a selling price advantage over ductile iron pipe in the water main usage market.

A. Yes.

Q. In your experience what, in what diameter sizes would PVC pipe have the selling price advantage?

A. Most times we find that in three, four and six inch, they have significant advantage, in eight inch, in most cases they have an advantage, and in ten inch and 12 inch they have an occasional advantage.

(Waggoner 3635–36, 3580).[26] Mr. Waggoner also testified that neither pre-stressed concrete pipe nor asbestos cement pipe are cost competitive with PVC pipe in the smaller diameters in which [34] PVC pipe is sold (Waggoner 3626–27, 3645). Concrete pipe is more commonly used in larger pipe diameters (RX 3Z–36). At the same time, the

[25] In addition, the record reflects that ductile iron pipe producers will adjust their prices below "normal" levels in order to be cost-competitive with PVC. Mr. Waggoner of Griffin testified that if "[O]ur marketing intelligence tells us that if the specification is written, that we will be competing against PVC pipe, that will be in a competitive price situation so that we automatically know that our price must come in to be competitive, which would be probably lower than it normally would be" (Waggoner 3582–83). Mr. Waggoner further testified that ductile iron manufacturers have developed a thinner wall pipe, class 50 pipe, in order to meet cost competition from PVC (Waggoner 3614–15). Mr. Waggoner explained that reducing the iron content in ductile iron pipe enhances the product's cost competitiveness (Waggoner 3614).

[26] Overall, however, ductile iron continues to be the dominant in-place material in the municipal water pipe market, with an estimated 60 percent share of total footage installed (CX 539B). An internal memo prepared by Griffin Pipe Products for the fiscal year 1984 specifically notes that "substitute materials continue to capture a significant portion of the small diameter pipe market that accompanies subdivision development" and names PVC pipe as the chief competitor to ductile iron in 3–inch to 12–inch diameter pipe applications (CX 539B). An internal memo prepared by Griffin Pipe Products for the fiscal year 1984 specifically notes that "substitute materials continue to capture a significant portion of the small diameter PVC pipe as the chief competitor to ductile iron in 3 inch to 12 inch diameter pipe applications (CX 539B).

demand for asbestos cement has declined because of concerns relating to the carcinogenicity of asbestos (see Waggoner 3626–27; see also CX 756Z–34).

119. [ ] (CX 566D; CX 522B *in camera*). [ ] (see CX 387C *in camera;* RX 165E *in camera*).

120. [ ] (see RX 233A *in camera;* RX 234B-C *in camera;* RX 573O; RX 687A). [ ] (Schaefer 1141–42; L. Wheeler 988; see also Disch 686) to the upper 30's to low 40's (in cents per pound) (Schaefer 1141–42; L. Wheeler 988; McMath 1927; RX 255A *in camera;* RX 226A *in camera*). During this period, PVC pipe producers complained that as resin prices reached higher levels, they lost sales to substitute products (Schaefer 1142, 1210; DeLiddo 3264–65; RX 236E). [ ] (Liao 1543–44; RX 234B-C *in camera;* RX 236E *in camera*).

At the same time, there was testimony that the 1984 price increases did not affect any non-pipe applications (see Disch 688–89) and that such increases were perceived by PVC resin producers as "unusual" (see, *e.g.,* Liao 1543–44; Disch 689). [ ] (see Liao 1543–44; see also Weber 1828; RX 234B-C *in camera;* Disch 689; L. Wheeler 988–89).

2. Rural water pipe

121. The rural water pipe category includes pipe used in water wells and Farmers' Home Administration (FMHA) projects (RX 3Z–40. See also CX 756Z–21–22). PVC pipe is the principal material used in FMHA projects (CX 756Z–21, 22; RX 3Z–41. See CX 378A-F). [ ] (RX 165E *in camera*).

122. The evidence indicates that PVC pipe has achieved dominance in the rural water pipe segment because its distinctive properties are uniquely suited to the requirements of rural [35] applications. Specifically, rural areas require transportation of water over long distances at low pressure (Waggoner 3622).[27] PVC pipe is fabricated at a low pressure rating and in relatively long lengths, permitting miles of pipe to be laid in rural areas with fewer connecting joints (Waggoner 3622). Similarly, PVC pipe's light weight and ease of joining facilitate installation by hand labor, offering contractors a cost advantage (see Yu 2134, 2112–17). In addition, rural water systems can utilize pipe which has a lower safety factor relative to the break resistance characteristics of the pipe (see Yu 2099–100, 2133–34). Lower safety requirements are permitted in rural areas because replacement of broken or damaged pipe involves minimal disruption or inconve-

[27] Griffin Pipe's Mr. Waggoner testified that pipe pressure requirements are dependent upon the number of users to be served in a given location. Thus, municipal applications are generally better markets for ductile iron because ductile iron is manufactured at a high pressure rating and is marketed in shorter lengths than PVC pipe (Waggoner 3622).

nience to the rural population (see Yu 2099–100, 2133–34). Consequently, the vast majority (up to 85 percent) of PVC water pressure pipe sold on a footage basis is utilized in rural water applications (see Waggoner 3620–21; CX 756Z–20). Asbestos cement pipe is presently used for some of the large diameter needs, but industry sources expect that it will be displaced by PVC pipe within the next several years (RX 3Z–41).

3. Water services and distribution pipe

123. Service pipe conveys the water supply from the water main into the homes and buildings of users, while distribution pipe carries water from the water meter to taps and other individual outlets (RX 3Z–37). Both of these segments are pressure pipe applications (CX 756Z–20). Significantly, however, pipe used in service and distribution is smaller in diameter than pipe used in other water applications (RX 3Z–38). Distribution pipe diameters, for example, range from one-half to one inch for single family residential dwellings, to somewhat larger sizes used in multifamily or commercial buildings (RX 3Z–38). (RX 165E *in camera*).

124. Copper is the leading pipe material used in both water service and distribution applications (Becker 1272–74; RX 3Z–38, 39; CX 756Z –26). Steel was formerly a significant factor in these applications, but it has generally now been displaced by other materials (RX 3Z–38). Steel pipe exhibited a number of undesirable characteristics which precipitated the shift to copper pipe, including a tendency to corrode and accumulate [**36**] deposits (RX 3Z–38). In addition, steel pipe is heavier than alternative pipe materials, and entails a cumbersome joining procedure (RX 3Z–38).

125. PVC pipe is currently enjoying major growth in the service pipe market (RX 3Z–37–40; CX 756Z–26, 27). An industry sponsored study reported that among plastics, "PVC is the material of choice because of its strength and low cost" in service pipe applications (RX 3Z–39). Until recently, however, PVC's penetration of the service and distribution pipe markets was hampered by a lack of building code approval (RX 3Z–39). In 1975, only 5 percent of the codes permitted plastic cold water distribution, and virtually none allowed use in hot water systems (RX 3Z–39). By 1980, however, 50 percent of the codes approved plastic use in both areas (RX 3ZX–39). Nevertheless, as a practical matter, PVC distribution pipe is not used for hot water pressure pipe applications because of heat distortion problems in the material (Becker 1272–73; CX 756Z–26).

126. There is evidence that PVC pipe offers a cost advantage over alternative materials used in the water distribution segment of the pipe market. For example, a 1983 Goodrich document estimated the

manufacturing cost per foot for two inch diameter pipe in the years 1976–1982 to be as follows: [ ] (CX 247L *in camera*). Moreover, [ ] (see CX 247L *in camera;* CX 756Z–29, 31).

4. Sewer and drain pipe

127. The sewer and drain pipe segment includes sanitary sewers, storm sewers, and drainage applications (RX 3Z–44; CX 756Z–24). This market segment is divided into three categories; pressure sewer pipe, which accounts for just over 8 percent of the industry; gravity sewers, which account for 86 percent of the industry; and drainage which accounts for the remaining 5 percent of the industry (CX 756Z–24). [ ] (RX 165E *in camera*). **[37]**

128. The principal materials used in the fabrication of pipe for this application include: concrete, clay, corrugated iron and PVC (Yu 2141; Waggoner 3645–46). Although asbestos cement was formerly an important factor in the market, it has declined significantly in recent years (Waggoner 3645). Similarly, the sewer and drain pipe segment consumes a relatively small amount of ductile iron pipe, although ductile iron is used almost exclusively in the pressure pipe applications of this market (CX 756Z–25).

129. Once again, the record suggests that the distinctive properties of PVC have contributed to its increasing acceptance by this segment. Unlike concrete and asbestos cement, PVC pipe is resistant to internal corrosion from hydrogen sulfide gas (RX 3Z–48). And like PVC municipal pipe, PVC sewer and drain pipe is not susceptible to external corrosion from acidic or alkaline soil conditions (Yu 2142). [ ] (Yu 2142–44; RX 3Z–49; CX 300Z–7 *in camera*). At the same time, however, PVC's penetration of this market has been hindered by the reluctance of local officials to approve plastic materials, and by the general inclination of engineers to specify materials with a proven track record (CX 756Z–24, 25; see Yu 2146–48). In addition, PVC pipe is not manufactured in all of the diameters used in sewer and drain applications (CX 756Z–24, 25).

130. On the whole, however, the evidence indicates that PVC pipe has increased its share of the sewer and drain segment at the expense of traditional materials. Clay pipe, formerly the dominant material in gravity sewer applications, has declined in volume as a result of replacement by PVC (Waggoner 3646; CX 756Z–24). [ ] (CX 3Z–48 *in camera;* Waggoner 3646), and provides advantages over clay pipe in terms of lighter weight, installation costs, integrity of joints, and breakage resistance (Yu 2142–44; Waggoner 3646). [ ] (see CX 579F,M,S *in camera*). [ ] (see CX 579F,M,S *in camera*). Indeed, one 1980 PVC pipe cost comparison study predicted that clay pipe might disappear from the market altogether: [ ] **[38]**

[ ] (CX 579R *in camera*). Mr. Waggoner of Griffin Pipe Products attributed the decline in clay directly to PVC pipe's superior cost and performance advantages noting, "PVC came along and had a better joint system and it was cost competitive if not better than clay so usage of clay began diminishing as PVC started taking that market [sewer applications] away from it" (Waggoner 3646).

131. Approximately 86 percent of sewer and drain applications are non-pressure (CX 756Z–25). PVC pipe can be fabricated with thin walls for non-pressure applications (Yu 2137–39; Waggoner 3643–44). As a result, the cost of PVC sewer pipe is even less than the cost of PVC municipal water pipe (Yu 2105–06, 2140–41). A PVC industry witness placed the cost of a pipe 8″ in diameter at $3.90 for PVC water pipe (Klass 150), and at $1.82 for PVC sewer pipe (Yu 2106, 2140–41). On the other hand, ductile iron producers sell the same pipe product for both pressure and non-pressure applications (Waggoner 3579, 3644). Consequently, ductile iron pipe, which is already at a cost disadvantage to PVC pipe in the municipal water pipe segment, experiences an even greater disadvantage in gravity sewer applications (Waggoner 3583).

132. Similarly, concrete pipe does not compete successfully with PVC pipe in the sewer and drain pipe segment. Although it has good crush resistance, concrete pipe is suceptible to hydrogen sulfide attack (RX 3Z–48). In addition, concrete pipe presents difficulties in sealing joints, which results in excessive exfiltration when used in sanitary sewers (RX 3Z–48). And due to its heavier weight, concrete pipe is more costly to install than PVC pipe in small diameters (RX 3Z–48, 50). As a result, concrete pipe tends to be used mainly in very large diameter storm sewer and drainage applications, and accordingly does not compete directly with PVC pipe in most sewer and drain end-uses (RX 3Z–48).

5. Drain, waste and vent (DWV) pipe

133. Drain, waste, and vent (DWV) systems form the interior network of pipe and fittings used for sanitary and waste removal (RX 3Z–52; CX 756Z–25, 26; Waggoner 3637). DWV applications utilize two interconnecting pipe systems—one for waste removal and the other to vent the system to the atmosphere (RX 3Z–52). The drain, waste and vent segment is not classified as a pressure pipe application (CX 756Z–20; Waggoner 3639). Pipe diameters used by DWV systems generally range in size from one half inch to eight inches (see, *e.g.*, CX 379). [ ] (RX 165E *in camera*). **[39]**

134. Cast iron and copper are the traditional materials used in the DWV segment (RX 3Z–54; Becker 1292; Waggoner 3637–38). However, copper has declined because of market penetration by more

economical plastics systems (RX 3Z–54). Acrylonitrile butadiene styrene (ABS) and PVC are the dominant plastics utilized in drain, waste, and vent applications (RX 3Z–54, 55; Becker 1292; Waggoner 3637–38).

135. The record reflects that PVC pipe has eroded cast iron's share of the DWV market because PVC offers substantial savings in both the cost of the pipe and the cost of installation (RX 3Z–54, 55; CX 756Z–25, 26). PVC's growth, however, has been impeded by two concerns. First, cast iron provides lower noise conductivity—an attribute that is particularly important in multi-family dwellings (RX 3Z–54). And second, a number of fire codes prohibit installation of PVC pipe because of the emission of toxic fumes upon combustion (Waggoner 3638). As a result, use of PVC pipe is frequently banned in highrise structures (see Waggoner 3637–39; RX 3Z–54, 55; CX 756Z–35). Nevertheless, PVC pipe has gained increasing acceptance for use in single family dwellings, and industry forecasts anticipate that because of its cost savings, PVC will continue to displace traditional materials to the extent permitted by code requirements (RX 3Z–55; CX 756Z–26).

136. PVC pipe has largely replaced ABS as the leading plastic pipe used in DWV applications (Weber 1806–09; CX 583Z–80; CX 756Z–26). Until 1973, ABS was the dominant plastic material in the DWV segment due to earlier code acceptance and the superior properties of ABS compounds (CX 583Z–80; RX 3Z–55). PVC producers ultimately developed an improved PVC compound offering performance properties similar to ABS at a substantially lower cost (CX 583Z–80; CX 756Z–26; Weber 1806–09). Although ABS pipe manufacturers have produced a foam core product to cut costs, PVC pipe still enjoys a considerable cost advantage (CX 756Z–26).

137. The evidence indicates, therefore, that PVC pipe maintains a significant cost advantage over both ABS and cast iron pipe in DWV applications. Goodrich estimated the manufacturing costs for three inch pipe produced from each of the foregoing materials to be as follows: [ ] (CX 247L *in camera*) **[40]**

6. Irrigation pipe

138. The irrigation pipe segment is classified as a pressure pipe application (Yu 2099–100; CX 756Z–20; see, *e.g.*, CX's 378A-F, 381A-D). However, pressure ratings for irrigation pipe are lower than those required for other pressure applications, permitting use of a thinner PVC pipe (Yu 2049–100, 2150–52). Irrigation systems are divided into three main categories: below-ground systems, above-ground systems, and on-the-ground systems (see Yu 2148–50). Below ground systems are further divisible into sprinkler systems and drip pipe systems (CX 756Z–23, 24; RX 3Z–68). [ ] (RX 165E *in camera*).

139. PVC and aluminum are the principal materials used in the irrigation pipe segment (Yu 2153; CX 756Z–24). Selection of either material is governed chiefly by the distinctive properties of the pipe product and the particular requirements of the irrigation system (Yu 2153). For example, PVC pipe is used predominantly in below-ground irrigation systems (CX 756Z–24). Unlike aluminum pipe, PVC pipe has superior impact resistance and will not crush when installed (Yu 2154). In addition, PVC pipe enjoys a substantial cost advantage over aluminum pipe (Becker 1290; CX 756Z–24). Thus, PVC is currently the leading material in below-ground sprinkler systems (CX 756Z–24).

140. On the other hand, PVC pipe is generally considered inappropriate for use in above-ground sprinkler systems (Yu 2152–54). PVC pipe lacks the requisite stiffness to ensure against breakage when the pipe is transported across a field (Yu 2153–54). Moreover, PVC resins must be formulated with special additives to protect the pipe from ultraviolet degradation (CX 756Z–24). Even with the inclusion of additives, PVC pipe is still available at lower cost than aluminum pipe prompting one forecasting report to predict that rapid price increases for aluminum could cause a shift to PVC (CX 756Z–24).

141. For many of the foregoing reasons, aluminum is the leading material used in on-the-ground irrigation systems [41] (Yu 2154; CX 756Z–24).[28] [ ] (CX 756Z–24; Becker 1289–90; CX 300Z–7 *in camera*).

7. Communications duct

142. Communications duct (or conduit) is used to protect telephone cable and wire running to and from telephone company facilities (Becker 1296; CX 756Z–27). Communications duct is classified as a non-pressure application (CX 756Z–20). Nearly all communications conduit is installed underground and is therefore manufactured from non-corrosive materials including: concrete, clay, bituminous fiber, asbestos cement, PVC and polyethylene (RX 3Z–59). [ ] (RX 165E *in camera*).

143. PVC gained the dominant position in the communications conduit segment largely because of its low price and ease of installation (RX 3Z–59). Until the mid-1960's, concrete and clay dominated communications duct applications (RX 3Z–59). PVC duct has replaced these materials because it offers a cost advantage and because its particular physical properties facilitate cable insertion (RX 3Z–59).

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[28] Ductile iron and asbestos cement pipe are not competitive in irrigation applications because the key characteristics of those materials, strength and high pressure ratings, are simply not needed (see CX 756Z–23, 24; RX 3Z–68; Waggoner 3642). As a result, ductile iron is at an overwhelming cost disadvantage compared to other materials (Waggoner 3642).

A small amount of polyethylene pipe is currently used in below-ground drip pipe systems (CX 756Z–24). A 1982 B.F. [ ] (RX 145Z–1 *in camera*). [ ] (RX 145Z–1 *in camera*).

Similarly, PVC has displaced bituminous fiber and asbestos due largely to its significant cost advantage over both materials (RX 3Z–59). At least one forecasting study has predicted that polyethylene duct (PE) will capture a growing percentage of the communications duct market (RX 3Z–59). Like PVC, polyethylene duct is lightweight and offers economies in installation (RX 3Z–59). At present, however, the evidence indicates that PVC duct remains the leading material in the communications duct segment (RX 3Z–59; CX 756Z–27). [42]

8. Electrical conduit

144. Electrical conduit is used in industrial and commercial structures as a protection for bundled wires (CX 756Z–27). Most electrical conduit is used above ground, although an increasing percentage of conduit is being buried in a manner similar to communications duct (CX 756Z–27; RX 3Z–60). [ ] (CX 300Z–7 *in camera;* CX 756Z–27–28). [ ] (RX 165E *in camera*).

145. Steel is the chief material used in above-ground electrical conduit, due largely to its superior strength (CX 756Z–28; RX 3Z–60, 61). [ ] (CX 756Z–28; RX 3Z–60, 61; see also CX 300Z–8 *in camera*). In addition, steel can be galvanized and coated with PVC in order to resist corrosion (RX 3Z–61). One industry study estimated that steel conduit accounted for over 72 percent of the electrical conduit market in 1980 (CX 756Z–28).

146. PVC, on the other hand, is used principally in underground applications (CX 756Z–28; RX 3Z–61). [ ] (RX 3Z–62; CX 756Z–28; CX 300Z–7, 8 *in camera*). Moreover, plastic conduit can be encased in concrete without being attacked by chemicals, and has smooth bores which promote easy wire insertion (RX 3Z–61). On the downside, PVC electrical conduit lacks the strength of steel and requires the use of a ground wire (CX 756Z–28). 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 (CX 756Z–28).

b. Wire and cable applications

147. [ ] (Disch 663; see also CX 428Z–100; CX 126C; RX 145L *in camera*). PVC is used primarily as insulation and protective jacketing around copper and aluminum conductors (Disch 674; Becker 1269–70; 1303). [ ] (CX 591I *in camera;* see Commission physical exhibits 9 and 12).

148. Bulk and suspension PVC coatings for wire and cable have been established industry standard since World War II (CX 454). PVC displaced rubber, the traditional material in the wire and cable segment, because PVC was deemed to be flame resistant (Disch 676), to

have good weathering capabilities, excellent insulation properties, and flexibility, thus providing [43] an assurance of longevity and good performance (Disch 674–76; Becker 1270; DiLiddo 3108). As a result, the U.S. Government used the entire output of PVC during World War II for the coating of wire in naval ships (Di Liddo 3107).

149. [ ] (CX 45Z *in camera;* Becker 1269–70). [ ] (CX 126P-Q *in camera;* Becker 1269).

150. Industry forecasts are not unanimous in their performance predictions for PVC (see CX 126C; CX 45). At least one study characterizes the wire and cable industry as a "mature market" for PVC, noting that consumption should parallel—but not exceed—total industry growth (CX 126C).[29] This study further predicts that PVC will lose its share of some market segments to materials with better cost/performance characteristics (CX 126C). The forecast identifies nylon jacketing in building wire and fluoropolymer insulation in commercial plenum areas as potential competing materials (CX 126C). Nevertheless, the study also notes that PVC holds a strong position in the rapidly growing electrical segment which should enable it to recoup its lost share on a total industry basis (CX 126C).

On the other hand, another industry forecast prepared by Arthur D. Little predicts that "in wire and cable applications PVC will continue to be preferred because of its ease of handling and also cost versus other materials" (CX 45H). [ ] (CX 300Z–8 *in camera;* Disch 675–76), but PVC is generally viewed as having superior properties (Disch 676; CX 126C).

151. Industry witnesses testified that consumption of bulk and suspension PVC resin in wire and cable applications is not sensitive to fluctuations in the price of PVC resin (Disch 675; Becker 1305). Mr. Giles Disch, Vice President and General Manager of Tenneco Polymers, Inc., attributed this "insensitivity" to fluctuations in price to PVC's unique performance properties (Disch 675). In addition, many alternative materials lack building code acceptance (CX 45Z), a primary criterion in meeting the governing standard or [44] specification for most applications (CX 126Z–1). The ability to meet the governing specification is of central concern in the wire and cable industry (CX 126Z–1).[30] A B.F. Goodrich internal report states, however, that "price considerations come heavily into play" once a competitive material has satisfied the governing specification (CX 126Z–1). This report goes on to add that "competitive material pricing is considered a minimum standard" in the wire and cable industry (CX 126Z–1).

[29] This study, prepared by B.F. Goodrich personnel, divides the wire and cable industry into six segments: telephone, electrical, power, building wire, automotive, and apparatus (CX 126A-D).

[30] Mr. Disch's testimony alluded to the lengthy testing and review process required to certify alternative materials and suggested that this factor has discouraged shifts away from PVC products in the face of fluctuating resin prices (Disch 675).

Complaint counsel contend that the cost share of PVC resin as a factor in finished wire and cable products is small (CPF 8.77). They assert that the cost of PVC resin alone as a percentage of the cost of wire and cable compound is no more than 30–50 percent depending upon the specification for the particular wire or cable compound (CPF 8.77). Testimony provided at trial does not confirm that the cost share of PVC resin in the finished product is "low," or that this share is precisely "no more than 30 percent to 50 percent" (Becker 1306–07).[31]

c. Packaging film and sheet

152. [ ] (see CX 591J-K *in camera;* CX 581A *in camera;* CX 428Z–100; see also [45] Disch 663; RX 206A *in camera*). [ ] (CX 581A-D *in camera;* CX 45P; CX 591K *in camera*) [ ] (CX 581A-D *in camera;* CX 45P; see also CX 428Z–75, 76; CX 444D). PVC is also used in "blister packs;" vacuum-formed rigid PVC film used to package products such as hardware, toys, and stationery (Becker 1321–25; CX 428Z–76; CX 444D), [ ] (CX 581H-J *in camera;* RX 145Z–30 *in camera*). [ ] (CX 45H; RX 145Z–29 *in camera*), [ ] (Disch 679; Becker 1308; McMath 1936; CX 581B *in camera;* CX 45H; RX 145Z–29 *in camera*). The foregoing characteristics combine to ensure the freshness of the product and to enhance the product's physical appeal (Becker 1308, 1310–11; McMath 1936; Disch 679). [ ] (CX 581B *in camera;* CX 45H; CX 92V; CX 300Z–9 *in camera;* RX 145Z–29 *in camera*). PVC is also preferred to other materials for use in blister packs of non-food items because of its clarity, strength, and tear-resistant characteristics, and because it is relatively easy to vacuum form (Becker 1322–24; McMath 1921).

153. [ ] (CX 300Z–9 *in camera*). [ ] (RX 145Z–29 *in camera*). [[46]][32] (Becker 1310–11; Disch 680; McMath 1936; CX 300Z–29 *in camera;* RX 39F).

There was testimony at trial that the demand for bulk and suspension resin in the consumer wrap segment is relatively insensitive to fluctuations in PVC resin price (Becker 1309; Disch 680). PVC's unique characteristics, which are described in the foregoing paragraphs, have made it the preferred material in the consumer wrap

[31] When asked by complaint counsel if the cost share of PVC resin in wire products would be 30 percent or 50 percent, the witness, Mr. Becker, a former Sales and Marketing Manager of Diamond Shamrock responded:

THE WITNESS; Thirty to fifty percent, somewhere in those kind of ranges.

I can't for the life of me imagine what value the answer to that question is because without looking at something specific and comparing prices of all the materials at some point in time, it is difficult to make any kind of definitive statement.

It is not certainly at the 100 percent level, we can say that. For some applications it may be only a third. For other applications it could be more than that (Becker 1306–07).

[32] [ ] (RX 145Z–30 *in camera*). The last category, medical packaging, is discussed at a later point in these findings (see Findings 189, *infra*). [ ] (RX 145Z–30 *in camera*). [ ] (RX 145Z–29, 30 *in camera*). [ ] (RX 145Z–30, 31 *in camera*). [ ] (RX 145Z–30 *in camera*). [ ] (RX 145Z–29 *in camera*). [ ] (RX 145Z–29 *in camera*).

applications (Disch 680; Becker 1309). Significantly too, PVC is well entrenched in the consumer wrap market because packaging fabrication equipment has been developed based on PVC (CX 444D).

d. Siding

154. The vinyl siding and accessories market utilize approximately 300 million pounds of bulk and suspension PVC resin annually, accounting for about 5 percent of PVC consumption (Belt 2065; see also Disch 664). Vinyl siding consists of extruded panels of compounded PVC resin used as exterior sheeting that is installed over the existing walls of a building (Belt 1986–87). Vinyl siding accessories, which are typically sold in conjunction with vinyl siding, include extruded products used to install the vinyl siding such as trim, corner posts, soffits and fascia board (Belt 2000–01; see Commission physical exhibit 14). [**[47]**][33] which consumes between [ ] and [ ] of all vinyl siding produced (Belt 2002; CX 590B *in camera*). The remaining 5 percent to 10 percent of vinyl siding is sold into the new construction market, which includes both site-built and manufactured homes (Belt 2002).

155. Vinyl siding possesses several key properties which have contributed to its increasing popularity. It is lightweight and pliable, making it easy to install. At the same time, vinyl siding does not have to be painted, is relatively maintenance-free, and is long lasting (Belt 2010–11). Vinyl siding also offers high impact resistance. [ ] (Belt 2010–11, 1987–88; CX 300Z–8 *in camera;* CX 45H).

156. The principal alternative siding products used in the remodeling market are wood, aluminum, and steel. An industry study prepared by CertainTeed Corporation allocated market shares in the residing segment in 1981 as follows: vinyl, [ ]; wood, [ ]; aluminum, [ ]; steel, [ ]; and other materials, [ ] (CX 590F *in camera*). [ ] (CX 590I *in camera*).[34]

157. According to the record, the characteristics of vinyl siding compare favorably to aluminum. [ ] (CX 300Z–8 *in camera*). [ ] (CX 300Z–8 *in camera*). [ ] (CX 300Z–8 *in camera*). Nevertheless, aluminum compares favorably with vinyl siding in at least two important respects. **[48]** [ ] (CX 300Z–8 *in camera;* CX 590H *in camera*). [ ] (CX 300Z–8 *in camera*).

158. Similarly, vinyl siding compares favorably with wood siding in a number of respects, [ ] (CX 300Z–8 *in camera*). Unlike wood siding, [ ] (Becker 1299; CX 300Z–8 *in camera*). On the other

[33] Traditional materials such as aluminum, wood, and masonry account for the bulk of the *new* construction market. An industry study prepared by the Pipe and Plastics Group of CertainTeed Corporation [ ] (CX 590F *in camera*).

[34] In contrast, the new construction market [ ] (CX 590C *in camera*). [ ] (CX 590D *in camera*).

hand, wood siding offers several important advantages that influence its selection over vinyl siding. [ ] (CX 300Z–8 *in camera*).

159. Finally, vinyl has generally replaced steel in the remodeling segment because vinyl is lighter and easier to install (Belt 2011–12). [ ] (Belt 2011–12; CX 590D *in camera*).

160. At the same time, [ ] (Belt 2011; CX 300Z–8 *in camera*). Indeed, vinyl siding enjoys a substantial price advantage over both aluminum and steel siding. Mr. John Belt, Jr., President of the Vinyl Building Products Division of CertainTeed Corporation, one of the largest vinyl siding producers in the United States, testified that at the distributor level,[35] vinyl siding is less expensive than aluminum siding by a [ ] (Belt 2017–18 *in camera;* see also CX 588A-B).

161. [ ] (CX 590I *in camera*). [ ] (CX 590I *in camera*). One industry report estimated that "aluminum siding costs are currently [ ] above vinyl" and "energy costs **[49]** about [ ] that required for vinyl" (CX 590K *in camera*). [ ] (Becker 1299–3000; Belt 2014, 2020; CX 590G, K *in camera;* see also RX 70C *in camera;* RX 90G *in camera*).[36]

162. In addition, Mr. Belt of CertainTeed testified that the prices of alternative siding materials were not presently considered in setting the price of vinyl siding. In response to a question on this point, [ ] (Belt 2024–25, 1984 *in camera*). [ ] (Belt 2024–25, 1984 *in camera*). [ ] (Belt 2025 *in* **[50]** *camera*).

163. Moreover, the evidence suggests that the cost of 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 blended with a variety of additives and ingredients, such as titanium dioxide, impact modifiers, heat stabilizers, lubricants, and waxes, to form a compound (Belt 1995; Becker 1300–01). [ ] (Belt 1995–96; RX 90Z–80 *in camera*). At this juncture, the cost of PVC resin on the average accounts for approximately [ ] of the selling price of a square of vinyl siding to the distributor (see Belt 2026–27 *in camera;* CX 756Z–59). Mr. Belt testified that the current average selling price of a white vinyl siding square[37] to the distributor

[35] Siding products in the remodeling market move through two distribution channels. [ ] (Belt 2007–08; CX 590C *in camera*). The distribution chain also consists of sales from the manufacturer to chain home centers or lumber yards and then to professional home remodelers or do-it-yourselfers (Belt 2007–08).

[36] Documentary evidence cited by respondents indicates that vinyl siding producers are engaged in research and development activities designed to enhance the competitive edge vinyl already holds over aluminum. [ ] (Belt 2012–13; CX 582J *in camera;* RX 84J *in camera;* RX 94A; RX 109H *in camera;* RX 158Z–19 *in camera;* RX 169I *in camera;* RX 91A *in camera*). In addition, [ ] (see RX 109H *in camera;* RX 158Z–19 *in camera;* RX 185X-Y). As a whole, respondents' evidence suggests [ ] (RX 68D *in camera*). For example, respondents cite an internal memorandum which evaluates the competitive position of plastics as follows: [ ] (RX 91D *in camera*).

[37] Vinyl siding is sold in units called "squares," referring to the fact that one unit equals 100 square feet (Belt 1995, 2004).

level ranges from [to] (Belt 2017–28 *in camera,* 1998; CX 756Z–59). Mr. Belt further testified that if the vinyl siding is installed by a home improvement contractor, the final installed price will include additional labor costs running from [to] (Belt 2040–41 *in camera*). Finally, market research studies conducted by CertainTeed indicate that the average installed price for vinyl siding is about [ ] with such variable factors as the contractor's margin and other costs beyond materials (Belt 2041 *in camera*).

164. The evidence also indicates that an increase in the price of bulk and suspension PVC resin of [ ] across the industry would not affect the demand for vinyl siding (Belt 2039 *in camera*). Mr. Belt testified as follows regarding the impact of a permanent PVC resin price increase of [ ]:

> [I]f it happened through the industry, you know, we went through a period where I think the high and the low on resin was something like [ ] and [ ] and I didn't see anything except siding prices coming down slowly through this entire period.
>
> So there are other factors that I think are much more important than the cost of resin.
>
> Q. And given what you have just said, do you have an opinion as to what would happen to the volume of overall industry-wide volume of vinyl siding sales should a [ ] PVC resin price increase be instituted? [51]
>
> A. Well, my projections, my business projections have increased and we are still projecting the [ ] increase on siding that frankly would have been projected had we seen the reverse true in terms of the trend on PVC resin.
>
> We are in an industry that operates probably at [ ] of capacity and we are in a high growth area and we have many people adding more lines, more sophisticated lines, higher output lines and adding still more capacity. [ ] (Belt 2039–40 *in camera*).

e. Floor tile

165. Approximately [ ] of suspension PVC resin is consumed annually in the production of vinyl floor tiles (see RX 145Z–51 *in camera;* RX 90Z–73 *in camera;* CX 591I *in camera;* CX 45P; see also Disch 672). [ ] (CX 300Z–9 *in camera;* CX 450; see Commission physical exhibit 8).

166. Most floor tile is made of vinyl, although a small amount of asphalt tile is still produced (Disch 673; CX 450). [ ] (Disch 673; CX 300Z–9 *in camera*). [ ] (RX 51C *in camera*).

167. Nevertheless, price is not the central factor influencing the demand for a particular material as a floor covering. [ ] (CX 450P; CX 756Z–76; RX 51C *in camera*). [ ] (CX 450P; CX 756Z–76; RX 51C *in camera*). [ ] (Disch 673; RX 145Z–49 *in camera;* CX 300Z–9 *in camera*). A 1982 study noted that resilient flooring, the segment in which vinyl flooring is contained, "fared worse than the total floor covering market" during the years 1975–1980 (CX 756Z–

73). The study attributed resilient flooring's poor performance to an increase in the use of carpeting during the years studied, as well as several other factors (CX 756Z–73). The study further noted that while competition from carpeting had affected the growth of [52] resilient flooring, vinyl still held an advantage over carpeting for use in kitchens, bathrooms, and other hard-use areas in the home (CX 756Z–76).

168. The record indicates that the price of PVC resin is but a small component of the cost of a finished vinyl floor tile. Mr. Disch of Tenneco Polymers testified that PVC resin accounts for approximately 15–20 percent of the physical composition of a vinyl floor tile, with the remainder consisting of fillers, calcium carbonate, and other ingredients (Disch 672). The value of the tile product is also enhanced through various decorative processes such as coloring, embossing, and engraving, increasing the value of the tile relative to the cost of the resin (Disch 672–73). Thus, as Mr. Disch explained: "[t]he 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 673).

f. Bottles

169. According to complaint counsel, approximately 100 million pounds of PVC resin were used in the manufacture of bottles in 1981 (CX 158A). Complaint counsel contends that this figure represents roughly [ ] of domestic PVC consumption (see Disch 664; RX 145L *in camera*). About [ ] of the PVC bottle applications involve general purpose non-food uses for products such as shampoo, dishwashing soap, charcoal lighter fluid, powdered laundry detergent and window cleaner (CX 158A-B; CX 92X; RX 145Z–35 *in camera*). The remaining 25 percent of the PVC bottle segment involves food-contact applications and includes containers for products such as cooking oil, vinegar, and mouthwash (CX 158A-B).

170. Demand for PVC fabricated bottles in general purpose, non-food applications is influenced by PVC's distinctive product characteristics. These properties include: transparency, impact resistance, light weight, chemical and oil resistance, low oxygen and carbon dioxide permeability, low moisture absorption, high melt strength, and ease of adaptation to conventional bottle manufacturing equipment (Becker 1317; CX 92X).

171. Similarly, utilization of PVC products in the food contact segment is also a function of PVC's particular performance properties. [ ] (Becker 1318; CX 157U *in camera*). [ ] (Becker 1318; CX 157U *in camera*).

However, regulatory prohibitions against PVC's use in food contact

applications are the most significant factors affecting demand for this PVC product (see CX 158A; CX 581K-L). The Bureau of Alcohol, Tobacco, and Firearms ("BATF") banned PVC [53] as a liquor packaging material in 1975 due to concerns about vinyl chloride migration (CX 158A).[38] For the same reason, the Food and Drug Administration ("FDA") has proposed a ban on PVC in all food contact applications (CX 158A). [ ] (see H. Wheeler 1732–33; CX 158A; CX 581K-L *in camera;* CX 157J *in camera*), [ ] (RX 145Z–35 *in camera;* CX 581K *in camera*). In addition, negative public opinion generated in response to regulatory activity concerning the use of PVC in food-contact bottles is considered likely to continue to affect demand for some time (CX 45Q-R).

172. The principal alternative materials used in bottle applications are glass, high density polyethylene ("HDPE") and polyethylene terephalate ("PET").

173. HDPE accounted for over [ ] of all plastic material used in the manufacture of bottles in [ ] (CX 157F *in camera*). HDPE is used predominantly in one gallon milk containers which comprise the single largest use for plastic bottles of any kind, with over [ ] sold in [ ] (CX 157F *in camera*). [ ] (CX 157U *in camera*). Nevertheless, HDPE has two key drawbacks. [ ] (CX 157U *in camera*). [54] [ ] (CX 157U *in camera*). [ ] (CX 157U *in camera*).

174. [ ] (CX 157F *in camera*). [ ] (CX 157U *in camera*), and notes that [ ] (CX 157F *in camera*). Indeed, the Goodrich study also notes that PET's largest market, [ ] (CX 157F *in camera*). Significantly, PET has a number of advantages that compare favorably with PVC. First, [ ] (CX 157B *in camera;* CX 158C *in camera*). In addition, [ ] (CX 157U *in camera*). [ ] (CX 157B *in camera*). Finally, [ ] (CX 157B *in camera;* CX 157U *in camera*). On the other hand, [ ] (CX 158C; CX 157U *in camera*). [ ] (CX 158C *in camera;* CX 157V *in camera*).

175. Documentary evidence also indicates that despite vigorous dis-

[38] B.F. Goodrich withdrew from the production of bulk and suspension resin for bottle applications in the wake of the BATF ban on PVC use in liquor packaging in 1975 (CX 158A). Thus, by 1982, a B.F. Goodrich internal memorandum declared that "For all practical purposes, BFG is a non-entity in the domestic PVC bottle industry" (CX 158F). The memorandum also noted that in 1982, Goodrich had only one current customer for resin for bottle applications (CX 158F). Nevertheless, the memorandum projected an improved climate for PVC in the food-contact bottle segment and advocated a return to production of bottle grade resin (CX 158I-J). Significantly, the memorandum noted that Goodrich was at a disadvantage in three key areas: technology, marketing, and manufacture, and it therefore concluded that Goodrich would need to make a major commitment in terms of personnel, time, and money in order to become competitive (CX 158G, I-J). At the same time, the memorandum identified Ethyl and Hooker as the leading producers of bottle grade resin in 1982 (CX 158D). As a result, it is difficult to determine, in the absence of further evidence, what role Goodrich currently plays in the production of bottle grade resin and whether the acquisition of Diamond Shamrock has enhanced its competitive position.

counting by glass bottle producers, plastic bottles continue to erode market share (RX 288N-O). As one market research study notes:

> Glass manufacturers acted too late and too slowly to prevent plastic bottles from becoming entrenched in a number of markets. The subsequent slow discounting actually helped plastics manufacturers in the long run by forcing them to make newer, more efficient equipment, cut bottle weight tremendously and improve resin production technologies. The bottom line was that plastics had to keep on their toes to stay competitive and this is helping them increase market share today (RX 2880).

176. This study goes on to add that plastic products have displaced glass for use in both the kitchen and the bathroom because of plastic's shatter-proof properties (RX 2880). The study further notes that supermarkets and distributors feel that [**55**] plastic bottles are easier to handle and that the whole process will cost them less than facilities for handling glass returns (RX 288N-O).

177. Mr. Becker, formerly Sales and Marketing Manager of the Plastics Division of Diamond Shamrock, testified that the demand for PVC resin in bottle applications is generally insensitive to fluctuations in the price of PVC resin (Becker 1319). Mr. Becker noted that PVC had "found very specific market niches in the bottle trade" and that "within reason" there wasn't a great deal of sensitivity to normal shifts in resin prices (Becker 1319). However, Mr. Becker further testified that if resin prices move from an "insensitive range" of between $0.15 to $0.35 to a range between $0.75 to $1.00, customers would switch to alternative products (Becker 1319–20).

178. In addition, Mr. Becker indicated that the cost share of PVC resin in the price of the bottle compound might be "somewhere between 30 percent and 50 percent" (Becker 1319). He testified that PVC bottle manufacturers often requested additional quantities of key ingredients such as impact modifiers, thereby reducing the cost share of PVC resin in the final product (see Becker 1319).

g. Windows

179. Approximately [ ] was consumed in the manufacture of vinyl windows for the replacement market in [ ] (RX 145Z–23 *in camera*).

180. Vinyl replacement windows first entered the market in the late 1970's. Since that time, their use has increased rapidly, attaining [ ] of the remodeling market in [ ] (see Belt 1977, 2052; CX 92Y; RX 90G *in camera;* RX 145Z–23 *in camera*). A 1982 PVC Growth Study prepared by Goodrich estimated that the vinyl window segment of the replacement market would grow at an annual rate of about

[ ] of the replacement market from [through] (RX 145Z–23 *in camera*). The Study further predicted that this growth would amount to [ ] from [ ] through [ ] (RX 145Z–23 *in camera*).

181. Mr. Belt of CertainTeed Corporation attributed the rapid growth in demand for vinyl replacement windows to the superior insulation properties provided by vinyl windows (Belt 2047–48). Mr. Belt noted that windows can be the greatest source of heat loss in a home, next to the attic (Belt 2047), and in his view, heightened energy-consciousness has created a strong demand for vinyl replacement windows to improve thermal efficiency (Belt 2047, 2051–52).

182. [ ] (CX 300Z–8 *in camera*). Aluminum is **[56]** the dominant material in the remodeling segment (CX 756Z–107), followed by wood and vinyl in second and third position (CX 756Z–107). [ ] (CX 300Z–8 *in camera*). [ ] (Belt 2062 *in camera;* CX 300Z–8 *in camera;* RX 145Z–23 *in camera*).

183. [ ] (see RX 90G, Z–60 *in camera*), [ ] (Belt 2062 *in camera;* CX 756Z–118). [ ] (Belt 2062 *in camera;* CX 756Z–118). Nevertheless, [ ] (Belt 2062 *in camera*).

184. [ ] (see Belt 2057–61 *in camera;* CX 756Z–118; RX 90Z–80 *in camera*). For example, PVC resin represents about [ ][39] to the fabricator of a vinyl window system (Belt 2058 *in camera*). The lineals are then assembled by the fabricator, with the glass and accompanying hardware, into a finished window. [ ] (Belt 2059–60 *in camera*). Thus, according to complaint counsel, if PVC resin were selling at [ ] the value of the PVC resin content in a finished window would be less than [ ]. Mr. Belt estimated that the price for a vinyl window sold by a fabricator to the home improvement contractor and then to the homeowner could range from [ ] to [ ] (Belt 2059–61 *in camera;* CX 756Z–118). Mr. Belt further testified that, in his view, an increase in resin prices across the board of 5 percent or even 10 percent would have "no impact" on the demand for vinyl replacement windows (Belt 2062–63).

h. Records

185. According to complaint counsel, phonograph records account for roughly 2–3 percent of bulk and suspension PVC resin consumption (CPF 8.115). Phonograph records are produced by the **[57]** compression molding of PVC suspension resin (Disch 678, see Commission physical exhibit 13).

186. [ ] (Disch 678; CX 300Z–10 *in camera*). [ ] (Disch 678; CX 300Z–10 *in camera*).

[39] Vinyl lineals constitute the four to five sash and frame members that are used in making a finished vinyl replacement window (Belt 2046–51).

187. A limited amount of polystyrene has been used in the production of low priced children's records (Disch 678; CX 45Z–4). However, compared to PVC, polystyrene is brittle and breaks easily (Disch 678). Thus, it has never been considered a significant factor in the phonograph record market (Disch 678–79; CX 45Z–4).

188. Finally, Mr. Disch of Tenneco Polymers testified that as many as three records can be produced from one pound of PVC resin, making the cost share of the resin a small portion of the cost of the finished processed phonograph record (Disch 678). Mr. Disch further testified that, in his view, changes in the price of PVC resin would have no affect on the demand for PVC fabricated phonograph records (Disch 679).

i. Medical applications

189. Medical applications consumed approximately [ ] pounds of bulk and suspension resin in [ ] (RX 145Z–32 *in camera*), and are projected to attain a volume of over [ ] pounds by [ ] (RX 206A *in camera*). [ ] (RX 145Z–30, 31 *in camera;* Disch 767–77; Becker 1309–12; see Commission physical exhibits 10 and 11). A study conducted by Goodrich in 1982 noted that PVC "has virtually eliminated glass and other materials from these applications (blood and IV bags), and that [ ] (RX 145Z–30 *in camera*). In the same vein, the study noted that PVC's flexibility and clarity in thick cross sections make it [ ] (RX 145Z–31 *in camera*). Moreover, PVC has secured FDA approval for use in medical applications (Disch 676). Thus, Mr. Disch testified that the demand for PVC products in medical applications is insensitive to fluctuations in the price of PVC resin because of the particular need for the properties supplied by PVC products (Disch 677). [58]

j. Calendered products

190. A variety of rigid and flexible calendered products[40] account for the remaining PVC resin consumption (see CX 45W-Y, Z–2–4; CX 428Z–100; RX 1325Z–65–86; Disch 663). Rigid calendered PVC sheet is used to manufacture decorative laminates and credit card stock (H. Wheeler 1728, 1753; RX 1325Z–85, 86). Applications for flexible calendered PVC sheet include: wall coverings (both commercial and residential); upholstery; automotive interiors and landau tops; apparel such as footwear, raincoats, and shower caps; household items such as shower curtains and tablecloths; and various consumer goods such as wallets and luggage (H. Wheeler 1727–28; Becker 1313–14; DiLiddo

[40] A calendered product is manufactured by a process known as "calendering," in which large heated rolls are used to produce wide sheets of PVC materials, which are later turned into a finished product (Becker 1312–13; DiLiddo 3376–77).

3375–79; CX 45W-Y, Z–22; see Commission physical exhibits 16 and 17). PVC resin is used in the manufacture of these diverse end-use segments because, with the addition of compound additives and ingredients, it can be made flexible or rigid, strong, tear resistant, and it is easy to fabricate and color (Becker 1313–14; DiLiddo 3376–77; see also Disch 665). Moreover, Mr. Howard Wheeler of GenCorp testified that the demand for calendered products is influenced primarily by the general state of the economy, and tends to be more responsive to movement in the GNP than to fluctuations in the price of PVC resin (H. Wheeler 1754).

191. Alternative materials are available to the consumer in each of the applications in which PVC calendered products are used. Complaint counsel suggests that the central factor affecting demand for PVC calendered products is the individual taste and preference of the purchaser (CPF 8.123). Thus, complaint counsel argues that although wallpaper is less expensive than vinyl wall coverings, vinyl wall coverings may be preferred by purchasers because of vinyl's washability and durability (CPF 8.123). Documentary evidence indicates that the primary factors affecting the use of vinyl coated fabrics in furniture applications are the general health of the furniture industry and fashion trends or fads (CX 45W). In furniture applications, vinyl fabrics are used in low priced residential furniture and office, institutional and industrial markets (CX 45W). Although vinyl coated fabrics still dominate "business" applications, one study noted (CX 45W):

> The only area where vinyl coated fabrics face major competition is in consumer use. In this area new synthetic fibers have taken a good share of the market. The major competitive materials are polypropylene, polyester and nylon. A survey shows **[59]** that of all upholstered furniture purchased in 1975, 41% were upholstered with Herculon polypropylene, 20% with nylon and 17% with vinyl coated fabric. We do not expect PVC to be replaced in such applications as dinette sets, outdoor furniture, etc. The all plastic polypropylene or other molded furniture does not compete directly with vinyl coated fabrics. We do not believe that even though there have been advances in ultraviolet stability of the polyolefin that they can compete in outdoor furniture with the vinyls.

192. The use of vinyl coated fabrics in automotive applications is generally perceived to be a function of customer preference rather than price. Mr. Becker, former Sales and Marketing Manager for Diamond Shamrock, testified that customers prefer fabric upholstery in automobiles to vinyl coated fabrics because vinyl retains heat in the summer and cold in the winter (Becker 1267–68). In the same vein, Mr. Becker observed that "PVC in a car top is obviously nothing more than an aesthetic basis, nothing else could be used that would be very close to PVC in cost" (Becker 1314).

193. Moreover, complaint counsel contends that the cost share of

PVC resin as a percentage of the price of a finished calendered good is "generally insignificant as a result of the addition of compounding ingredients to give PVC the properties required in the specific end use, and the fabrication and finishing processes that occur after the resin is compounded" (CPF 8.124). Accordingly, Dr. DiLiddo testified that a typical shower curtain could have as much as 25 parts of plasticizer in it per 100 parts of PVC resin (DiLiddo 3377–78). Thus, in a shower curtain weighing approximately two pounds, approximately one-half pound would be plasticizer and one and one-half pounds would be PVC resin by composition (DiLiddo 3377–78). In theory, therefore, if PVC resin were selling at a price of $0.30 per pound, the shower curtain could contain $0.45 worth of PVC resin (CPF 8.124). Complaint counsel contends that the disparity between the possible retail price for a finished vinyl shower curtain and the cost of its PVC resin content is illustrated by Commission physical exhibit 16, a vinyl shower curtain which retails for $7.99 (DiLiddo 3378). Similarly, if resin is selling at $0.30 per pound, a vinyl shower cap weighing four ounces might contain three ounces of PVC resin resulting in less than $0.08 worth of PVC resin in a vinyl shower cap retailing at $1.79 (DiLiddo 3379; see Commission physical exhibit 17).

D. Similarity of PVC raw material and production costs

194. There are two broad categories of costs associated with the production of bulk and suspension PVC: (1) the cost of the VCM feedstock; and (2) the cost of converting this into the PVC product. These are considered in reverse order: **[60]**

1. Production costs

195. The record shows that the technology needed for the manufacture of PVC is widely available to all producers; there being no patents of significance to impede this activity (Eades 1499–1500; H. Wheeler 1773; Kaserman 2406, 2409; DiLiddo 3288–89; Klass 4425–26).

196. The amount of VCM consumed in the production, for example, of a pound of PVC is the same or similar for all producers. Mr. Disch of Tenneco placed this as "slightly more than a pound" of VCM for a "modern plant," there being a small loss of VCM in the manufacturing process (Disch 643).

197. There was testimony that current manufacturing technology is approaching its limits in the use of VCM without waste. Raw materials efficiency was believed by Goodrich witness DiLiddo to be nearly 100 percent (DiLiddo 3395).

198. The reason for such production efficiency was attributed to the increasing use of the larger reactors (Disch 643; DiLiddo 3395). In the

United States, this equipment arrived on the scene in the early 1970's, and presently accounts, in the estimation of Mr. Disch, for "about two-thirds of the installed capacity" (Disch 641).[41]

199. There was also testimony from industry witnesses that manufacturing costs to producers for converting VCM into PVC using large reactors was similar (Disch 645; Schaefer 1149).

200. [ ] (see CX 246A-Z–44 *in camera;* RX 35Z–10, 67–70 *in camera;* RX 172L *in camera;* RX 184B-E *in camera;* RX 245A-Y *in camera;* RX 667S *in camera;* RX 715A; RX 1168A-B *in camera;* DiLiddo 3224–26). These estimates do indicate variances in manufacturing costs among PVC producers.

201. In the view of complaint counsel, however, such evidence fails to explain how producers can have access to [61] similar technology and similar raw materials and still not have similar production costs.[42]

2. Raw material costs

202. [ ] (H. Wheeler 1746; RX 22A; RX 29B *in camera; cf.* RX 1204A *in camera*). As to vertically integrated producers, Goodrich's Dr. DiLiddo testified that "different levels of integration, either forward or backward could impact their cost position or cost functions" (DiLiddo 3217). And respondents point to studies by industry participants reflecting the existence of raw material cost differences.[43]

203. Complaint counsel's response to this evidence is that it is an error to rely upon it to establish the cost of VCM to integrated PVC producers. Thus, it is urged, the appropriate value to assign to an integrated firm's transference of VCM is the firm's "opportunity costs," *viz.*, "the value of the product in the next best alternative use" (complaint counsel's brief at 35). Under this reasoning, the appropriate value of VCM for an integrated firm is the amount the firm could sell it for if it [62] did not use it internally. Accordingly, since all firms "pay" market prices, all pay similar amounts for their VCM (complaint counsel's brief at 36).

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[41] Complaint counsel calculates that the total industry nameplate capacity accounted for by large reactors is 84 percent (CPF 9.08).

[42] [ ] RX 172L *in camera* and RX 35Z–67, 68 *in camera* in attributing lower costs to plants to the extent that they have been depreciated (complaint counsel's reply brief, p. 62).

Complaint counsel also claims that respondents have failed to show that any PVC plants have a "locational" advantage over others, *viz.*, lower shipment costs, based upon the relative distances that incoming VCM and outgoing PVC resins might have to be transported. In their view, locational differences tend to "cancel out," in that, *e.g.*, a producer on the Gulf Coast, incurring less transportation costs for incoming VCM than competing plants in the Northeast or Midwest, would nevertheless have to pay more in shipping outgoing PVC resin than his counterparts to service customers in those areas (*id.* at 64).

In addition, complaint counsel belittles respondents' contentions based upon the cheaper production of "commodity" resins in large reactors, as opposed to the higher cost of producing "specialty" resins in smaller reactors. It is sufficient, in their view, that costs for producing each of these grades remain similar (*id.* at 63–64).

[43] See L. Wheeler 1030–31 and RX 877D, *in camera.*

E. The availability of price information in the PVC market

204. As noted in the *Guidelines*, "[c]ollusive agreements are more likely to persist if participating firms can quickly detect and retaliate against deviations from the agreed prices or other conditions. Such deviations are easiest to detect, and therefore less likely to occur, in markets where detailed information about specific transactions or individual price or output levels is readily available to competitors" (*Guidelines* at 3.42).

205. Respondents maintain that reliable price information concerning sales of PVC resins is not readily available to competing producers, thus lessening the susceptibility of this market to price collusion.

206. In this connection, there is certain evidence lending support to respondents' position, as follows:

207. The record shows instances where PVC producers would not be fully cognizant of the selling prices of their own resin until after the product had been shipped, delivered and possibly even consumed. [ ] (Disch 710–12; McMath 1959 *in camera;* RX 902A *in camera;* RX 906A *in camera;* RX 1042A *in camera*). [ ] (McMath 1959 *in camera;* Disch 712).

208. It is respondents' position that despite suppliers' efforts to gather competitor price information, there nevertheless remained "a great deal of uncertainty" in this regard (DiLiddo 3257). This uncertainty is said to exist for a number of reasons:

First, the actual selling price at any given time for any given PVC resin can be difficult to determine precisely. [ ] (RX 886A *in camera;* RX 910A *in camera*), [ ] (Disch 710, 726; McMath 1951–52; DiLiddo 3251–52; see Becker 1338; RX 898A *in camera;* RX 921A *in camera;* see also CX 83A *in camera;* CX 140A-D; CX 152D *in camera;* RX 268D-E *in camera;* RX 510A).

[ ] (see RX 455A *in camera;* RX 964A; RX 965A). [**[63]**] (DiLiddo 3251–52; see RX 271P; RX 363A *in camera*). Mr. Becker, formerly of Diamond, testified that there were almost always special deals, discounts, rebates or special price concessions offered by competitors to Diamond's customers (Becker 1338). [ ] (McMath 1950; see RX 563D; RX 897A *in camera;* RX 904A *in camera;* RX 1042A *in camera*).

209. [ ] (H. Wheeler 1767; McMath 1967; RX 140Z–39 *in camera*). The volatility of prices for PVC resins, and the variety of discounts and rebates operate to make it difficult for competitors to be fully informed as to the prices offered by different suppliers at any given time (Schaefer 1197; Weber 1838).

210. A number of PVC resin producers testified that their custom-

ers attempted to mislead them concerning prices available from competing producers:

a. Mr. Schaefer testified that customers are not always truthful about current PVC prices, and that some customers will lead PVC suppliers astray (Schaefer 1136–37);

b. Similarly, Mr. Becker testified that "[s]ome buyers are particularly astute at purposely leading a salesman astray" and, some buyers "just flat [tell] a less than truth" (Becker 1337–38);

c. Mr. H. Wheeler observed that GenCorp sales personnel were misled either intentionally or unintentionally by resin customers, and that sales personnel received imperfect information about price movements (H. Wheeler 1768);

d. And, Mr. DiLiddo of Goodrich testified that he thought that a number of PVC buyers, while not actually lying, did not tell the complete story in competitive pricing situations, thereby misleading Goodrich sales personnel concerning the current level of pricing (DiLiddo 3257).

Notwithstanding the above, the evidence relied upon by complaint counsel shows that, as a practical matter, competitive price information is reasonably available to resin suppliers. **[64]**

211. [ ] (Disch 683–85; Weber 1790; DiLiddo 3253; RX 53B *in camera*).[44] While prices are negotiated at the outset, the typical contract permits price adjustments initiated by either seller or buyer (Weber 1789–90), [ ] (Disch 683–84; Weber 1789–90; see CX 73H *in camera;* CX 76C *in camera;* CX 78B *in camera;* CX 84E *in camera;* CX 89C *in camera;* CX 152B *in camera*).

[ ] (Disch 685–86; DiLiddo 3254; Weber 1797; RX 53B *in camera*). As in the case of contract accounts, these customers likewise reported competitive offers to their regular suppliers (Weber 1798–99; Schaefer 1136–37).

212. Bulk and suspension PVC suppliers obtain a considerable amount of price and other competitive information through their customers. [ ] (Disch 728; H. Wheeler 1747–48; CX 188; CX 95 *in camera;* CX 139F; CX 141C-D; CX 142; CX 143; CX 148; CX 228; CX 234; CX 239; CX 466; CX 534; CX 571).

213. [ ] (CX 99 *in camera;* CX 127; CX 128B-E; CX 149; CX 231; CX 463; CX 464; CX 470; CX 578 *in camera*).

214. Bulk and suspension PVC suppliers also learn of competitor price changes by virtue of the fact that many suppliers announce price changes publicly in the trade press (Weber 1799–1800; Becker 1248; CX 98; CX 131; CX 139E; CX 409; CX 410; CX 411; CX 413; CX 436; CX 532; CX 563; CX 711; CX 714; CX 715; CX 718; CX 719A).

215. Apart from the above, there was evidence that suppliers regularly devote serious efforts to obtain competitive price information (Weber 1799–1800; Becker 1246–48; CX 138C; CX 141A-C; CX 143; CX 148; CX 228; CX 234; CX 239; CX 241; CX 242; CX 243). Although the

[44] The duration of such contracts appears normally to be one year (Disch 685).

information obtained from customers is not always accurate, the bulk of this intelligence is considered to [65] be reliable and current (Becker 1338; Wheeler 1749–50, 1768; Weber 1799). Sales and marketing personnel are specifically trained to probe and verify the accuracy of the information available (Schaefer 1136–37; Weber 1797–98; Becker 1246–47). [ ] (Becker 1248–49; H. Wheeler 1747–48; DiLiddo 3127; see McMath 1897 and 1902, 1905 *in camera*). All in all, industry witnesses believed that they generally had a good working knowledge of competitors' prices and price changes, and that they were aware of price trends in the industry (H. Wheeler 1749–50, 1768; Schaefer 1199; Becker 1338).[45]

F. Number and size of PVC purchasers

216. Mr. Disch of Tenneco estimated the number of PVC purchasers in the United States to be "probably over 2,000, but many of them buy very small volumes" (Disch 681). Dr. Eades of ICI Americas estimated total PVC buyers as "[h]undreds if not thousands" (Eades 1505). A 1979 Goodrich study summarized the market in this fashion (CX 53J-K):

> 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.

Another study, done for Goodrich in 1979, speaks of a "broad customer base," and refers to a total of 1,426 PVC industry customers that purchase over 40,000 lbs. annually (CX 64P, S). [66]

Whatever the exact figures may be, the record demonstrates that the number of PVC resin purchasers is large in relation to the current number of 11 suppliers (see Finding 58, *supra*).

Furthermore, substantial numbers of this overall body of PVC purchasers appear to be present in the various segments of the resin market. [ ] (read CX 64S with CX 58K *in camera*). At the time of the hearing, Mr. Disch of Tenneco estimated the number of pipe purchasers as "probably over 100," in a segment accounting for about 40 percent (Disch 663, 683; see Yu 2091 (estimating 75 to 85).

[45] [ ] (CX 252 *in camera;* RX 35 *in camera*), and capacity data (CX 30; CX 31; CX 32; RX 296; RX 297; RX 299; RX 303; RX 304; RX 311; RX 314).

In addition, PVC producers regularly submit monthly data on production and sales to the Society of the Plastics Industry (Goodrich Adm. 519; CX 4Z–41, 42), which compiles the information and makes it available in aggregate form as monthly and yearly figures (Goodrich Adm. 518; CX 4Z–41; CX 757; CX 758; CX 759; CX 760; CX 761; CX 762; CX 763; CX 764; CX 765; CX 766; CX 767; CX 768; CX 769).

217. The record shows that the top four purchasers in the overall PVC resin market are pipe manufacturers, *viz.*, Carlon (a Division of Indian Head Corporation), CertainTeed Corporation, Formosa Plastics Corporation U.S.A. (J-M Manufacturing Co.), and Simpson Timber Co. (Disch 682; Yu 2089, 2092; see also CX 53J). It was estimated that these four companies consume 60 percent of the total amount of PVC resin used annually in pipe production (Disch 683; see also CX 756Z–40, 41).

218. It is complaint counsel's position that regardless of the large quantities of PVC purchased by these pipe customers, none of them accounts for more than a minor fraction of overall industry sales (CPF 11.06–.09 (5 percent and less)). Respondents' counter is that they are "power buyers," whose purchases would represent such a significant portion of an individual suppliers' production that their pricing demands could not be ignored (RPF 336–38; respondents reply brief 28–29). Complaint counsel, however, points to evidence that PVC purchasers sometimes split their business among two or more sellers;[46] and that, in any event, individual purchase orders are not for annual volumes, but occur on a monthly, sometimes daily basis.[47]

G. Repeat sales by PVC suppliers

219. [ ] (DiLiddo 3253; Weber 1790; Disch 683–85; see, *e.g.*, *in camera* contract [67] exhibits: CX 72, CX 73, CX 76, CX 77, CX 80, CX 85, CX 89, CX 151, CX 152; CX 156).

[ ] (DiLiddo 3253–54; Disch 685–86; RX 53B *in camera*). These ongoing, noncontractual 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 3254).

220. Once a particular PVC supplier's resin has been tested and qualified for use on a customer's fabricating equipment by its technical staff, switching suppliers would involve adjustments either to the resin's formulation or to the fabricating equipment (DiLiddo 3371–72; H. Wheeler 1747–48). Thus, according to Dr. DiLiddo, there would be a certain hesitancy on the part of purchasers to switch suppliers if competing prices were identical (DiLiddo 3272).

221. While PVC purchasers sometimes qualify more than one resin supplier to fill their requirements, those that buy from more than one

[46] See Disch 728; Schaefer 1140; Becker 1336–37; McMath 1897–98; Yu 2171; DiLiddo 3371–72.

[47] Weber 1803–04; Disch 683–85; DiLiddo 3371–72.

supplier tend to have more than one plant. This is to ensure that the resin used in each plant is relatively consistent (DiLiddo 3371).

H. Rapid technological changes in the PVC industry

222. [ ] (see DiLiddo 3106–08; CX 53D; RX 639H *in camera*). [ ] (RX 639H *in camera*).

223. [ ] (see Eades 1464–65; McMath 1893, 1922; RX 639H *in camera*). [ ] (RX 639H, P *in camera*). As demand for bulk and suspension PVC shifted toward large volume, commodity grade end-use applications, PVC producers began to install large reactors of 18,000–35,000 gallon capacity to serve [68] this demand. Accompanying technology, such as computerization to ensure consistency in resin quality and efficiency using large-batch processes, was also developed (see Finding 29, *supra*).

224. While large reactors in use today in the United States range in size from 18,000 gallons to about 40,000 gallons in capacity, reactors of 50,000 gallon capacity are currently in use in Europe (Disch 638–40; Schaefer 1213–14). As noted, small reactors range in size from 2,000 to 5,000 gallons in capacity (Schaefer 1213).

225. Large reactor technology increased the efficiency of PVC production, reduced labor costs, and provided economies of scale above that available from small reactor technology (Disch 643; Schaefer 1140; see CX 515G). The cost disadvantage in using small reactors as compared to large reactors can be quite significant for producing commodity grade resins (see, *e.g.*, H. Wheeler 1734; Eades 1465).

226. [ ] (see H. Wheeler 1722–25; RX 639D, H *in camera;* CX 515G; see also Eades 1479–80). Many of the remaining small reactor plants continue to be used to manufacture specialty resin grades (H. Wheeler 1757–58; Schaefer 1078–79; Becker 1263–64). However, there was testimony that it is unlikely that new small reactor capacity would be built by a producer today (H. Wheeler 1758; Disch 640).

227. The mid-to-late 1970's was also a period for fundamental changes in the government regulatory environment facing the PVC and VCM industries (Findings 66–67, *supra*). These changes had a profound effect on the technological design, siting, and operation of plants, capital costs, and the structure of markets (see CX 642Z–5, 6; CX 504D-O; CX 597A-E; CX 505S-U). While regulations promulgated by both federal and state agencies during this period affected all aspects of the PVC and VCM businesses, environmental regulations had the greatest overall impact (CX 597C). Following the discovery of VCM as a specific cause of liver cancer, the Occupational Health and Safety Administration (OSHA) promulgated a standard in 1975 to reduce worker exposure to this product. And in 1976, the Environ-

mental Protection Agency (EPA) promulgated a standard to reduce atmospheric VCM emissions (see CX 642U). Additional environmental regulations affecting other aspects of PVC and VCM/EDC production facilities were subsequently promulgated.

228. Promulgation of the VCM emissions standard was followed by significant changes in both the PVC and VCM industries. These changes included plant and equipment modernization, process modifications, and redirection of research and development sources (Findings 66–67, *supra*). Most of the requirements regarding VCM control technology pertain to PVC plants because **[69]** these facilities contribute proportionately more emissions than VCM/EDC plants as a result of characteristics inherent in the batch process.

229. Changes brought about by the promulgations of the VCM emissions standard were felt most acutely by the older PVC plants, which had to retrofit their processes with new controls (CX 642Z–5). As a result of the stringent requirements, seven PVC plants were forced to close down, three on a permanent basis (CX 642Z–6). Several PVC and VCM/EDC plants were still in the design phase during development of the regulation, and their engineering had to be altered to comport with the new requirements (CX 642Z–5; see, *e.g.*, CX 505S-U; CX 504D-O). PVC producers also reported a 10–12 percent average loss in capacity as a result of compliance requirements (CX 642Z–5; see, *e.g.*, (CX 447J). This capacity loss was due mainly to the time needed to clean reactors and purge systems after each batch in an effort to reduce VCM emissions (CX 642Z–5, 6).

230. The total cost of compliance borne by producers affected by the federal VCM atmospheric emissions standard alone for the 10–year period 1977–1986 was estimated to be $765.7 million (in 1977 dollars), including investments, capital, operating, and maintenance costs for new and existing plants (CX 642Z–5).

231. The technological trend in the PVC industry throughout the 1970's toward large reactors, automation, computerized control of production, and decreased emphasis on the production of specialty PVC resins was partly prompted by and, in turn, greatly facilitated compliance with, the various environmental regulations (CX 642Z–6, 49–137).

232. Current technology appears to be well-established and stable (CX 642Z–50, 51). There was evidence that, at the present time, nearly all existing PVC plants have completed the modifications necessary for compliance (CX 642Z–6).

I. The decreased rate of growth in demand for PVC

233. There was testimony that the rate of growth in demand for bulk and suspension PVC is expected to be much lower in the 1980's

and beyond, than it was earlier in the 1960's and 1970's (DiLiddo 3107–14, 3119; Disch 691–92; Schaefer 1122; Becker 1265–68; see CX 64U; see also Liao 1518–19).

234. [ ] (see CX 64U; CX 185D *in camera*). [ ] (see DiLiddo 3110; Becker 1265–66; CX 14F *in camera;* CX 67Z–8 *in camera*). [**[70]**] (see RX 639H *in camera*). [ ] (see DiLiddo 3109–10; CX 67Z–8 *in camera*). Rapid growth through the 1960's and early 1970's was accounted for by the increasing end uses found for the product; its versatility enabled PVC to replace traditional materials in a multitude of applications (Disch 719; Schaefer 1154–55; DiLiddo 3108; Becker 1268–70; CX 53D). Beginning in 1979, however, average growth rates declined to the 3–4 percent range (see H. Wheeler 1731–32; Becker 1265–66; see also Eades 1471).

235. [ ] (Becker 1266–67; Eades 1470; L. Wheeler 941; DiLiddo 3112–14, 3324–25; CX 16Z–11 *in camera;* CX 513C *in camera;* CX 374E-G, L *in camera*). As observed by Dr. DiLiddo of Goodrich, "[t]he world is changing, the PVC business is maturing, the opportunities for new markets . . . have been defined to a very large degree" (DiLiddo 3324–25). There was testimony that demand for PVC is expected to rise at approximately the same rate as overall economic activity as measured by GNP, *i.e.,* in the 3–4 percent range, for the foreseeable future (Disch 690–92; Becker 1265–66; H. Wheeler 1732–33; DiLiddo 3119). In addition, a number of industry participants acknowledged that they envisioned no major new areas of growth which would change this assessment of the future rate of growth (Schaefer 1155–57; Becker 1266–68; Eades 1475; H. Wheeler 1732–33; DiLiddo 3324–25).

236. [ ] (see Liao 1519; RX 639H *in camera*). The downturn in growth that occurred in the late 1970's and early 1980's discouraged entry into the U.S. PVC market (see Eades 1468–70). A slower rate of growth in PVC demand is acknowledged by producers in the industry to have an impact on their expectations regarding new entry (see, *e.g.,* Schaefer 1133; H. Wheeler 1736; see also Eades 1486–87).

J. Price protection mechanisms in sales of PVC

237. As earlier noted, contracts for the sale of PVC frequently contain "meeting competition" clauses (Finding 211, *supra*). Furthermore, in supplier-customer dealings not involving written contracts, customers often bring competitive offers to the attention of suppliers as if a "meeting competition" proviso were in effect (Findings 211, *supra*). Under such arrangements, information regarding lower prices offered by competitors is regularly transmitted to suppliers.

238. In addition, as earlier noted, PVC sales contracts often contain

clauses requiring advance notification of price [**71**] increases (*e.g.*, 30 days). And price increases are regularly announced in advance in the trade press (Findings 211, 214, *supra*).

K. Mutual interdependence of PVC suppliers

239. Complaint counsel contends that PVC competitors are "keenly aware of their mutual interdependence" (CPF 16.01 *et seq.*). This, we are told, is manifested in the record in a variety of ways:

a. Suppliers realize that it may be an unwise strategy to attempt to gain market share by cutting prices (CPF 16.03);

b. Suppliers recognize that competitive restraint will help maintain higher prices (CPF 16.04);

c. Suppliers' willingness to sell excess PVC in the export market at a lower price, rather than adding additional supply to the domestic market (CPF 16.05);

d. The continuation by Goodrich of its tolling agreement with Diamond in an effort to maintain the PVC industry pricing structure (CPF 16.06);

e. [ ] (CX 182Z–9 *in camera;* CPF 16.06);

f. Alleged "joint actions" in connection with the raising of prices, such as trade press announcements by the various industry members (CPF 16.08);

g. The close monitoring of competitors' prices, and attempts to predict competitors' reactions in various situations (CPF 16.09);

h. Suppliers' attempts to influence the actions of competitors, including capacity expansions (CPF 16.10–.12); and

i. Suppliers' efforts to monitor capacity and changes in capacity of competitors (CPF 16.13).

240. According to the testimony of complaint counsel's economic expert, factors such as the foregoing indicate the existence of mutually interdependent behavior among competitors in the PVC market (Kaserman 2438–41). [**72**]

L. Level of capacity utilization

241. It is respondents' position that there is substantial excess capacity in the PVC industry, brought on through forecasting errors on the part of numerous suppliers (RPF 302).

242. Complaint counsel concedes that the PVC industry has experienced excess capacity in recent years, which they ascribe to the severe recession and a downturn in the PVC's growth rate (CPF 17.03 –04), and they agree that this excess capacity has had an adverse impact on profitability in the industry (CPF 17.07).

243. Complaint counsel nevertheless maintains that the implications stemming from the existence of excess capacity are uncertain.

They assert, on the one hand, that it may increase the incentive of firms to cheat on a collusive agreement (CPF 17.01); and that, on the other hand, the downturn in profitability that accompanies excess capacity may increase the incentive of firms to collude (CPF 17.02); and furthermore, that excess capacity may reduce the likelihood of new entry (CPF 6.37–.40, 17.05).

244. According to Dr. Kaserman, complaint counsel's economic expert, this factor should not be given "a great deal of weight," since in the last several years, excess capacity levels have risen and fallen according to variations in overall economic activity (Kaserman 2431). Dr. DiLiddo of Goodrich ascribed the most recent decline in demand for PVC and low capacity utilization as being reflective of general business conditions existing at that time (DiLiddo 3116–18). There was testimony of industry witnesses that surplus capacity in the manufacture of PVC would not be entirely diminished or come into balance for the next three to five years or some even longer period (Disch 691–92; Schaefer 1125; Eades 1473–74; H. Wheeler 1736–37; CX 220C).

M. Competitive performance in the PVC industry

245. On this question, respondents maintain that the competitive environment of the PVC industry is "extremely intense" (RPF 354).

246. As noted earlier (Findings 208–15, *supra*), price competition among competing PVC suppliers is brisk. [ ] (see CX 143E; CX 808A; CX 809A; Belt 1992 *in camera,* 2067).

247. [ ] (RX 907A-C *in camera;* RX 274B *in camera;* CX 527). [ ] (RX 186F *in camera*). [73] Mr. Disch of Tenneco testified that since the acquisition, PVC "has been a very volatile industry with, in my opinion, no profit since that time, [due to] overcapacity and a very difficult market place" (Disch 706–07; see also Disch 726). Similarly, Mr. H. Wheeler of GenCorp observed that "the profit history of the [PVC] business has been very poor" (H. Wheeler 1736). And, Goodrich's Dr. DiLiddo testified that the PVC business is "very, very competitive, such that it is impossible to generate any return," and further testified that Goodrich has "been through a blood bath for the last five years" (DiLiddo 3250, 3419).

248. Each PVC industry witness who testified described the business as highly competitive (Kienholz 849; Schaefer 1197; H. Wheeler 1767; McMath 1941–42; DiLiddo 3250, 33327; see also Disch 706–07; Becker 1338–39; Belt 2065–66). Mr. H. Wheeler of GenCorp observed that price competition in the PVC industry "is extremely intense. In 20-plus years in the chemical industry I don't think I have ever seen more intense price competition [sic] than has occurred in PVC since 1981" (H. Wheeler 1767).

249. It is the position of complaint counsel that regardless of what the record shows concerning competitive performance, this still would not, as a practical matter, indicate anything of substance concerning the legality of the acquisition (CPF 18.01 *et seq.*). This is because of the difficulties involved in determining "profits;"[48] a distortion factor brought on by excess capacity; and the importance in a Section 7 proceeding of focusing on future effects rather than past conditions (CPF 18.03).[49]

VIII. VCM QUANTITATIVE ANALYSIS

A. U.S. VCM producers

250. [**[74]**][50] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). [ ] (CX 662A *in camera;* CX 663A *in camera;* CX 669F *in camera*). [ ] (CX 662B *in camera;* CX 663C *in camera;* CX 669N *in camera;* CPF 22.16).

251. [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). [ ] (Diamond Adm. 3; CX 6A; CX 662A-B *in camera;* CX 663A, C *in camera;* CX 669F, N *in camera;* CPF 24.15–.16).

252. The Dow Chemical Company ("Dow") was [__] in actual production of VCM prior to the acquisition. [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). [ ] (CX 662A, B *in camera;* CX 663A *in camera;* CX 669F, N *in camera;* CPF 22.15–.16).

253. At the time of the acquisition, Shell ranked [__] in VCM production among U.S. producers, accounting in 1981 for [__] percent of VCM production. [ ] (CX 662A-C *in camera;* CX 663A, C, E *in camera;* CX 669F, N, Z–2 *in camera;* CPF 22.15–.17).

254. [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). By the time of the acquisition, however, Georgia Pacific had increased its share of VCM industry capacity. [**[75]**] (CX 662A-B *in camera;* CX 663A, C *in camera;* CX 669F, N *in camera;* CPF 22.15–.16).

255. In 1981, PPG Industries ("PPG") ranked [__] in U.S. actual VCM production, with a market share of [__] percent. [ ] (CX

[48] Further elaborating, complaint counsel asserts that even if the problems of measuring long run marginal cost curve (rather than individual segments) could be overcome, such an exercise would yield only "accounting" profits, not "economic" profits. It is the latter, we are told, which is the proper standard for measuring allocative efficiency; yet no party has attempted to make such determination on the present record. Thus, there "has been a failure of proof" (CPF 18.04–.06).

[49] Complaint counsel urges that excess capacity in recent years is likely to be a temporary phenomenon, and that industry structure has changed by virtue of the reduction of the number of competitors from 17 in January 1982 to a present 11 (CPF 18.08).

[50] The market share and industry capacity figures in this section reflect the size and distribution of VCM producers in January 1981, one year prior to the acquisition, and January 1, 1982, immediately preceding the acquisition.

662A-C *in camera;* CX 663A, C, E *in camera;* CX 669F, N, Z–2 *in camera;* CPF 22.15–.17).

256. [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2, N *in camera;* CPF 22.17). Conoco's ranking remained virtually unchanged in the period immediately preceding the acquisition. [ ] (CX 662A-B *in camera;* CX 663A, C *in camera;* CX 669F, N *in camera;* CPF 22.15–.16).

257. [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). [ ] (CX 302B *in camera;* CX 321B *in camera;* CX 373G *in camera*). Accordingly, the 1981 capacity data reflect Borden's partial interest in the joint venture. [ ] (CX 302B *in camera;* CX 321B *in camera*). [ ] (CX 662A-B *in camera;* CX 663A, C *in camera;* CX 669F, N *in camera;* CPF 22.15–.16).

258. [ ] (CX 321B *in camera;* CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17). Uniroyal exited the VCM business at the end of 1981 when it withdrew its participation in the Monochem venture (CX 321B).

259. Ethyl ranked [__] in actual VCM production in 1981 accounting for [__] percent of the United States VCM supply. At the time of the acquisition, Ethyl remained [__] in VCM production by all measurements. [ ] (CX 662A-B [**76**] *in camera;* CX 663A, C, E *in camera;* CX 669F, N, Z–2 *in camera;* CPF 22.15–.17).

260. Formosa Plastics Corporation accounted for [__] percent of 1981 actual VCM production, placing it [__] among United States producers. [ ] (CX 662A-C *in camera;* CX 663A, C, E *in camera;* CX 669F, N, Z–2 *in camera;* CPF 22.15–.17).

261. [ ] (CX 318A *in camera*). [ ] (CX 662C *in camera;* CX 663E *in camera;* CX 669Z–2 *in camera;* CPF 22.17).

B. Concentration in the VCM market

1. The effect of the acquisition on concentration

262. Goodrich's acquisition of Diamond Shamrock's VCM plant resulted in an increase in concentration in the VCM product market in the U.S. Following the acquisition, the HHI measurement of industry nameplate capacity increased 226 points to a level of 1,529 (CPF 22.15). The practical production capacity HHI increased 253 points to a level of 1,552 (CPF 22.16). Measured in terms of actual VCM production, the acquisition produced an increase of 304 points in the HHI to a level of 1,663 (CPF 22.17).

263. Four-firm concentration figures also increased following the acquisition. Measured in terms of nameplate capacity, four-firm concentration rose 10.6 percent to a level of 70.8 percent (CPF 22.15). Four-firm concentration in practical capacity increased by 10.5 per-

cent to a level of 71.3 percent (CPF 22.16). And the four-firm concentration measurement increased 7.5 percent to a level of 72.6 percent (CPF 22.17).

264. Two-firm concentration levels likewise increased as a result of the acquisition. In nameplate capacity, two-firm concentration rose by [__] percent to [__] percent (CPF 22.15). Two-firm concentration in practical production capacity increased [__] percent to a level of [__] percent (CPF 22.16). And [77] measured in terms of VCM production, two-firm concentration increased by [__] percent to a level of [__] percent (CPF 22.17).[51]

2. Concentration trends

265. Concentration in VCM production capacity has increased in each of the years since the January 1982 acquisition (CPF 22.23–.24). Prior to the acquisition, there were 12 U.S. producers of VCM. By the time of the acquisition, the number of firms in the VCM market had declined to 10, because of the exits of Stauffer and Uniroyal. Following the acquisition, Diamond Shamrock was no longer in the market, and the next year Ethyl ceased production (CPF 22.23–.24). Thus, by January 1984, the number of VCM producers in the market had declined to eight, and the market has remained at that level up to the present. Finally, since the Goodrich acquisition, three VCM producers, Dow, Shell, and PPG, each have shut down a VCM plant (CPF 22.23–.24).

266. Following the acquisition, Goodrich assumed the leader position in industry practical production capacity, and ranked closely behind Dow in industry nameplate capacity (CPF 22.23–.24). Concentration in HHI terms was essentially level in the year immediately prior to the acquisition, measuring between 1293 and 1318 in 1981 and 1982 nameplate and practical production capacity. Concentration in the VCM market has risen successively following the acquisition, with the HHI in nameplate and practical production capacity respectively reaching 1433 and 1468 in January 1983, 1559 and 1575 by January 1984, and 1632 and 1650 by January 1985 (CPF 22.23–.24).

IX. VCM QUALITATIVE ANALYSIS

A. Entry considerations

267. According to complaint counsel's economic expert, Dr. Kaserman, there are five factors significantly affecting the conditions of entry into the VCM market: (1) the size of the minimum efficient scale plant; (2) the magnitude of sunk costs; (3) the lead time required for

[51] Eight-firm concentration figures show an increase in nameplate capacity of 3.5 percent to a level of 96.8 percent; an increase in practical capacity of 3.4 percent to a level of 96.8 percent; and an increase measured by VCM production of 3 percent to a level of 97 percent (CPF 22.15–.17).

planning, permitting, and construction of new plants; (4) the presence or absence of excess capacity in the industry; and (5) the extent of vertical integration in the industry (Kaserman 2472). [78]

1. Minimum efficient scale plant

268. [ ] (L. Wheeler 928; DiLiddo 3290–91; see Taylor 1563; CX 557Z–21 *in camera*). In constructing its VCM plant in the 1970's, Diamond Shamrock "considered it essential to build a plant with a production capacity of one billion pounds of VCM per year" (CX 424B; see also Diamond Adm. 429; CX 6R). [ ] (CX 44A *in camera*). Dr. Eades of ICI concluded that a plant capacity of one billion pounds per year would be more desirable than a 500 million pound plant (Eades 1462).[52]

269. The capacities of more recently constructed VCM plants support the conclusion that a minimum efficient scale plant is approximately [ ] to [ ] pounds per year. [ ] (Goodrich Adm. 1; CX 4A; CX 310C *in camera*). [ ] (Goodrich Adm. 731; CX 4Z–73); and Shell's plant at Deer Park, Texas (CX 316C *in camera*). Although Formosa Plastics recently constructed a 500 million pound plant at Point Comfort, Texas, Mr. Liao testified that it was sized to match the company's PVC plant previously built at the same site, and that Formosa did not possess experience with building larger VCM plants (Liao 1532–34).

2. Sunk costs

270. In assessing the magnitude of sunk costs in the VCM industry, it should be kept in mind that VCM plants are durable and highly specialized (Klass 4397, 4521–24; CPF 23.20). One [79] cannot normally produce materials other than VCM in a VCM plant (L. Wheeler 989–90).[53]

271. Mr. Kienholz of PPG testified that sunk costs represent virtually all of the total value of a VCM plant (Kienholz 820–21). [ ] (CX 40W *in camera* (30 years)). There was testimony that investment in a new plant would entail considerable financial risk (DiLiddo 3134–37), and that, should it be necessary to close the plant, virtually the entire investment could be lost (Kienholz 783; see also DiLiddo 3396). This indeed was the case when PPG closed its Puerto Rican plant in 1978 (Kienholz 775–76).

[52] According to Goodrich, at least, there may be scale economies in plants larger than one billion pounds. Goodrich expected to achieve further scale economies in its proposed 1.6 billion pound-per-year facility at Convent, Louisiana (DiLiddo 3341).

[53] One can, of course, manufacture EDC in the front portion of a VCM plant, since the production of EDC is the first step in the VCM manufacturing process. However, the EDC portion of the plant would amount to only 10 percent of the total capital of a VCM plant (L. Wheeler 990).

3. Required lead time

272. [ ] (Taylor 1581; CX 36Q, S *in camera;* CX 5Z–5; CX 182I *in camera;* CX 439B; see also Diamond Adm. 416; CX 6R; CX 440M; CPF 23.25–.33).

273. [ ] (Taylor 1581; CX 36Q, S; CX 52Z–5 *in camera;* see CX 440M).

274. Prior to beginning plant construction, however, it is necessary to obtain necessary environmental permits[54] (DiLiddo 3188–89; Diamond Adm. 413; CX 6Q; Goodrich Adm. 368, CX 4Z–19). [ ] (Diamond Adm. 415; CX 6Q), [ ] (Kienholz 804; CX 440M; CX 15A; CX 36S *in camera;* CX 39Z–6 *in camera*).

275. In addition, certain engineering work must be performed even before applying for regulatory permits, since the resulting information must be presented in the permit applications (DiLiddo 3337). In this connection, the basic technology and capacity of the plant must be determined (DiLiddo 3337). This pre-permit engineering, according to Goodrich, could take approximately six months (DiLiddo 3337). In 1980, EPA amended its regulations to **[80]** require that air quality near the site might have to be monitored for a period of time prior to applying for permits (40 CFR 51.24(m), 40 CFR 52.21(m)). This change may add even additional time to the process of obtaining permits.

276. Another factor to be considered prior to filing for permits, is selecting a site for a new VCM facility. This itself can be a "complicated" process (see DiLiddo 3335–37), including raw material and product logistics, community acceptance, labor relations, labor supply, political climate, and the availability of local support services (CX 574I, M-U; see also RX 1061D-E; RX 1304; RX 1308; Diamond Adm. 221; CX 6J; Diamond Adm. 222; CX 6J; Diamond Adm. 414; CX 6Q; Diamond Adm. 436; CX 6R).

277. A new entrant may also need time to evaluate and license VCM manufacturing technology. There was testimony that this could take approximately six months (Kienholz 804). [ ] (see CX 523 *in camera;* CX 53A).

278. Formosa Plastics' recent entry experience supports the four-to-five year lead time estimation. Formosa Plastics began looking for a site for its PVC/VCM complex in the latter half of 1978 (Liao 1523), and commenced production at the beginning of 1983 (Liao 1534–35). This time period does not include any time spent for strategic analysis prior to the search for a site. Furthermore, Formosa already had its own VCM production technology (Liao 1539), and had had experience in the U.S. market through its participation in its Rico Chemicals project (Liao 1519–1522).

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[54] See discussion of the various regulatory requirements for PVC and VCM plants, *supra*, Findings 66–67.

279. Goodrich's proposed VCM plant at Convent, Louisiana is also instructive in assessing the lead time necessary for a new VCM entrant. [ ] (DiLiddo 3337; CX 48Q; CX 52Z–5 *in camera*). Prior to the July 1979 announcement, Goodrich had completed an extensive PVC/VCM strategy study over an eight-month time period (DiLiddo 3335; CX 53A). During these eight months, Goodrich had also completed a complex site selection process and had chosen the Convent, Louisiana site (DiLiddo 3336).

4. Excess capacity

280. Complaint counsel's economic expert testified that excess capacity in VCM makes entry less likely (Kaserman 2328–29, 2337). **[81]**

281. There has been excess capacity in the VCM industry since 1981 (CPF 34.02). There was testimony from industry witnesses that this condition is expected to continue for the foreseeable future (L. Wheeler 938; Schaefer 1190; Taylor 1570). However, complaint counsel makes the point that the magnitude of excess capacity has declined, as demand conditions improve following the recent recession (CPF 34.02; CPF 34.06).

5. Extent of vertical integration

282. [ ] (Findings 76–78, *supra*), [ ] (CX 667 *in camera*), [ ] (CX 667I-J *in camera*).

B. VCM is a homogeneous product

283. Physically, VCM is admittedly a fungible product, with only trace differences (Goodrich Adm. 465; CX 4Z–33; Diamond Adm. 505; CX 6U, Z–65). [ ] (CX 376K *in camera;* Goodrich Adm. 464; CX 4Z–33; Diamond Adm. 504; CX 6U, Z–65). [ ] (L. Wheeler 918; CX 376K *in camera;* CX 557K *in camera*).

284. VCM plants are located in [ ]. [ ] (see CX 302B; CX 304B *in camera;* CX 305D *in camera;* CX 308B-C; CX 310C *in camera;* CX 315F *in camera;* CX 376C *in camera;* CX 316C *in camera;* Goodrich Adm. 1; CX 4A; Goodrich Adm. 728; CX 4Z–73).

285. The VCM industry is not undergoing significant process or product technological change (CPF 29.01–.08; see Findings 309–312, *infra*). Nor is there customized production of VCM; VCM producers carry inventories (Kienholz 816); make spot sales (see Taylor 1668), and post prices (see CX 702; CX 703; CX 705; CX 707).

286. Respondents describe VCM as [ ] (Kienholz 848; L. Wheeler 930, 1011, 1013; Schaefer 1128–29, 1145, 1186, 1189–90; Taylor 1564; H. Wheeler 1760–61; RX 57Z–35, Z–58–63, Z–87 *in camera;* RX 138E *in camera;* RX 380A *in camera*).

C. VCM elasticity of demand

287. In measuring the price elasticity of demand for VCM, it is significant that VCM is an intermediate (or input) product **[82]** rather than a consumer good (Kaserman 2369). Complaint counsel's economic expert testified that 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 (Kaserman 2370–71). He further testified that 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 2377).

288. A consideration of these factors points to the conclusion that the price elasticity of demand for VCM is low. First, there is no substitutability between VCM and other input products in the manufacture of PVC (Kaserman 2376–77; Finding 17). Second, the cost share of VCM is only a portion of the cost of producing bulk and suspension PVC end-use products (Kaserman 2375). Third, as noted in Findings 94–193, *supra,* the elasticity of demand for bulk and suspension PVC is relatively low (Kaserman 2373). Because there is no substitutability between VCM and other input products in the manufacture of bulk and suspension PVC, it is apparent that the price elasticity of demand for VCM is lower than the price elasticity of demand for bulk and suspension PVC (Kaserman 2377; Klass 4003–11, 4533).

289. Approximately 96 percent of the VCM supply is used in the manufacture of PVC (Kaserman 2484; L. Wheeler 919; see also Diamond Adm. 62; CX 6D, Z–37). The record confirms that VCM is the only raw material suitable for this purpose (Diamond Adm. 57; CX 6D, Z–36). [ ] (see, *e.g.*, CX 246 *in camera*).

D. Similarity of VCM production costs

290. The costs of manufacturing VCM can be divided into two categories: (1) the costs of converting ethylene and chlorine into VCM; and (2) the cost of the ethylene and chlorine feedstocks.

291. VCM producers have access to similar manufacturing technology. There are no significant patents that would give one firm a cost advantage over another. "Most firms, if not all, have access to effective production technology which enables them to produce large

volumes at low costs" (Klass 4008–09). Thus, Mr. Kienholz noted that PPG was "competing with producers who pretty much have the same advantages as PPG does" (Kienholz 809). He further noted that in "VCM you don't have a particular [83] proprietary niche that allows one firm to achieve returns or earnings that somebody else wouldn't" (Kienholz 884).

292. Indeed, VCM producers employ similar manufacturing processes. [ ] (*cf.* CX 302B *in camera;* CX 557D *in camera;* CX 557Z–5 *in camera*). [ ] (*cf.* CX 302B *in camera;* CX 557D *in camera;* CX 557Z–5 *in camera* with CX 663 *in camera*). [ ] (CX 557Z–5 *in camera*). "There is no great competitive advantage in the VCM operation between one person's process and another's" (Kienholz 809–10).

293. [ ] (see RX 428F-G *in camera*). These chemicals are consumed in fixed proportions to the amount of VCM produced (L. Wheeler 917–18; *cf.* Goodrich Adm. 59–60; CX 4I). All producers use similar quantities of ethylene and chlorine in the manufacture of VCM (*cf.* Goodrich Adm. 59–60; CX 4I; L. Wheeler 917–18).

294. [ ] (CX 297Z–3 *in camera;* CX 473A-B; RX 107L *in camera;* RX 429A *in camera*), it appears likely that VCM firms would pay similar prices for these chemicals.[55]

295. There was testimony from industry witnesses that VCM firms have similar production costs. Mr. Wheeler of Shell testified that there was only a difference of one-half cent per pound in short run avoidable costs across the spectrum of the firms in the industry (L. Wheeler 936–38). Mr. Kienholz of PPG agreed that there were no significant differences among firms in the cost of producing VCM (Kienholz 814). Mr. Taylor of Dow also was of the belief that VCM producers had similar manufacturing costs (Taylor 1685). [ ] (RX 57Z–29, 128, 131 *in camera*).

E. The availability of price information in the VCM market

296. [ ] (Taylor 1663–68; L. Wheeler 958 *in camera*). [[84]] (Goodrich Adm. 507; CX 4Z–40; *cf.* Taylor 1596; L. Wheeler 960 *in camera*). Contacts often require the seller to give notice a certain number of days in advance of price increases (Goodrich Adm. 509; CX 4Z–40; see also CX 206; CX 207; CX 212; CX 215; CX 229). [ ] (Wheeler 958–60 *in camera;* Taylor 1594–95).

297. [ ] (see Schaefer 1223 *in camera;* CX 88X-Y *in camera*).

298. VCM suppliers obtain a considerable amount of price information through their customers. By bringing competitive offers to their

[55] As with PVC (Finding 203, *supra*), complaint counsel relies upon the significance of "economic costs" as compared to "accounting" costs (CPF 26.10 *et seq.*).

regular supplier's attention, pursuant to meeting competition clauses in contracts, customers provide information concerning prices offered by VCM competitors (Kienholz 810–11).

299. VCM suppliers also learn of competitive price changes through public announcements in the trade press (see, *e.g.*, CX 736; CX 737; CX 739).

300. [ ] (Wheeler 958–60 *in camera;* Taylor 1596; Goodrich Adm. 509; CX 4Z–40). In practice, advance notice of VCM price increases is a common practice (see, *e.g.*, CX 702; CX 705; CX 707; CX 735; CX 736; CX 739).

301. [ ] (see DiLiddo 3295 *in camera,* 3299; CX 88 *in camera;* CX 24 *in camera;* CX 26 *in camera*). One reason for the existence of these arguments is that a number of VCM producers are also PVC producers. Thus, they may enter into VCM supply arrangements as either a supplier or a customer. [ ] (see, *e.g.*, CX 206A; CX 207; CX 208; CX 212; CX 213; CX 214; CX 215; CX 217 *in camera*).

302. Competitive pricing information obtained by VCM firms is relatively reliable and accurate (see, *e.g.*, Diamond Adm. 535; CX 6V, Z–67).

303. [ ] (Kienholz 853–56; L. Wheeler 1020–24 *in camera;* Schaefer 1193–95; DiLiddo 3306–09). Mr. Schaefer noted that it had been a "topic of conversation in the industry" (Schaefer 1193). Mr. Kienholz **[85]** believed his information about the nature of the contract was "quite good" (Kienholz 854). In similar vein, Dr. DiLiddo of Goodrich described the outlines of a supply contract between Dow and Shintech (DiLiddo 3313).

304. As part of their intelligence gathering operations, VCM producers also make efforts to monitor competitors' market shares (Diamond Adm. 523; CX 6V, Z–66; CX 169F). [ ] (see, *e.g.*, CX 97I *in camera;* CX 146; CX 215; CX 238E; CX 425; CX 541 *in camera;* CX 542 *in camera;* RX 302; RX 307; RX 311; RX 362 *in camera;* RX 367 *in camera;* RX 379C *in camera;* RX 401F; RX 427D *in camera;* Diamond Adm. 520; CX 6V, Z–66).

F. Repeat sales by VCM producers

305. [ ] (Weber 1839–40; L. Wheeler 958 *in camera;* Kienholz 811–12; Taylor 1592–93; Schaefer 1145; see, *e.g.*, CX 26A *in camera*).

306. [ ] (Taylor 1567–68; Schaefer 1145; see, *e.g.*, CX 24A-J *in camera;* CX 25A-E *in camera;* CX 26A-R *in camera*).

307. Approximately one-half of the VCM sold in the U.S. is transported by pipeline from suppliers' plants to their customers' premises (L. Wheeler 989; Taylor 1564). There was testimony that pipeline transportation of VCM offers economic and safety advantages over alternative modes of transportation, such as railcar or barge (Kien-

holz 756, 759–60, 789; L. Wheeler 980–81; Taylor 1563–64; Schaefer 1129). Once a connecting pipeline has been put in place, the cost savings involved would render it unlikely that a VCM customer would switch to a non-pipeline supplier as a primary source (Kienholz 787–88, 790, 868–70; Taylor 1566–67; *cf.* Schaefer 1129).

308. [ ] (Kaserman 2500; see, *e.g.,* Schaefer 1145; CX 523T *in camera;* CX 419).

G. Rapid technological changes in VCM industry

309. The principal commercial process by which VCM is produced today is the thermal cracking of ethylene dichloride ("EDC") (Finding 32, *supra;* see L. Wheeler 918–26; Kienholz 756–58). **[86]**

310. [ ] (Finding 32, n. 7, *supra;* see CX 40Q *in camera;* CX 39T *in camera*). Thus, prior to 1960, acetylene was the primary feedstock. However, acetylene supply became inadequate following World War II to support the growing demand for VCM. [ ] (see CX 40R *in camera;* CX 39U *in camera;* RX 57U *in camera*). [ ] (CX 40R *in camera;* CX 39U *in camera*). The rapid replacement of acetylene-based technology with that of ethylene proceeded throughout the late 1960's and the 1970's. [ ] (see L. Wheeler 924–25; CX 40V *in camera;* CX 39Y *in camera*).

311. [ ] (see CX 40R *in camera;* CX 39U *in camera*). All VCM plants built since the late 1960's have employed the ethylene technology. At the present time, only one producer, Monochem uses acetylene technology; its plant at Geismar, Louisiana accounting for less than 2 percent of total domestic VCM practical production capacity.

312. [ ] (Kienholz 794; L. Wheeler 989; Taylor 1592; CX 557H *in camera;* RX 57W-Y *in camera*). [ ] (CX 40U, H *in camera;* CX 39X *in camera*). [ ] (CX 40V *in camera;* CX 39Y *in camera;* RX 57W).[56]

H. The decreased rate of growth in demand for VCM

313. According to the record, the rate of growth in demand for VCM has been and is expected to be significantly lower in the 1980's than in the 1960's and 1970's. As VCM is the principal **[87]** input in the production of PVC, the growth in demand for VCM is closely tied to the growth in demand for PVC (see L. Wheeler 941; Kienholz 756; Taylor 1556–57).

314. Annual growth rates for VCM in the 1960's were in the 12–15 percent range (Kienholz 792; Taylor 1558; CX 541B). Growth rates for VCM in the early 1970's were in the 8–10 percent range (See Kienholz 792; L. Wheeler 942–43).

[56] Vinyl chloride emissions control technology as it applies to EDC/VCM manufacturing is also considered to be well-established and stable (see Finding 232, *supra;* see generally CX 642B-O, Z–12–19, 52).

315. [ ] (Taylor 1571; CX 541B *in camera;* CX 542A *in camera*). [ ] (Taylor 1572; see also Kienholz 793; CX 554C *in camera*).

316. Industry witnesses testified that overall demand for VCM is expected to grow at about the same rate as overall economic activity, as measured by GNP. This would mean an increase in demand for VCM of only about 3 percent per year for the foreseeable future (Kienholz 792; L. Wheeler 940; Taylor 1571).

I. Price protection mechanisms in sales of PVC

317. As earlier discussed, Finding 211, *supra,* most contracts for the sale of VCM contain price protection clauses. These include most favored nation and meeting competition provisions (also known as meet-or-release clauses) (*cf.* Klass 5675, 5704). They also include clauses requiring advance notice of price increases.

J. Mutual interdependence of VCM suppliers

318. Complaint counsel contends that VCM suppliers are "keenly aware of their mutual interdependence" (CPF 32.01), manifested in the record in a variety of ways:

a. Suppliers recognize that competitive restraint will help maintain higher prices (CPF 32.02);

b. Suppliers' willingness to sell VCM in the export market at prices lower than the prices received for VCM in the United States, rather than adding additional supply to the domestic market which could result in lower prices (CPF 32.04);

c. Suppliers' efforts to monitor the pricing activities of competitors (CPF 32.05); [88]

d. The realization by suppliers that their actions may cause a reaction by competitors, resulting in adjustment of suppliers' behavior (CPF 32.06);

e. Suppliers efforts to monitor capacity and changes in capacity of competitors, and suppliers' attempts to influence the capacity decisions of competitors (CPF 32.07); and

f. Goodrich's "preemptive strategy" in planning the size, timing and publicity of its new Convent, Louisiana plant to discourage expansions by competitors and the entry of new firms (CPF 32.08).

K. Previous collusive behavior in the VCM industry

319. According to complaint counsel, the record contains "strong evidence" that during the late 1970's the VCM market was characterized by "disciplined, collusive pricing and price leadership" (CPF 33.01).

320. Evidence cited in support of the above assertion includes observations by PVC producers regarding the "strong discipline" of VCM suppliers in being able to maintain high prices in the face of adverse PVC market conditions (CPF 33.02).

321. Complaint counsel finds further support for their proposition in the consideration by certain PVC producers of integrating backwards into VCM, a step actually taken by Diamond and Georgia Pacific in 1978 and 1980, respectively (CPF 33.03).

322. As for the existence of price leadership, which "may make collusion more likely," the evidence relied on by complaint counsel identifies the VCM producer in the price leadership position to be Dow Chemical (CPF 33.04).

L. Level of VCM capacity utilization

323. Respondents maintain that substantial over-capacity exists among VCM producers, which is expected to continue for the foreseeable future (RPF 447; L. Wheeler 938; Schaefer 1190; Taylor 1570; Kaserman 2873).

324. According to complaint counsel's economic expert, however, the existence of excess capacity is not a factor to be accorded much weight (Kaserman 2503–04). As in the case of PVC, economists can regard this as beneficial or not, depending on one's point of view (see Finding 244, *supra*). [89]

325. [ ] (Schaefer 1126; Kienholz 774; see L. Wheeler 941–43; RX 873A *in camera;* RX 853A *in camera;* see especially VCM capacity utilization table set forth in CPF 34.02).

326. There was testimony of industry witnesses that the level of VCM capacity utilization improved in 1984 (Kienholz 796; L. Wheeler 943; Taylor 1572); that continued improvement in utilization would occur over the next few years, so that new capacity might be needed near the turn of the 1990 decade (Kienholz 796–97; L. Wheeler 947–48; Taylor 1580).

M. Competitive performance in the VCM industry

327. [ ] (Disch 697–99; Kienholz 768, 850; L. Wheeler 1025 *in camera;* see RX 987A; RX 428E *in camera;* RX 747C *in camera*).

328. [ ] (Taylor 1672; see H. Wheeler 1766–67; see L. Wheeler 1051 *in camera*).

329. [ ] (Klass 4537–41, 5462–65; RX 365A *in camera;* RX 431A *in camera;* RX 688C; RX 856A *in camera;* see RX 379E *in camera*).

330. Moreover, a number of industry witnesses testified as follows regarding the competitive nature of the VCM industry:

a. Mr. Paul Kienholz of PPG testified that "competition" was what basically determined the price of VCM and, further, that the VCM market was "extremely competitive" (Kienholz 805, 849).

b. [ ] (L. Wheeler 991; see RX 873A-E *in camera*).

c. Mr. Ronald Taylor of Dow testified that VCM producers competed on the basis of price, and also on the basis of other terms, like credit provisions, that may affect price (Taylor 1672). **[90]**

d. Dr. DiLiddo of Goodrich testified that the state of competition in VCM "is absolutely cutthroat" and that in the future competition "is going to be very, very vigorous" (DiLiddo 3327).

331. It is the position of complaint counsel, however, that regardless of what the record shows concerning competitive performance, this nevertheless would not, as a practical matter, indicate anything of substance concerning the effects of the Goodrich acquisition (Kaserman 2444–48, 2511–12). This is because of the difficulties involved in determining "profits;"[57] a distortion factor brought on by excess capacity; and the importance in a Section 7 proceeding of focusing on future effects rather than on past conditions.[58] **[91]**

DISCUSSION

The Commission has but recently had occasion to set forth its view concerning the analytical framework within which to evaluate the legality of corporate acquisitions. In its decision in *Echlin Manufacturing Co.*, Docket 9157, the following statement appears (slip op. at 8–9, June 28, 1985):

> Section 7 of the Clayton Act prohibits acquisitions that may have the effect of substantially lessening competition or tending to create a monopoly. Because Section 7 applies to "incipient" violations, actual anticompetitive effects need not be shown; an acquisition is unlawful if such an effect is reasonably probable. *E.g., American Medical International, Inc.*, No. 9158, slip op. at 17–18 (FTC July 2, 1984).
>
> Traditionally, an analysis under Section 7 begins with the definition of a relevant market and measurement of the concentration in that market. *See generally* FTC Statement §§ III, VI; DOJ Guidelines § 2, 3.11. This approach by itself is unsatisfactory, however, because it fails to reflect many factors that can determine whether

[57] Complaint counsel contend that even if the problems of measuring long-run marginal cost curve (rather than individual components) could be overcome, such an exercise would yield only "accounting" profits, not "economic" profits. It is the latter, in their view, which is the proper standard for measuring allocative efficiency; yet no party has attempted to make such a determination on the present record. Thus, there "has been a failure of proof" (CPF 35.04–.06).

[58] Complaint counsel urges that the excess capacity factor in recent years "is likely to be a temporary phenomenon" (CPF 35.08).

a merger is likely to lessen competition substantially by enabling one or more sellers to impose higher prices than would prevail under competitive conditions. *See Grand Union Co.*, 102 FTC 812, 1038–41 (1983). Therefore, the Commission also looks to other considerations that bear on the likelihood of anticompetitive effects. *See generally* FTC Statement § III; DOJ Guidelines §§ 3.21 to 3.45. These additional considerations often do not lend themselves to precise mathematical expression, but they can be more important than quantitative measures of concentration. *See American Medical International, Inc.*, No. 9158, slip op. at 27 (FTC July 2, 1984).

The focus of this proceeding is upon those "additional considerations" referred to by the Commission in its *Echlin* decision.

This is not to say, however, that the quantitative aspects of the Goodrich acquisition were not addressed in this case. In fact, evidence was presented concerning the acquisition's effect upon concentration in both the PVC and VCM markets, and appropriate findings have been made (Findings 49–53, 262–64, *supra*).

In short, the findings show a rise in HHI in PVC of 113 to a level of 1,098 measured by nameplate capacity; and a rise of 112 to 1,079 measured by practical production capacity. Neither [**92**] Dr. Kaserman nor Dr. Klass, the respective parties' expert witnesses, attached much significance to the HHI PVC figures standing alone (Kaserman 2451; Klass 4121).

The HHI figures as to VCM show a rise of 226 to a level of 1,529 measured by nameplate capacity; a rise of 253 to a level of 1,552 measured by practical production capacity; and a rise of 304 to a level of 1,663 measured by actual production. Respondents' expert, Dr. Klass, described these figures "as being essentially in the middle of the range of moderate concentration" (Klass 4479), while his counterpart, Dr. Kaserman, placed the numbers "toward the upper end of the moderate concentration level," greatly exceeding the DOJ guideline level (Kaserman 2465–66). Neither expert, however, believed that an inquiry into the competitive significance of the Goodrich acquisition as to VCM should be decided by reference to these figures alone. Both believed that an examination of additional factors was needed (Kaserman 2471; Klass 4479).

Turning then to the qualitative side of this case, complaint counsel has identified and offered evidence with respect to several "additional considerations" deemed relevant on the question of whether the Goodrich acquisition may pave the way for "collusion" among the various PVC and VCM producers with respect to raising prices and restricting output. We take up these points in order, and make the following observations:

a. *Entry considerations* (Findings 59–84). While the parties agree that there are no "Stigler type" entry barriers, I nevertheless agree with complaint counsel that entry into the manufacture of bulk and suspension PVC "is difficult and takes a long time" (CPF 6.01). The size of a minimum efficient scale plant alone can be conservatively placed at 500 million pounds of PVC output per year (Findings 60–62). The magnitude of sunk costs, while perhaps not overwhelming to a large oil or chemical company full bent on entry or capacity expansion, is certainly sufficient to give any potential entrant grave pause (Finding 63; see DiLiddo 3396). The lead time required for *de novo* entry has been established in the record as being at least four, and perhaps five years (Findings 64–72). And potential entrants into PVC manufacture would be faced with formidable problems presented by the industry's existing excess capacity, and the extent of vertical integration in the industry (Findings 73–78). Moreover, the record shows that there has, as a practical matter, been no *de novo* entry into the manufacture of PVC over the last decade. It is true, as respondents urge, that PVC suppliers have from time to time expanded their capacities in the face of rising demand. Yet this has not been the general experience of the industry in recent years (Findings 79–84). **[93]**

b. *PVC homogeneity.* The record shows that, within grades, bulk and suspension PVC is, on the whole, physically fungible and therefore homogeneous (Findings 85–90). Respondents' contention based upon "commercial heterogeneity" is, I believe, beside the point and must be rejected (Findings 91–93).

c. *PVC elasticity of demand.* The findings on this point establish that (1) there are no substitutes for PVC in the manufacture of PVC finished end products (Findings 94–95); (2) the cost share of PVC in many finished end products is low (Finding 96); and (3) elasticity of demand for many PVC end products is low, basically because of their physical properties and because they are relatively inexpensive (Findings 97–193). It follows that demand for bulk and suspension PVC is at least relatively inelastic.

d. *Similarity of PVC raw material and production costs.* Respondents rely upon various estimates in the record indicating variances among producers in costs of manufacture. Complaint counsel questions the accuracy of such information, and rely upon the fact that manufacturing technology, especially respecting large reactors, is similar (Findings 194–201).

As to raw materials, respondents contend that costs of VCM to PVC manufacturers vary, depending in large part upon whether it was

produced in-house or obtained elsewhere. Complaint counsel responds that all suppliers "pay" market value if in-house VCM is valued at the price the integrated firm could sell it for if it were not consumed internally (Findings 202–03).

Whichever party may be "right" on this point, it seems only logical that producers who have access to similar technology and similar raw materials would tend to have similar costs of manufacture.

e. *Availability of price information in the PVC resin market.* Respondents maintain that despite the efforts of competing suppliers to monitor such information, there nevertheless remains a good deal of uncertainty regarding prices charged for PVC (Finding 205–10). The record nevertheless establishes that, as a practical matter, reliable competitive price information is reasonably available to resin suppliers (Findings 211–15).

f. *Number and size of PVC purchasers.* Informed estimates of industry witnesses place the number of PVC purchasers as being somewhere between one and two thousand, largely disbursed throughout all segments of the PVC resin market. Although four of these purchasers together account for a major portion of the pipe grade market, none of these account for more than a minor fraction of overall industry sales (Findings 216–18). [94]

g. *Repeat sales by PVC suppliers.* The record shows a high incidence of PVC repeat sales made pursuant to regular ongoing customer/supplier relationships, either contractual or noncontractual (Findings 219–21).

h. *Technological state of PVC manufacturing.* Current PVC manufacturing technology appears to be well-established and stable, following the switchover of a major portion of PVC production to large reactors and automation, and following compliance by industry with federal safety and environmental regulations (Findings 222–32).

i. *Decreased rate of growth in demand for PVC.* Although the PVC market grew rapidly in the 1960's and into the 1970's, it was generally acknowledged by industry witnesses that PVC is presently a mature product whose rate of growth in demand is expected to be much lower in the 1980's and beyond (Findings 233–36).

j. *Price protection mechanisms in sales of PVC.* Contracts for the sale of PVC frequently contain two forms of price protection provisions: meeting competition clauses and clauses requiring advance notice of price increases (Findings 237–38).

k. *Mutual interdependence of PVC suppliers.* It is the contention of complaint counsel that PVC suppliers are "keenly aware of their mutual interdependence," as manifested in a variety of ways set forth in Findings 239–40.

l. *Excess PVC capacity.* There has unquestionably been an excess

capacity situation in the PVC industry in recent years, which complaint counsel ascribes to the recent economic recession and to a slowdown in the PVC growth rate, and which respondents describe as brought about through forecasting errors on the part of numerous suppliers (Findings 241–44).

m. *Competitive performance in the PVC industry.* Although complaint counsel would ascribe little or no weight to this factor, respondents rely heavily upon evidence of prevailing competitive conditions in defense of the challenged acquisition (Findings 245–49).

VCM

The "additional considerations" respecting VCM are virtually the same as those respecting PVC, and similar findings have been made:

Entry into the VCM market is difficult and takes a long time because of the size of the minimum efficient scale plant (Findings 268–69); the magnitude of sunk costs (Findings 270–71); the required lead time (Findings 272–79); existing excess [**95**] capacity (Findings 280–81); and the extent of vertical integration (Finding 282). As in the case of PVC, VCM is physically fungible and therefore homogeneous (Findings 283–86); VCM elasticity of demand is low (Findings 287–89); VCM producers have similar production costs (Findings 290–95); reasonably reliable competitive price information is generally available (Findings 296–304); there are repeat sales to VCM customers by regular suppliers (Findings 305–308); VCM manufacturing is not characterized by rapid technological change (Findings 309–12); there is decreased growth in demand for VCM (Findings 313–16); there are price protection mechanisms in VCM sale contracts (Finding 317); complaint counsel's contentions regarding mutual interdependence among VCM producers are similar to those made with respect to PVC producers (Finding 318). In addition, complaint counsel points to alleged previous "collusive behavior" in the VCM industry (Findings 319–22), (the evidence concerning which I deem inconclusive). Counsel also relies upon the currently existing excess capacity in the VCM industry (Findings 323–26). Lastly, complaint counsel urges that little or no weight be ascribed to competitive performance in the VCM industry (Findings 327–331), a factor upon which respondents rely heavily in defending the legality of the challenged acquisition.

If I properly understand complaint counsel's position, if a sufficient number of the above-recited qualitative factors can be shown to be established in the record, then complaint counsel must prevail in this case. This is because the existence of these "additional considerations" in the PVC and VCM markets would manifest a climate for collusion among producers regarding the raising of prices or the re-

stricting of output (see transcript of oral argument on proposed findings, p. 23–30).[59]

This, then, is the theory of law violation which I am urged to apply in setting aside the acquisition by Goodrich of the Diamond PVC/VCM assets for $125 million, on the grounds of reasonable probability of lessening competition.

I have much difficulty, however, in bringing myself to apply this theory to the facts of this case, in view of what the record shows concerning the state of competition in the PVC and VCM markets.

In this connection, the record shows that competition among producers is ongoing, vigorous and intense. This has been [96] conclusively demonstrated in a variety of ways: the activity of producers' sales forces; the extensive discounting; the attempts to obtain raw materials at lowest possible prices; the active monitoring of competitors' prices and meeting of competitive offers; the attempts to keep abreast of competitors' operating costs; the efforts to keep pace with changing technology. All of these factors and more are pervasive in the record.

While it may be conceivable that these factors can be related up to a "collusion" theory, it seems more reasonable to conclude that PVC and VCM suppliers have been, and indeed are, engaged in a spirited head to head contest for market share. This, I believe, to be the case both before and subsequent to the Goodrich acquisition.

The state of competition in the PVC and VCM markets being as it is, the adverse competitive effects required by Section 7 have not been established.

Order

I am thus constrained from entering the relief requested. Accordingly, dismissal of the complaint is hereby directed.

Opinion of the Commission

By Calvani, *Commissioner:*

This case concerns an acquisition affecting the manufacture of polyvinyl chloride ("PVC") and vinyl chloride monomer ("VCM"). PVC is a thermoplastic resin that, when combined with other ingredients, can be used to produce a wide variety of plastic products, ranging from irrigation pipe to phonograph records.[1] VCM is a gaseous chemical that is an essential and primary input needed to manufacture

[59] I understand that complaint counsel is not referring to collusion in the Sherman Act sense, which has been held to be an incorrect legal standard in a Clayton Section 7 case. Federal Trade Commission v. Warner Communications, Inc., 742 F.2d 1156, 1160 (9th Cir. 1984).

[1] A thermoplastic resin becomes soft and malleable when heated, and therefore can be fabricated by applying heat and pressure. By contrast, thermosetting plastics do not return to a malleable state upon reheating.

PVC resin. This case concerns an acquisition affecting the manufacture of both products. Respondent B.F. Goodrich ("Goodrich") is a large New York corporation, headquartered in Akron, Ohio, that manufactures a wide variety of chemicals, plastics, rubber and other products worldwide. In calendar 1980, Goodrich had net sales of $3.08 billion, net income of $61.7 million, and total assets valued at [2] $2.2 billion.[2] Respondent Diamond Shamrock ("Diamond") is a Delaware corporation, headquartered in Dallas, Texas, whose operations include natural gas and crude oil exploration and production; petroleum refining and marketing; coal, chemicals and plastics production; and technology development. In calendar 1980, Diamond Shamrock had revenues of $3.143 billion, net income of $201 million, and total assets valued at $2.8 billion. IDF 4.

In January 1982 Goodrich acquired Diamond's largest PVC plant, its VCM plant, and certain other assets for $125 million. IDF 11 *in camera*. The Federal Trade Commission simultaneously issued the administrative complaint in this matter.[3] The [3] complaint alleges that the acquisition violated Section 7 of the Clayton Act, 15 U.S.C. 18, and Section 5 of the Federal Trade Commission Act, 15 U.S.C. 45. More particularly, the complaint alleges that the acquisition would eliminate actual competition between Goodrich and Diamond and increase concentration levels in two product markets: the bulk and suspension PVC market and the VCM market. Administrative Law Judge Howder dismissed the complaint with respect to both markets, because in his view "the record shows that competition among producers is ongoing, vigorous and intense." ID at 95.

As explained in detail below, the Commission has concluded that the acquisition may substantially lessen competition in the VCM

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[2] IDF 1. The following abbreviations are used in this opinion:

ID	—	initial decision page number
IDF	—	initial decision finding number
Tr.	—	transcript of testimony page number
CX	—	complaint counsel's exhibit number
CAB	—	complaint counsel's appeal brief
CRB	—	complaint counsel's reply brief
CPF	—	complaint counsel's proposed finding of fact number
CRF	—	complaint counsel's reply finding of fact number
RX	—	respondents' exhibit number
RAB	—	respondents' answering brief
RPF	—	respondents' proposed finding of fact number
RRF	—	respondents' reply finding of fact number

This opinion, and the opinions of Chairman Oliver and Commissioner Azcuenaga, contain some references to material in the *in camera* portion of the record. Pursuant to an order issued on February 8, 1988, the Commission has determined, without objection from the submitting parties, to place these references on the public record of this proceeding.

[3] PVC is currently the subject of another Commission proceeding. In April 1986 the Commission issued an administrative complaint challenging Occidental Petroleum's acquisition of two PVC plants from Tenneco Polymers. The Commission also sought a preliminary injunction against the transaction. The district court denied that application, but its decision was later vacated as moot. *FTC v. Occidental Petroleum Corp.*, 1986-1 Trade Cas. (CCH) ¶67,071 (D.D.C. April 29, 1986), *vacated as moot*, No. 86-5254 (D.C. Cir. Oct. 23, 1986).

market, but is unlikely to lessen competition substantially in the PVC market. Accordingly, the Commission affirms the decision of Judge Howder with respect to the PVC market, and reverses with respect to the VCM market. [5]

I. STATEMENT OF FACTS

At the time of the acquisition, Goodrich operated bulk or suspension PVC facilities—with a total nameplate capacity of over one billion ounds er year—in Avon Lake, Ohio; Henry, Illinois; Long Beach, California; Louisville, Kentucky; Pedricktown, New Jersey; and Plaquemine, Louisiana. CX 4Z73. It also operated a VCM plant with a nameplate capacity of approximately one billion pounds per year in Calvert City, Kentucky. IDF 3 *in camera.* At the time of the acquisition, Diamond operated several bulk and suspension PVC facilities—with a total nameplate capacity of 590 million pounds per year—in Deer Park, Texas and Delaware City, Delaware. IDF 5 *in camera.* Its Deer Park facilities included several specialty PVC resin plants (plants numbers 1, 3, 4 and 4X), with a combined practical production capacity of 215 million pounds per year; one large commodity PVC resin plant (plant number 5), with a practical production capacity of 260 million pounds per year; and a powder compound plant, with a capacity of 152 million pounds per year. Diamond also operated a VCM facility with a nameplate capacity of one billion pounds per year at LaPorte, Texas, adjacent to its Deer Park facility.[4] [6]

In July 1979 Goodrich announced that it intended to double its PVC capacity by 1986.[5] In 1980, it announced that it would execute that strategy by constructing a 1.6 billion pound per year VCM plant and a 1.1 billion pound per year suspension PVC plant at Convent, Louisiana.[6] Goodrich privately described its plans in 1981 as a successful "preemptive" strategy designed to

> freeze the competition into inaction, thereby delaying expansions and forestalling new entrants into the business. . . . This preemptive strategy, reinforced by the 1980 recession, has been quite successful to date . . . No new expansions beyond 1983 have been announced by any competitor. New entries in PVC have been forestalled . . . We have also seen consolidation occurring within the industry . . . the Diamond Shamrock and Air Products PVC businesses are for sale. As a result of all of the above developments, as well as the industry perception of our commitment, we are in an excellent competi-

[4] IDF 5–6 *in camera;* Goodrich Admissions 1, 15, 21, 23 (CX 4A, C-E); RX 320M, P; CX 11B *in camera.* The record indicates that Diamond continues to hold a fifty percent interest in a 220 million pound per year bulk PVC plant in Alberta, Canada. RX 320S-T.

[5] DiLiddo, Tr. 3335; CX 38C *in camera; see* CX 109D, Z4 *in camera.*

[6] DiLiddo, Tr. 3131, 3135–36, 3178–79; CX 8B; CX 38C *in camera.* A joint venture between Goodrich and Bechtel Petroleum was already constructing a chlor-alkali and ethylene dichloride complex at that same location; that facility was completed in 1981. CX 8B; Goodrich Admission 665 (CX 4Z62); DiLiddo, Tr. 3131; CX 38C *in camera.*

tive position to move ahead with our plans.[7]

These developments helped Diamond to conclude that its plastics business would not satisfy new corporate financial [7] targets; it also believed that selling the business would provide capital for expansion in other areas.[8] Diamond therefore organized its plastics business into a new subsidiary, Diamond Shamrock Plastics Corporation ("DSPC"). IDF 7. Several firms expressed interest, and between September 1980 and September 1981 Diamond negotiated most actively with [ ] firm. CPF 1.26 *in camera*. In August 1980 Diamond rejected a Goodrich proposal, in part because it believed that such an acquisition would present antitrust problems. However, Diamond subsequently changed its mind, and in August 1981 began negotiating actively with Goodrich.[9] Although Goodrich believed that Diamond duplicated rather than complemented its own PVC capabilities, with "only a suggestion of synergy," it viewed the acquisition as "an attractive defense against acquisition [of Diamond] by another PVC producer."[10]

In the course of their negotiations Goodrich and Diamond agreed that only Diamond's large commodity grade plant (number 5) would be directly transferred to Goodrich, while Diamond would retain the four Deer Park small reactor specialty PVC plants [8] (numbers 1, 3, 4 and 4X) and operate them for Goodrich.[11] At a meeting on September 9, 1981, Goodrich and Diamond discussed the shutdown of Diamond's remaining plants, and tentatively agreed that the Delaware City plant would be shut down as soon as possible, while the remaining Deer Park plants would be operated for "at least a year."[12] In late September 1981, Diamond and Goodrich reached an agreement in principle on the acquisition. Goodrich Admission 297 (CX 4Z12). In January 1982, Goodrich acquired Diamond's Deer Park plant number

[7] CX 47B; *accord* CX 59D *in camera;* DiLiddo, Tr. 3170–74; CX 49R; CX 56A *in camera;* CX 57C-E *in camera.*

[8] CX 112G-H; CX 541F *in camera;* Diamond Admissions 294, 295, 297 (CX 6M); Becker, Tr. 1342–48; CX 401E; CX 402B; CX 403A-B.

[9] Schaefer, Tr. 1092–93, 1106–07; CX 295Z75–76 *in camera;* Arp, Tr. 3458, 3476.

[10] CX 34A *in camera; see* Klass, Tr. 4963 *in camera.* These statements suggest that the acquisition did not increase efficiency to a significant degree.

[11] CX 60A *in camera;* CX 197B *in camera.*

[12] CX 60A *in camera.* In a September 1981 internal memorandum, Goodrich outlined some of the terms of the transaction as follows:

> DS will operate DP small poly plant for BFG for two years with option to extend a third year. Upon 6 mos. notice BFG can terminate small poly operations. DS & BFG will jointly develop a shutdown plan.

CX 115C, H *in camera.* Respondents argue that this document was "a summary of the key points of the negotiation," rather than a description of the agreement, and that Goodrich and Diamond did not agree that Deer Park plants 1 through 4X would utlimately be shut down. RRF at 14–16, *citing* DiLiddo, Tr. 3198; Schaefer, Tr. 1183; Becker, Tr. 1357–58. However, the document is dated September 11, 1981, and Diamond and Goodrich reached an agreement in principle in late September. In any event, the Delaware City plant was subsequently sold to Ethyl Corporation, rather than shut down. *See* page 10, *infra.*

5, its VCM plant, and certain other assets for $125 million.[13] Goodrich subsequently [9] cancelled its plan to build a VCM plant at Convent, Louisiana, and wrote off the $27 million it had thus far invested in the project as a loss.[14]

Goodrich and Diamond believed that the sale of Deer Park plant number 5 to Goodrich effectively precluded the sale of plants numbers 1, 3, 4 and 4X to another firm, and that these plants would be closed within two years.[15] However, Diamond agreed to toll needed raw materials from Goodrich and use the plants to supply specialty grades of suspension PVC resin for resale by Goodrich.[16] As a result, Goodrich was able to assume responsibility for supplying specialty resins to Diamond's customers.[17] After Goodrich established itself as the supplier for these accounts, and Diamond dissolved its PVC marketing [10] organization, Goodrich shifted the source of supply from plants 1, 3, 4 and 4X to one of its own plants. *See* CX 570B.

After the first year of the tolling arrangement, Goodrich determined to minimize Diamond's suspension PVC production as much as possible, but to continue to take all the suspension PVC Diamond produced until Diamond shut down the remaining Deer Park plants.[18] Goodrich perceived this strategy as

> the only option that keeps Diamond from being a disruptive force in the market place. Since they have no sales force, if we don't take their resin, they will be able to only sell the resin based on price and this could have a devastating effect on overall industry pricing.

CX 117A. In April 1982 Diamond sold its Delaware City PVC plant to Ethyl Corporation, and by December 1983 Diamond had closed or sold all its remaining PVC plants and disbanded its plastics division. IDF 14 *in camera.*

II. SECTION 7 OF THE CLAYTON ACT

Section 7 of the Clayton Act prohibits acquisitions that may substantially lessen competition or tend to create a monopoly; that is,

[13] IDF 10–11 *in camera.* The other assets Goodrich acquired included Diamond's suspension PVC production technology and formulations; its suspension PVC and powder compound inventories; its PVC and VCM railcars; its research and development resources; and various patents. IDF 12 *in camera.* They also included Diamond's Deer Park powder compound plant, which had been used to supply compounded PVC resin to PVC pipe producers. CX 452. As a part of the sales agreement, Diamond also agreed to supply ethylene and chlorine feedstocks to Goodrich—and to manufacture suspension PVC for Goodrich using Goodrich VCM—on an interim basis. IDF 13 *in camera.*

[14] DiLiddo, Tr. 3187–88, 3396.

[15] Schaefer, CX 295 Z97 *in camera;* CX 115C *in camera; see* CX 11J *in camera.*

[16] Under most tolling arrangements, a firm agrees to manufacture product for another firm using raw materials supplied by the other firm. Kienholz, Tr. 845–46.

[17] *See* CX 567; CX 570B.

[18] Beginning in March 1982 Diamond sold over 90 percent of its PVC production to Goodrich, pursuant to the tolling agreement. CX 300Z10 *in camera;* CX 117A-B.

that create a reasonable likelihood of anticompetitive effects.[19] As the Court of Appeals for the Seventh Circuit [11] indicated recently in affirming the Commission decision in *HCA*, the crucial question is

whether the challenged acquisition is likely to hurt consumers, as by making it easier for the firms in the market to collude, expressly or tacitly, and thereby force price above or farther above the competitive level . . . the ultimate issue is whether the challenged acquisition is likely to facilitate collusion . . . the worry is that [the acquisition] may enable the acquiring firm to cooperate (or cooperate better) with other leading competitors on reducing or limiting output, thereby pushing up the market price.[20]

The Court went on to point out:

Section 7 does not require proof that a merger or other acquisition has caused higher prices in the affected market. All that is necessary is that the merger create an appreciable danger of such consequences in the future. A predictive judgment, necessarily probabilistic and judgmental rather than demonstrable . . . is called for.[21]

In short, if an acquisition creates an "appreciable danger" of [12] anticompetitive effects such as supracompetitive prices, then it violates section 7 of the Clayton Act.

III. RELEVANT MARKETS

The first step in determining whether a particular acquisition satisfies the foregoing standard is to delineate the relevant geographic and product markets.[22] As the Supreme Court has indicated,

determination of the relevant market is a necessary predicate to a finding of a violation of the Clayton Act because . . . [s]ubstantiality can be determined only in terms of the market affected.[23] [13]

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[19] *Hospital Corporation of America*, 106 FTC 361, 464 (1985) (*hereinafter HCA*), *aff'd*, 807 F.2d 1381 (7th Cir. 1986), *cert. denied*, __ U.S. __, No. 86-1492 (May 3, 1987); *Echlin Manufacturing Co.*, 105 FTC 410, 483 (1985); *B.A.T Industries, Ltd.*, 104 FTC 852, 919 (1984).

[20] *Hospital Corporation of America v. FTC*, 807 F.2d 1381, 1386 (7th Cir. 1986), *cert. denied*, __ U.S. __, No. 86-1492 (May 3, 1987) (*hereinafter HCA v. FTC*); *accord*, *HCA*, 106 FTC at 477.

[21] *HCA v. FTC*, 807 FTC at 1389 (citation omitted); *accord*, *United States v. General Dynamics Corp.*, 415 U.S. 486, 505 (1974); *HCA*, 106 FTC at 499 ("actual anticompetitive effects need not be shown; an acquisition is unlawful if such an effect is reasonably probable").

[22] As the Commission has noted, one could arrive at relatively precise estimates of market power—without proceeding through the market definition-market structure paradigm—if one could measure "all relevant demand and supply elasticities." *Federal Trade Commission Statement Concerning Horizontal Mergers*, 2 Trade Reg. Rep. (CCH) ¶ 4516 (June 14, 1982) (*hereinafter FTC Statement*), at 6901-3. However, as the Commission has also noted, such evidence "is rarely, if ever, available, and is not readily susceptible to direct measurement." *Id. But see* Baker and Bresnahan, *The Gains From Merger or Collusion in Product-Differentiated Industries*, 33 J. Indus. Econ. 427 (1985) (direct assessment of market power through residual demand curve estimation).

[23] *United States v. E.I. duPont de Nemours & Co.*, 353 U.S. 586, 593 (1957); *accord United States v. Marine Bancorporation*, 418 U.S. 602, 618 (1974); *Brown Shoe Co. v. United States*, 370 U.S. 294, 324 (1962); *Domed Stadium Hotel, Inc. v. Holiday Inn, Inc.* 732 F.2d 480, 491 (5th Cir. 1984); *Weyerhaeuser Co.*, 106 FTC 172, 274 (1985); *American Medical International*, 104 FTC 1, 190-191 (1984) (*hereinafter AMI*).

A. *Relevant Geographic Market*

Relevant geographic markets can be delineated by measuring cross elasticities of supply and demand; that is, by determining the degree to which—within a given period of time—price changes in one area will induce changes in the quantities of the relevant product demanded in and supplied from other areas, with all other factors affecting supply and demand held constant.[24] Thus, the Supreme Court has determined that

> [t]he area of effective competition in the known line of commerce must be charted by careful selection of the market area in which the seller operates and to which buyers can practicably turn for supplies.[25]

Consistent with that position, the Commission has determined that "the relevant geographic market must be broad enough that buyers would be unable to switch to alternative sellers in sufficient numbers to defeat an exercise of market power by firms in the area."[26] Similarly, the Department of Justice has concluded that an area is probably a relevant geographic market if a firm or a group of colluding firms within the area could [14] "profitably impose a 'small but significant and nontransitory' increase in price"—in most contexts, a five percent increase lasting one year—without (1) inducing a significant number of buyers to shift to firms outside the area, or (2) inducing a significant number of sellers outside the area to begin selling inside the area.[27] It is often difficult to measure these effects directly, either by calculating cross-elasticities of supply and demand, or by calculating the degree to which firms within the area could in fact exercise market power.[28] Surrogates such as persistent price differences; price change differences; similarities or differences in price movements; impediments to trade, such as transportation costs that are high relative to product value; shipment patterns and transshipment levels; and industry perceptions therefore may be used.[29] Imports that could profitably enter the market within one year in [15] response to a "small but significant and nontransitory" price increase should also

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[24] *Weyerhaeuser Co.*, 106 FTC at 274; *Grand Union Co.*, 102 FTC 812, 1039–40 (1983); *Beatrice Foods Co.*, 101 FTC 733, 836 (1983) (Douglas, Commissioner, and Miller, Chairman, concurring); *FTC Statement*, ¶4516 at 6901–7.

[25] *Tampa Electric Co. v. Nashville Coal Co.*, 365 U.S. 320, 327 (1961); *accord United States v. Philadelphia National Bank*, 374 U.S. 321, 359 (1963).

[26] *HCA*, 106 FTC at 466.

[27] *Justice Department Merger Guidelines*, 2 Trade Reg. Rep. (CCH) ¶4490 *et seq.* (1984) (*hereinafter DOJ Guidelines*) at ¶¶2.11, 2.31.

[28] *But see* Scheffman and Spiller, *Geographic Market Definition Under the United States Department of Justice Merger Guidelines*, 30 J. L. & Econ. 123 (1987) (operationalizes *DOJ Guidelines* market definition algorithm by estimating residual demand elasticities).

[29] *United States v. General Dynamics Corp.*, 415 U.S. 486, 490–91 and n.3 (1974); *Grand Union Co.*, 102 FTC at 1041; *FTC Statement*, ¶4516 at 6901–7; *DOJ Guidelines* at ¶2.32.

be included.[30]

In this case, the parties have stipulated that the United States as a whole is the relevant geographic market (IDF 15), a delineation that is consistent with the record evidence.

B. *Relevant Product Market*

A relevant product market can also be delineated by measuring cross-elasticities of supply and demand; that is, by determining the degree to which—within a given period of time—changes in the price of a given product or service will induce changes in the quantities of a second product or service that are demanded or supplied.[31] Thus, the Supreme Court has concluded that both demand and supply substitutability are relevant to determining the contours of a relevant product market.[32] **[16]** Consistent with that position, the Commission seeks "to define a product or group of products sufficiently distinct that buyers could not defeat an attempted exercise of market power on the part of sellers of those products by shifting purchases to still different products."[33] Similarly, the Justice Department has concluded that a given item constitutes a relevant product if its manufacturer could "profitably impose a 'small but significant and nontransitory' increase in price"—in most contexts, a five percent increase lasting one year—without (1) inducing a significant number of buyers to begin purchasing substitute products, or (2) inducing a significant number of manufacturers of other products to begin producing the product at issue.[34] It is often difficult to measure these effects directly, either by calculating cross-elasticities of supply and demand, or by calculating the degree to which firms within the postulated product market could in fact exercise market power. Surrogates such as distinctive uses or characteristics, industry firm perceptions, and persistent price differences over time may therefore be considered.[35] **[17]**

1. Bulk and Suspension Polyvinyl Chloride

PVC is manufactured from ethylene, a petroleum compound, and chlorine.[36] These chemicals are first converted into ethylene dichlo-

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[30] *See, e.g., HCA*, 106 FTC at 466–467. On the other hand, imports that could profitably enter the market within twelve months to two years are treated as new entry under the DOJ Guidelines. *DOJ Guidelines* at ¶ 3.3. Here, in view of the parties' stipulation that the United States constitutes the relevant geographic market, we consider respondents' arguments concerning the impact of imports in our analysis of entry conditions. *See* pages 36–38, 42–43, *infra*.

[31] *Grand Union Co.*, 102 FTC at 1039–40; *Beatrice Foods Co.*, 101 FTC at 830 (Douglas, Commissioner, and Miller, Chairman, concurring); *FTC Statement*, ¶ 4516 at 6901–6.

[32] *Brown Shoe Co. v. United States*, 370 U.S. 294, 325 and n.42 (1962); *United States v. Columbia Steel Corp.*, 334 U.S. 495, 510–511 (1948); *see also United States v. E. I. duPont de Nemours & Co.*, 351 U.S. 377 (1956).

[33] *HCA*, 106 FTC at 464, 466.

[34] *DOJ Guidelines* at ¶2.11.

[35] *Grand Union Co.*, 102 FTC at 1041; *FTC Statement*, ¶4516 at 6901–6 through 6901–7; *DOJ Guidelines* at ¶2.12.

[36] Chlorine is produced by applying an electrical current to brine; the process yields one pound of chlorine to 1.1 pounds of caustic soda. Chlorine is highly volatile and corrosive, and therefore cannot be stored economically.

(footnote cont'd)

ride, which is then "cracked" to produce vinyl chloride monomer ("VCM"). VCM molecules are then linked into chains ("polymerized") by heating them in the presence of certain catalysts. IDF 17, 19. Approximately 85 percent of all PVC manufactured in the United States is classified as "suspension PVC." IDF 21; Disch, Tr. 627–28. It is produced by adding suspension agents to VCM, in the presence of water and catalysts, thereby producing large PVC particles while using smaller amounts of energy than other processes require. IDF 21; Disch, Tr. 627–29. Approximately 5 percent of all PVC manufactured in the United States is classified as "bulk PVC." It is produced by polymerizing VCM without adding any liquids, producing a purer product suitable for end use applications requiring greater optical clarity, such as packaging materials.[37] [18]

When combined with other ingredients, such as stabilizers, plasticizers or impact modifiers,[38] PVC resin can be used to manufacture a wide variety of products, including pipe and pipe fittings, wire and cable insulation, packaging film for meat and produce, vinyl siding, floor tile, bottles, medical and surgical tubing, records, and vinyl window frame components. IDF 18 *in camera.* In 1981, approximately 5.242 billion pounds of PVC were produced for domestic consumption; by 1983 that total had increased to 5.635 billion pounds.[39] During the 1981–1983 period, approximately 43 to 44 percent of total PVC resin consumed was used to produce pipe and pipe fittings;[40] 20 to 25 [19] percent was used to produce calendered products;[41] 10 percent was used in wire and cable applications (IDF 147); and 6 to 7 percent was used for packaging film and sheet.[42]

RPF 45, 46. Ethylene is manufactured by cracking petroleum feedstocks such as ethane, propane, butane or naptha. RPF 49.

[37] IDF 23; Disch Tr. 629, 633. The remaining 8 to 10 percent of PVC manufactured in the United States is produced through a "dispersion process," in which emulsifying agents are used, in conjunction with an expensive spray drying process, to produce very small PVC particles. IDF 22; Disch, Tr. 630. The complaint also alleged a violation in the dispersion PVC market, but complaint counsel elected not to pursue—and presented no evidence concerning —that allegation at trial. ID at 2 n.2. Bulk and suspension PVC resins have "quite different" applications than dispersion resins. Disch, Tr. 634. In order to simplify the discussion, the term "PVC" in this opinion refers to bulk and suspension PVC, and not to dispersion PVC.

[38] These ingredients are added to PVC resins to produce PVC compounds, which are used in turn to manufacture PVC end use products. Disch, Tr. 655–58.

[39] *See* Tables I and II, *infra.*

[40] IDF 99; Disch, Tr. 663. This end use includes municipal water pipe (200 million pounds of PVC resin in 1983); rural water pipe (340 million pounds); water services and distribution pipe (260 million pounds); sewer and drain pipe (480 million pounds); drain, waste and vent pipe (450 million pounds); irrigation pipe (150 million pounds); communications duct (280 million pounds); and electrical conduit (120 million pounds). IDF 109, 121, 123, 127, 133, 138, 142, 144 (amounts *in camera*).

[41] IDF 190. Calendered products are produced through "calendering," in which large heated rolls are used to produce wide sheets of PVC material. Rigid calendered sheet is used to manufacture rigid products such as decorative laminates and credit card stock. Flexible calendered sheet is used to manufacture more flexible products such as wall coverings, upholstery, automotive interiors and landau tops, luggage, wallets, raincoats, footwear, and a variety of other products. IDF 190 and ID at 58 n.40.

[42] IDF 152. The remaining approximate percentages of the total over the 1981–1983 period were devoted to vinyl siding and accessories (5 percent); floor tile (3–4 percent); bottles (3–4 percent); medical applications (2 percent); phonograph records (2–3 percent); and windows (1 percent). IDF 154, 165, 169, 179 (and Table I), 185, 189 (and Table I) (percentages *in camera*); Disch, Tr. 664.

The parties have stipulated that the production of bulk and suspension PVC is a relevant product market (IDF 16), a delineation that is consistent with the record evidence. Firms that currently purchase PVC resin to manufacture PVC end use products cannot substitute other inputs in response to a small increase in PVC resin prices; there are simply no substitutes for PVC resin as an input to produce these products.[43] Moreover, firms producing other products are unlikely to switch to producing PVC in response to a small increase in PVC resin prices, because the machinery needed to produce PVC is [20] essentially unique to that application. *See* Disch, Tr. 663.

2. Vinyl Chloride Monomer

VCM is a "gaseous, reactive, acyclic intermediate chemical" under atmospheric temperature and pressure.[44] It is produced by thermally cracking purified ethylene dichloride at high temperatures. Ethylene dichloride is produced, in turn, by either oxyhydrochlorinating or directly chlorinating ethylene. IDF 32; Kienholz, Tr. 757–58. Approximately 0.6 pounds of chlorine and 0.49 pounds of ethylene are used to manufacture one pound of VCM. CPF 2.18 *in camera;* RPF 41 *in camera.* Small amounts of VCM are used to produce other plastics, but over 95 percent of the VCM consumed in the United States is used to manufacture PVC. IDF 31. Approximately 1.02 to 1.04 pounds of VCM are required to manufacture one pound of PVC. Kaserman, Tr. 2456. A substantial amount of processing—accounting for approximately 37 to 45 percent of the cost of producing PVC—is required to convert VCM into PVC.[45] In 1981, 6.856 billion pounds of VCM were produced for domestic consumption; by 1983 that total had increased to 7.033 billion pounds.[46]

Complaint counsel argue—and Judge Howder agreed—that VCM constitutes a relevant product market. IDF 16; CAB at 7 and [21] n. 11; CRB at 53–56. Respondents agree that "VCM is a product without substitutes, produced by distinct companies utilizing unique facilities." RPF 228 *in camera.* They argue, however, that VCM is not a relevant market "that could be subject to the exercise of market power" because VCM's only utility is in the manufacture of PVC and because VCM is "virtually fully integrated" into PVC by ownership or long term contracts. As a result, according to the respondents, "VCM and PVC producers are engaged in a single business, with the price of PVC determining revenues for all participants."[47]

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[43] There are, of course, substitutes for the end products made from PVC resin. They are discussed in detail in Part IV.C.2.a., *infra.*

[44] IDF 30. VCM is normally stored and transported as a liquid under pressure. L. Wheeler, Tr. 917.

[45] *See, e.g.,* RX 1213H *in camera.*

[46] *See* Tables IV and V, *infra.*

[47] RAB at 57. However, the respondents' economic expert testified that VCM "may likely meet" the *DOJ Guidelines* criteria for a market "and thus is a market definition concept that I can work with." Klass, Tr. 4473–74.

We conclude that VCM is a relevant product market for the purpose of Section 7 analysis. Even if the respondents' analysis were to apply if VCM and PVC were completely integrated, the record shows that the degree of vertical integration by ownership between VCM and PVC is neither complete nor symmetrical. IDF 78. Before the Goodrich acquisition, nonintegrated producers accounted for 46.9 percent of VCM practical production capacity and approximately 44.6 percent of PVC practical production capacity.[48] Accordingly, there is a market in which VCM is bought and sold that could be subject to the exercise of market [22] power. The long term VCM supply contracts to which the respondents refer typically give the firms they cover independent discretion as to the quantity they will buy or sell, and their customers and sources of supply.[49] Moreover, under most VCM supply contracts, neither the price nor the quantity is fixed; instead, both are subject to negotiation on a frequent basis. In addition, contract prices are often closely tied to VCM market prices by meeting competition clauses or specific references to competitors' VCM prices. Furthermore, even firms that are vertically integrated by ownership participate in the VCM market from time to time as either buyers or sellers of VCM, through sales, purchases and exchanges keyed to the market price of VCM. IDF 296–301 *in camera.*

From the perspective of the demand and supply elasticity analysis outlined above, the Commission therefore has concluded that VCM should be classified as a separate product market. A small increase in VCM prices is not likely to induce a significant increase in the quantity of a competing product that is demanded, because there are no substitutes for VCM, which must be used in fixed proportions to produce PVC.[50] In fact, one Goodrich document describes demand for VCM as "absolutely [23] inelastic."[51] Moreover, a small increase in VCM prices is not likely to induce producers of other products to switch to supplying VCM; no plants currently producing other products could be shifted into VCM production.[52] Thus, a group of colluding firms in the VCM market could sustain a price increase of at least five percent for at least one year.

As noted *supra,* a number of PVC producers—including Goodrich and Diamond at the time of the acquisition—also produce VCM. The Commission has determined that "captive production" of this type

[48] *See* Table VII, *infra.* In *Weyerhaeuser Co.*, 106 FTC 172, 271 (1985), the Commission found that corrugating medium was a relevant product market, even though only 12 percent of corrugating medium consumed was sold on the open market.

[49] For example, under a contract between Shell and Tenneco, Tenneco may resell any or all of the VCM it purchases from Shell; Shell may sell VCM to other firms; Tenneco may buy VCM from other firms; and Shell controls the factors that determine contract prices. Disch, Tr. 703–04, 726–27.

[50] Kaserman, Tr. 2456; L. Wheeler, Tr. 919 *in camera.*

[51] Lefebvre, CX 296Z *in camera.*

[52] Klass, Tr. 4706–07; Kaserman, Tr. 2455–56; Kienholz, Tr. 821; L. Wheeler, Tr. 990.

should ordinarily be treated as part of the relevant product market in merger cases when, as the Justice Department has suggested, a "small but significant and nontransitory" price increase is likely to induce vertically integrated firms to increase production of the relevant product, either for outside sales or to increase their own downstream sales.[53]

Under this standard, internally consumed VCM should be treated as part of the VCM market. Integrated VCM producers could respond to VCM price increases initiated by nonintegrated producers by [**24**] increasing VCM production, either for sale or for producing additional quantities of PVC.[54] VCM producers consider both independent and integrated VCM producers to be competitors in supplying PVC producers, and PVC producers secure VCM from both integrated and nonintegrated sources.[55] Any effort among nonintegrated VCM producers to collude could not succeed without the cooperation or acquiescence of integrated producers.[56]

IV. STRUCTURAL FACTORS

The foregoing discussion establishes that the PVC market and the VCM market are relevant product markets, and that the United States is the relevant geographic market. The next step is to determine whether the acquisition at issue may substantially lessen competition by facilitating collusive conduct (or other anticompetitive behavior) among the firms remaining in the industry. As the Commission has stated, the legal analysis of horizontal mergers " 'has focused on the extent to which the mergers . . . enhance the ability of firms to collude, either [**25**] expressly or tacitly.' "[57] The Seventh Circuit has confirmed that the issue is

> whether the challenged acquisition is likely to facilitate collusion . . . the worry is that [the acquisition] may enable the acquiring firm to cooperate (or cooperate better) with other leading competitors in reducing or limiting output, thereby pushing up the market price.

HCA v. FTC, 807 F.2d at 1386.

The effective coordination of price and output strategies requires developing a consensus concerning price and output levels, and a

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[53] *B.A.T Industries, Ltd.*, 104 FTC at 934, *citing DOJ Guidelines* at ¶2.23; *accord Spectrofuge Corp. v. Beckman Instruments, Inc.* 575 F.2d 256, 278 (5th Cir. 1978), *cert. denied*, 440 U.S. 939 (1979); *International Tel. & Tel. v. General Tel. & Elecs. Corp.*, 518 F.2d 913, 930 (9th Cir. 1975). *But see Grumman Corp. v. LTV Corp.*, 665 F.2d 10, 13–14 (2d Cir. 1981).

[54] Kaserman, Tr. 2456–59.

[55] L. Wheeler, Tr. 932 *in camera;* Kienholz, Tr. 786, 856–57; Klass, Tr. 3998, 4008; Taylor, Tr. 1563–65, 1623.

[56] Kaserman, Tr. 2458–59; *see* Klass, Tr. 4049–52.

[57] *Weyerhaeuser Co.*, 106 FTC at 273–274, *quoting FTC Statement*, ¶4516 at 6901–2. This case does not involve the alternative situation in which an acquisition permits a single firm to acquire or enhance market power approaching monopoly proportions.

means of enforcing its terms.[58] The first step requires harmonizing the incentives of participating firms and mitigating firm uncertainty concerning rival firms, so that they can effectively coordinate their behavior.[59] The second step requires creating circumstances in which the prospective value to each participating firm of cheating on the consensus does not [**26**] exceed the prospective loss from rival firm retaliation.[60] In order to create and maintain these circumstances, participating firms must be able to monitor rival firm conduct; that is, they must be able to detect cheating on the consensus. They must also be able to retaliate effectively if and when cheating occurs.

Structural conditions within an industry are crucially important to determining the feasibility of collusion, and consequently to determining whether a particular merger or acquisition is likely to have anticompetitive effects. An industry in which an acquisition is most likely to have anticompetitive effects will be characterized by the following attributes: (1) relatively high barriers or impediments to entry; (2) a relatively high level of concentration; (3) a low level of product differentiation, and a low level of geographic differentiation occasioned by transportation cost differences; (4) a relatively inelastic demand for industry output at competitive price levels; (5) insignificant intra-industry differences in cost functions; (6) a large number of small buyers; (7) a high degree of transaction frequency and visibility; and (8) relatively stable and predictable demand and supply conditions.[61] Not all of these criteria need to be [**27**] satisfied in order to establish that an acquisition may substantially lessen competition, but they are all relevant to one degree or another. This part of the Opinion analyzes each of these factors in detail. In addition, it evaluates the competitive significance of vertical integration between the VCM and PVC markets.

A. BARRIERS AND IMPEDIMENTS TO ENTRY

The absence of barriers or impediments to entry makes it highly unlikely that a merger or acquisition will have anticompetitive effects, because any effort to extract supracompetitive prices and profits

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[58] *See, e.g.*, R. Posner, *Antitrust Law: An Economic Perspective* 51 (1976); Salop, *Practices That (Credibly) Facilitate Oligopoly Coordination*, in *New Developments In the Analysis of Market Structure* (J. Stiglitz and G. F. Mathewson eds. 1986); Hay, *Oligopoly, Shared Monopoly, and Antitrust Law*, 67 Cornell L. Rev. 439, 445 (1982); Clark, *Price-Fixing Without Collusion: An Economic Analysis of Facilitating Practices After Ethyl Corp.*, 1983 Wis. L. Rev. 887, 891 (1983).

[59] *E.g.*, Clark, *supra* note 58, at 892.

[60] *E.g., id.* at 893.

[61] *See, e.g., Ethyl Corp.*, 101 FTC 425, 602–03, 607–09 (1983), *rev'd on other grounds sub nom. E.I. du Pont de Nemours & Co. v. FTC*, 729 F.2d 128 (2d Cir. 1984); *FTC Statement* ¶4516 at 6901 through 6901–5; *DOJ Guidelines* at ¶3.2; Posner, *supra* note 58, at 55–61; P. Areeda, *Antitrust Analysis* ¶262 (1981); F. Scherer, *Industrial Market Structure and Economic Performance* 171–72 (2d ed. 1980); G. Stigler, *The Organization of Industry* 39–45 (1968); Markham, *The Nature and Significance of Price Leadership*, 41 Amer. Econ. Rev. 891, 901–03 (1951); Clark, *supra* note 58, at 894–99. *See generally United States v. Citizens & Southern National Bank*, 422 U.S. 86, 120–22 (1975); *United States v. General Dynamics Corp.*, 415 U.S. 486, 503–05 (1974).

will induce new entry, which will reduce prices to competitive levels. Even if new entrants are willing to participate in an ongoing effort to coordinate price and output levels, accommodating their conflicting incentives is likely to be difficult. The Supreme Court has therefore recognized that an evaluation of the likely competitive effects of an acquisition should include an appraisal of the potential for competition from firms not currently in the relevant market. For example, in *United States v. Falstaff* [28] *Brewing Corp.*, the Court noted that although Falstaff did not currently sell the relevant product in the relevant geographic market, it clearly possessed the potential to enter relatively easily, and therefore constrained the pricing discretion of incumbent firms.[62]

For similar reasons, the Commission has concluded that in the absence of barriers or impediments to entry, an acquisition cannot have anticompetitive effects, and therefore cannot violate Section 7 of the Clayton Act.[63] The Justice Department has taken the same position:

> If entry into a market is so easy that existing competitors could not succeed in raising price for any significant period of time, the Department is unlikely to challenge mergers in that market. [29] *DOJ Guidelines* at ¶3.3. By contrast, high entry barriers "increase the probability that market power will result from an acquisition."[64] The Commission has defined entry barriers as additional long-run costs that must be incurred by an entrant, but that were not incurred by incumbent firms.[65] The Commission has noted that a long-run cost differential could create "a permanent barrier to new entry" that would permit incumbent firms to secure supracompetitive prices and profits indefinitely.[66] Governmental restrictions may create such a barrier,[67] and environmental regulations represent an example.[68] The Commission has determined that the relevant costs for comparison purposes [30] are the "economic costs measured at the time of entry;" that is, the costs that each firm—whether an incumbent or a

[62] *United States v. Falstaff Brewing Corp.*, 410 U.S. 526, 531–34 (1973); *accord FTC v. Procter & Gamble Co.*, 386 U.S. 568, 581 (1967); *United States v. Penn-Olin Chemical Co.*, 378 U.S. 158, 173–74 (1964); *see also United States v. Philadelphia National Bank*, 374 U.S. at 367 and n. 44.

[63] *Echlin Manufacturing Co.*, 105 FTC at 484, 487; *accord United States v. Waste Management, Inc.*, 743 F.2d 976, 981–984 (2d Cir. 1984); *United States v. Calmar Inc.*, 612 F. Supp. 1298, 1305 (D.N.J. 1985); *United States v. Tracinda Investment Corp.*, 477 F. Supp. 1093, 1108 (C.D. Cal. 1979); *United States v. M.P.M., Inc.*, 397 F. Supp. 78, 92, 94 (D. Colo. 1975); *HCA*, 106 FTC at 489; *FTC Statement*, ¶ 4516 at 6901–3 ("if entry barriers are very low it is unlikely that market power, whether individually or collectively exercised, will persist for long."); *see B.A.T Industries, Ltd.*, 104 FTC at 919; *Grand Union Co.*, 102 FTC at 1063. Hence, in evaluating the prospect of anticompetitive effects from a particular acquisition, the Commission must first determine whether any barriers or impediments to entry make the sustained exercise of market power feasible.

[64] *Grand Union Co.*, 102 FTC at 1063–64; *accord FTC Statement*, ¶4516 at 6901–3.

[65] *Echlin Manufacturing Co.*, 105 FTC at 485, *citing, e.g.*, G. Stigler, *supra* note 61 at 67; *accord HCA*, 106 FTC at 491; *Weyerhaeuser Co.*, 106 FTC at 286. In the rest of this opinion, the term "barriers to entry" is intended to refer to "Stiglerian" barriers to entry.

[66] *Echlin Manufacturing Co.*, 105 FTC at 485–86.

[67] For example, in *HCA* the Commission noted that both Georgia and Tennessee required prospective or incumbent hospitals to secure "certificates of need" from their respective States before, *inter alia*, establishing new acute care hospitals, expanding the bed capacity of existing hospitals, changing the services they offered, or making significant capital expenditures. *HCA*, 106 FTC at 489–91. Securing these certificates required following elaborate, time-consuming procedures, and the Commission concluded that these procedures represented a classic barrier to entry. *Id.* at 491.

[68] *Weyerhaeuser Co.*, 106 FTC at 287.

prospective entrant—confronts at the time of its entry effort.[69]

Impediments to entry that do not rise to the level of absolute barriers to entry may nevertheless permit the exercise of market power for substantial periods of time. The Commission has defined impediments to entry as

any condition that necessarily delays entry into a market for a significant period of time and thus allows market power to be exercised in the interim.[70]

The Commission has more recently indicated that when new entry is possible only through the construction of a plant that cannot be completed in less than four to four and one half years, that constitutes an impediment to entry.[71] The nature of sales [31] contracts within an industry helps to determine the significance of the delay arising from impediments to entry. If most prices are fixed pursuant to contracts with terms longer than the delay occasioned by impediments to entry, then the impediments may have no competitive significance.

As the time and expenditures needed to overcome barriers and impediments to entry increase, the likelihood that a given acquisition will have anticompetitive effects, *ceteris paribus,* increases as well. In this case, both the PVC and the VCM markets are characterized by substantial barriers and impediments to entry, and fringe firms are unlikely to constrain collusive conduct in either market.

1. PVC Market

Under current conditions, four or five years would be required to plan and construct a new bulk or suspension PVC plant, or to expand an existing plant,[72] including one to two years for required environmental permits;[73] at least six months [32] for pre-permit engineering;[74] and two years for actual construction. IDF 65–67; Schaefer, Tr. 1133. Additional time—up to one year—may be needed for prospective entrants to evaluate and secure the technology li-

[69] *Echlin Manufacturing Co.,* 105 FTC at 486. The fact that an incumbent firm confronts lower costs than a prospective entrant at the time the latter firm attempts to enter is not necessarily relevant. The incumbent's lower current costs may simply represent compensation for the risks it overcame when it entered. *Id.*

[70] *Id.* at 486; *accord Weyerhaeuser Co.,* 106 FTC at 286–87. The economic literature on "strategic entry deterrence" suggests that practices that fall within this characterization may also impede entry. *See generally* Salop, *Strategic Entry Deterrence,* 79 Am. Econ. Rev. 335 (Papers and Proceedings) (1979).

[71] *Weyerhaeuser Co.,* 106 FTC at 287. The Commission found that greenfield entry would require four to four-and-one-half years per plant from beginning to end, including the time required for plant development, site selection, design work, applications for environmental permits, and actual construction. *Id.* Nine recent plant expansions in the relevant market indicated, however, that "existing facilities [could] be upgraded fairly easily, and at relatively low cost." *Id.* at 287–88. The Commission therefore concluded that the consequent "possibility of expanded output by fringe firms" limited "the possibility of anticompetitive behavior." *Id.* at 289. In this case, by contrast, barriers and impediments to both greenfield entry and incumbent plant expansion are high.

[72] IDF 64; CX 15A; CX 16B-Z10 *in camera;* CX 196A *in camera;* CX 439B; CX 446C; *see* Disch, Tr. 653 (3–4 years).

[73] Schaefer, Tr. 1133; CX 38V *in camera;* CX 506B, 592 *in camera;* IDF 66.

[74] DiLiddo, Tr. 3337; IDF 67.

censes needed to begin PVC production.[75] Because these factors necessarily delay entry into the PVC market for a substantial period of time, they constitute a substantial impediment to entry. Moreover, because some of the environmental regulations were adopted recently —and have significantly increased the length of time required to enter the PVC market—they constitute a significant barrier to entry.

The environmental restrictions constrain both new entry and expansion by incumbent firms. Air emissions from PVC and VCM plants are subject to a number of air quality restrictions created pursuant to the Clean Air Act, 42 U.S.C. 7401–7642, including specific standards covering vinyl chloride emissions.[76] Therefore, preconstruction permits must be obtained for all new [33] PVC plants, and for major expansions of existing plants, certifying that they will comply with a variety of "Prevention of Serious Deterioration" ("PSD") regulations.[77] The PSD regulations are relatively restrictive in areas that currently meet federal air quality standards—requiring, *inter alia*, preconstruction permits[78]—and even more restrictive in areas that do not currently meet those standards.[79] Moreover, in 1980 EPA amended its PSD regulations to require the presentation of continuous air monitoring data *prior* to the processing of a permit application. Diamond estimated that this requirement

> 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.

CX 446D. Tenneco similarly estimated that one year of ambient air quality monitoring would probably be required before the submission of a preconstruction permit application. CX 574J.

In addition, effluent discharges from VCM and PVC resin 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. The EPA has specifically designated vinyl chloride as a toxic pollutant, 33 U.S.C. 1317; 40 C.F.R. 401.15, and [34] PVC plants as pollutant discharge point sources.[80] As a result, new and existing PVC manufacturing facilities must comply with the permit requirements of the National Pollutant Discharge Elimination System. 33 U.S.C. 1342.

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[75] Disch, Tr. 645–47; Schaefer, Tr. 1133; IDF 69.

[76] *National Emissions Standard for Vinyl Chloride,* 40 C.F.R. §§ 61.60–61.68, promulgated pursuant to the *National Emission Standard for Hazardous Air Pollutants,* 42 U.S.C. § 7412. Vinyl chloride has been specifically designated as an environmental pollutant; as a result, in 1976 the Environmental Protection Agency promulgated a standard to reduce atmospheric VCM emissions. In 1975, the Occupational Health and Safety Administration determined that VCM is a highly specific cause of liver cancer, and therefore promulgated a standard to reduce worker exposure to residual VCM. Disch, Tr. 649; Kienholz, Tr. 755.

[77] *Prevention of Significant Deterioration,* 40 C.F.R. §§ 51.24(b)(23), 52.21(b)(23).

[78] 42 U.S.C. §§ 7407, 7475; 40 C.F.R. §§ 51.24, 52.21.

[79] 42 U.S.C. §§ 7501–7508; 40 C.F.R. § 52.24.

[80] 33 U.S.C. § 1316(B)(1)(A); *see* 40 C.F.R. §§ 401.12, 416.10–416.15.

PVC plants may also be subject to a variety of local regulations such as land use restrictions. IDF 66; ID at 18 n.13.

These requirements have significantly lengthened the lead time and increased the risk associated with new plant construction and plant expansion since 1976. In one internal document, Goodrich noted:

> Complicating the development and implementation of new processes is the long lead time required for plant expansions and constructing grass root PVC plants. *This is now four to five years vs. the three years formerly required* due to the increasing number of local and federal restrictions and necessary approvals. The result is R&D's time table to freeze a plant design is drastically shortened . . . By-passing stages in process development to meet the shorter time tables will significantly increase the risks of long costly plant start-ups and not meeting planned capacity goals.[81]

Recent plant construction efforts confirm these assessments. For example, Formosa—which already had access to the production technology it needed—began a new PVC/VCM plant [**35**] construction effort in the latter part of 1978, and was not able to start operating the new facility until December, 1982. IDF 70; ID at 20 n. 15. When Goodrich began its never-completed Convent, Louisiana suspension PVC plant project in July 1979, it had already spent eight months conducting an extensive PVC/VCM strategy and site selection study, and did not expect to bring the plant onstream until the third quarter of 1983. IDF 71. Similarly, in 1981 Diamond projected the lead time for a new suspension PVC plant at Deer Park, using its own technology, to be four to five years "from concept to startup." IDF 72.

In short, newly adopted environmental restrictions may be characterized as a barrier to entry into the PVC market. They substantially slow both the construction of new capacity and the expansion of existing capacity, and represent a new cost that incumbent firms did not have to bear. Some expansion of existing facilities by large incumbent firms has occurred since 1970. However, expansion usually constrains the pricing discretion of incumbent firms only if it is undertaken by a fringe firm that is not likely to be a party to a collusive arrangement.[82] The number of firms that may be characterized as "fringe" PVC producers has been declining steadily. As Tables I and II indicate, in addition to Diamond Shamrock, three fringe firms—Stauffer Chemical, Talleyrand Chemicals, and Great American Chemical—left the PVC market between 1981 and 1983. [**36**]

Goodrich and other incumbent firms have on a number of occasions recognized that entry into the PVC market is difficult. In one internal

[81] CX 196A *in camera* (emphasis added); *accord* CX 14F *in camera* ("Building permits are being delayed by government regulations, causing longer lead times and/or higher RISKS to build new plants.").

[82] *Weyerhaeuser Co.*, 106 FTC at 287–88 and n.69.

assessment, Goodrich concluded that "[r]elatively high barriers to entry should prevent a large number [of] expansions or new entries."[83] Actual entry experience supports this view; no *de novo* entry has occurred since 1975.[84] Mr. Disch of Tenneco testified that he did not expect any new entrants into the PVC market over the next three or four years.[85] **[37]**

Of course, PVC imports are not constrained by domestic environmental restrictions, and they have increased to some degree over the last few years. In 1977, imports represented only 0.6 percent of U.S. bulk and suspension PVC consumption; in 1984 they accounted for approximately 4 percent of that total.[86] Much of the increase in imports, however, appears to be attributable to extraordinary events affecting domestic PVC supply and currency exchange rates. The dollar increased in value by 66 percent between the third quarter of 1980 and the third quarter of 1984,[87] producing, *ceteris paribus,* a 66 percent increase in domestic PVC prices, in comparison with foreign PVC prices. Even if these exchange fluctuation effects are not considered, domestic prices increased considerably more during the last part of that period than the 5 percent increase that is usually applied to define the relevant market, because freezing weather conditions during the 1983–1984 winter forced several domestic PVC plants to shut down.[88] Thus, imports are a small **[38]** proportion of domestic PVC consumption and, absent extraordinary conditions, do not appear to constrain domestic prices.

In addition, PVC imports manufactured by domestic producers in other countries are unlikely to constrain collusion among those same domestic producers. Canada and Mexico are the principal sources of PVC imports.[89] Goodrich is the largest PVC producer in Canada,[90]

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[83] CX 199Z76; *accord* CX 199Z82; CX 248E *in camera.*

[84] Kaserman, Tr. 2341–44; CX 664G, W *in camera.* Respondents argue that Formosa entered in 1974, "exited and then reentered in 1981" (RAB at 53), but Formosa's efforts are more akin to an expansion than to *de novo* entry.

[85] Disch, Tr. 692–93. At least two other factors may impede efforts to enter the PVC market to some degree. First, an entry effort at minimum efficient scale would apparently require at least 300 million pounds of annual production capacity, at a cost of $100 million. IDF 60; Schaefer, Tr. 1211–12; Diamond Admission 450 (CX 6S). In 1981 that represented 5.8 percent of total PVC production in the United States. *See* Table I, *infra.* It would be difficult to secure that percentage of total market sales without provoking a price response from incumbent firms. *See* Salop, *Measuring Ease of Entry,* 31 Antitrust Bulletin 551 (1986).

Second, sunk costs may represent an impediment to new entry. IDF 63; *see* IDF 73–75. PVC plants are suitable only for manufacturing PVC, and investing in such a plant therefore entails the risk of losing the entire investment. One might ordinarily conclude that incumbent firms faced precisely the same risks when they entered the PVC industry. However, Goodrich believed that its "preemptive strategy" heightened the risks associated with expansion or new entry into the PVC market. *See* CX 47B; CX 59D *in camera; see generally* Salop, *supra* note 70.

[86] RAB at 33 (240 million pounds is 4 percent of estimated domestic consumption of 5.635 billion pounds (*see* Table II, *infra*) in 1983).

[87] *Compare* CX 776E *with* CX 777E. The value of the dollar against other currencies—as measured by the Federal Reserve Board's index of weighted average exchange value—has more recently declined, producing the opposite effect, and making import prices less attractive relative to domestic prices.

[88] Kaserman, Tr. 2249–50; L. Wheeler, Tr. 986–89; DiLiddo, Tr. 3380–81; H. Wheeler, Tr. 1775–76.

[89] Kaserman, Tr. 2248; Taylor, Tr. 1687.

[90] Kaserman, Tr. 2248; CX 299 O-P *in camera;* RX 190D; *see* CX 92K.

and is a major PVC producer in Mexico.[91] Furthermore, PVC imports from overseas countries must be transported over water in bags, rather than in rail tank cars, at a cost disadvantage—relative to North American PVC—of three to seven cents per pound. H. Wheeler, Tr. 1776–77. This is a substantial disadvantage; three cents per pound represents 9 to 18 percent of the average selling price of "general purpose PVC resin"—17 cents to 35 cents per pound—during the 1981–1983 period. *See* note 179 *infra.* For all of these reasons, we conclude that PVC imports do not significantly constrain domestic pricing discretion.

2. VCM Market

The VCM market is also characterized by a substantial barrier and impediment to entry created by plant construction requirements, and an impediment to entry created by minimum scale requirements. First, substantial lead time—from four to five [**39**] years—is required to construct a new VCM plant, or to expand an existing plant, including six months to perform required preliminary engineering work; one to two years to secure needed environmental permits (the same ones noted in the PVC discussion, *supra*); six months to evaluate and secure needed VCM manufacturing technology; and one to two years for actual construction. IDF 272–277 *in camera;* Kienholz, Tr. 803–05. For example, as detailed *supra,* it took Formosa—which already had the requisite manufacturing technology in hand—about four and one-half years to construct its PVC/VCM complex. IDF 278. Similarly, Goodrich expected its proposed VCM plant in Louisiana to require approximately four years for construction. IDF 279 *in camera.* Incumbent firms confronted shorter timetables than prospective new entrants would confront now. As noted *supra,* in 1980 the Environmental Protection Agency amended its regulations to require air quality monitoring *prior* to filing permit applications. Diamond and Tenneco documents indicate that this additional requirement would add at least one year to the time needed to construct new plants, or to add capacity to existing plants where continuous air monitoring is not already in effect.[92]

Second, substantial minimum efficient scale requirements are likely to impede entry into the VCM market. If a new entrant must achieve a sales level that is a substantial percentage of [**40**] total industry output—in order to avoid suffering a significant cost disadvantage relative to other firms—its entry will increase industry supply significantly. If demand does not increase to the same degree, prices are likely to fall, because incumbent firms are more likely to

[91] Kaserman, Tr. 2249; CX 299 O-P *in camera; see* CX 92K.

[92] CX 446D; CX 574J; CRB at 40–41 n. 53; *see also* Kienholz, Tr. 803–04.

lower prices than to surrender market share. Faced with the prospect of either a substantial cost disadvantage or nonrenumerative prices, a prospective entrant is not likely to enter.

The minimum efficient scale for a VCM plant is generally considered to be 800 million to 1 billion pounds in annual production capacity.[93] When it built its billion pound VCM plant in the 1970's, Diamond "considered it essential to build a plant with a production capacity of one billion pounds of VCM per year" (CX 424B; *accord* CX 445), and estimated that plants 2/3 and 1/3 as large would respectively suffer cost disadvantages of 0.6 cents and 1.8 cents per pound. CX 445. A Georgia Pacific plant completed in 1980 similarly has a production capacity of 1 billion pounds. The plant that Formosa completed in 1982 has a capacity of 529 million pounds, but it was sized to match an existing PVC plant on the site, and Formosa was willing to [41] sacrifice some efficiency in order to avoid the costs associated with marketing surplus VCM.[94]

In 1981, prior to the acquisition, 6.856 billion pounds of VCM were produced in the United States. Minimum efficient plant scale (eight hundred million pounds) therefore represented about 11.7 percent of total United States VCM production in that year.[95] It is unlikely that a new entrant could secure that level of sales without provoking a substantial response from incumbent firms, thereby driving prices to lower levels. Indeed, one industry document indicated that VCM "capacity additions [are] disruptive to entire industry because efficient plant size is 1 billion pounds (10% of total U.S. industry size)." RX 90Z62 *in camera; accord,* L. Wheeler, Tr. 991. One witness—a Goodrich employee—testified that a new entrant with a new plant would need to "cut prices very substantially and over a long period of time."[96] [42]

The foregoing analysis establishes that environmental restrictions adopted in 1980 represent a significant barrier to entry into the VCM market, and that the four to five years currently required to construct

[93] IDF 268 *in camera;* Kaserman, Tr. 2472–73; L. Wheeler, Tr. 928; DiLiddo, Tr. 3290; Taylor, Tr. 2563; *but see* Disch, Tr. 858–859 (350 million to 500 million pounds). In 1981, Goodrich concluded that a "world scale" plant would have a capacity of one billion pounds. CX 44A *in camera.*

[94] Goodrich believed that Formosa might later expand that facility to bring it up to "world scale." RX 153T *in camera.*

[95] *See* Table IV, *infra.* By comparison, minimum efficient scale for PVC plants is considerably lower, representing less than 6 percent of PVC production. *See* note 85, *supra.*

[96] DiLiddo, Tr. 3255–56. Demand growth is not likely to make entry on this scale more feasible. Industry members expect demand for VCM to grow at an annual rate of no more than 3 to 4 percent, approximating the rate of growth of the gross national product. IDF 315–16 *in camera;* Kienholz, Tr. 792. Moreover, incumbent firms already possess some excess capacity that could be devoted to accommodating demand growth.

The entry-deterring effects of the minimum efficient scale requirements are accentuated by the fact that VCM plants are highly specialized, with no application other than VCM production. IDF 270. Thus, an investment in an unsuccessful entry effort at minimum efficient scale will be completely lost, or "sunk." *See* IDF 270, 271, 280, 281. Both the Commission and the Department of Justice have recognized that entry efforts requiring the investment of substantial sunk costs are less likely to occur. *B.A.T. Industries, Ltd.,* 104 FTC 852, 935 (1984); *DOJ Guidelines* at ¶3.3 n.21.

a new plant or expand an existing plant constitute a substantial impediment to entry. It also establishes that minimum efficient scale —in conjunction with sunk cost effects—represents a substantial impediment to entry into the VCM market. Actual entry experience supports the conclusion that entry into the VCM market would be difficult.[97] [43] It took Formosa four and one-half years to complete its VCM plant, and Goodrich similarly expected its proposed VCM plant to require four years of construction. *See* page 39, *supra.* Imports are not likely to constrain domestic producer pricing discretion. They accounted for only 1.6 percent of the total VCM production of domestic firms in 1981, and only 1.8 percent in 1983. CX 663E *in camera.*

B. Concentration Levels

As the number of firms in an industry declines, and industry concentration increases, *ceteris paribus,* it becomes easier for those firms to coordinate their pricing, and the likelihood of anticompetitive effects from an acquisition consequently increases as well.[98] Conversely, as the *DOJ Guidelines* indicate:

> Other things being equal, [market] concentration affects the likelihood that one firm, or a small group of firms, could successfully exercise market power . . . . As the number of firms necessary to control a given percentage of total supply increases, the difficulties and costs of reaching and [44] enforcing consensus with respect to the control of that supply also increase.[99]

Consistent with this view, in *United States v. Philadelphia National Bank* the Supreme Court indicated that a crucial initial question in merger cases is whether the merger or acquisition at issue

> produces a firm controlling an undue percentage share of the relevant market, and results in a significant increase in the concentration of firms in that market, [such that]

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[97] Kaserman, Tr. 2480–85. Respondents argue that some currently mothballed capacity could be brought back into production in response to supracompetitive prices. For example, Shell mothballed its Norco, Louisiana VCM plant in 1982 because of the decline in demand during the 1981–1982 period. RX 428A *in camera;* RX 822A; L. Wheeler, Tr. 1040–42 *in camera.* Corrosion is a problem with respect to such plants, but if properly maintained they can be brought back into production within six months to a year. Rawson, Oral Argument at 49. However, if a plant is simply mothballed, it will become very expensive to restart within two years. Moreover, even if it is constantly inspected, and deteriorating components are immediately repaired, at substantial expense, corrosion will render it inoperable within four to six years. Kienholz, Tr. 783–84.
In any event, 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. *Weyerhaeuser Co.,* 106 FTC at 287–88 and n. 69. As the sixth largest VCM producer, controlling almost 9 percent of VCM practical production capacity, (*see* Table V), Shell cannot be characterized as a fringe firm.

[98] *HCA v. FTC,* 807 F.2d at 1387; *accord HCA,* 106 FTC at 488–489; Scherer, *supra* note 61 at 199–200; *see also* Posner, *supra* note 58 at 52–56; Stigler, *A Theory of Oligopoly,* 72 J. Pol. Econ. 44 (1964).

[99] *DOJ Guidelines* at ¶3.1. Several factors support this conclusion. For example, inevitable differences in cost functions—and hence in price preferences—may become more pronounced as the number of firms increases. In this situation, each firm will prefer the level of output and prices that maximizes its own profits, and the difficulty of reaching and sustaining a consensus strategy will increase. *See generally* Scherer, *supra* note 61, at 156–60; Hay, *supra* note 58, at 447; G. Stigler, *The Theory of Price* 233–34 (3d ed. 1966).

it is . . . inherently likely to lessen competition substantially . . . .[100]

The Court determined that the acquisition at issue was presumptively illegal because it would have created a bank that controlled 36 percent of the relevant market; increased two-firm concentration ("C_2") from 44 percent to 59 percent; and increased four-firm concentration ("C_4") to 78 percent. The Court observed that the presumption of illegality could be rebutted by [45] "evidence clearly showing that the merger is not likely to have such anticompetitive effects."[101] Subsequently, in *United States v. General Dynamics Corp.*, the Court determined that premerger four-firm concentration ratios of 43 percent and 54.5 percent in two separate relevant markets, coupled with 4.8 percentage point and 8.1 percentage point increases in the acquiring firm's shares in those markets, were sufficient to establish a *prima facie* violation.[102]

The Commission has in the past taken the position that "four-firm market shares ["C_4"] in the range of 50 percent are sufficient to raise concern over the loss of potential competition," and therefore create a rebuttable presumption that the acquisition at issue is likely to have anticompetitive effects.[103] However, the Commission has also determined that the Herfindahl-Hirschman Index ("HHI") provides a better measure of the structural character of a relevant market than concentration [46] ratios.[104] Its principal advantage is that it reflects not only the combined share of the largest firms, but also their shares relative to one another and to all other firms in the industry,[105] and thus provides "a useful tool in interpreting market structure evidence".[106] The Justice Department has taken the same position, and has noted that—according to an empirical study it conducted—HHIs of 1000 and 1800 correspond roughly to four-firm concentration ratios of 50 percent and 70 percent respectively.[107] A number of federal

[100] *United States v. Philadelphia National Bank*, 374 U.S. 321, 363 (1963); *accord, e.g., Weyerhaeuser Co.*, 106 FTC at 278.

[101] *United States v. Philadelphia National Bank*, 374 U.S. at 331, 363–66.

[102] *United States v. General Dynamics Corp.*, 415 U.S. 486, 494–96 (1974); *accord, e.g., FTC v. Warner Communications, Inc.*, 742 F.2d 1156, 1163–64 (9th Cir. 1984) (*per curiam*); *Marathon Oil Co. v. Mobil Corp.*, 669 F.2d 378, 383 (6th Cir. 1981), *cert. denied*, 455 U.S. 982 (1982); *Grumman Corp. v. LTV Corp.*, 665 F.2d 10, 12–15 (2d Cir. 1981); *RSR Corp. v. FTC*, 602 F.2d 1317, 1324–25 (9th Cir. 1979), *cert. denied*, 445 U.S. 927 (1980); *FTC v. Bass Bros. Enters., Inc.* 1984–1 Trade Cas. (CCH) ¶66,041, at 68,609–11 (N.D. Ohio 1984).

[103] *Grand Union Co.*, 102 FTC at 1054, *quoting Tenneco, Inc.*, 98 FTC 464, 585–85 (1981), *rev'd on other grounds*, 689 F.2d 346, 352 (2d Cir. 1982).

[104] *Grand Union Co.*, 102 FTC, at 1053–54. The Commission has thereby rejected its earlier contrary holding in *Litton Industries*, 82 FTC 793, 904–07, 1010–11 and nn. 33–35 (1973). The HHI is calculated by summing the squares of the individual market shares of all the firms in the market. *HCA*, 106 FTC at 488.

[105] *HCA*, 106 FTC at 488; *Grand Union Co.*, 102 FTC at 1053–54.

[106] *HCA*, 106 FTC at 488; *see also* Stigler, *supra* note 98 at 55. It also provides a basis for estimating the degree to which a small number of firms could assess supracompetitive prices without expressly cooperating with one another. Cowling & Waterson, *Price-Cost Margins and Market Structure*, 43 Economics 267 (1970); Ordover, Sykes & Willig, *Herfindahl Concentration, Rivalry, and Mergers*, 95 Harv. L. Rev. 1857, 1865 (1982).

[107] *DOJ Guidelines* at ¶3.1. However, the presence of a single very large firm will substantially increase the HHI for a given industry, *ceteris paribus*. *See, e.g.*, American Bar Association, *Antitrust Law Developments* 161 n. 115 (2d ed. 1984).

courts have also [47] recently determined that the HHI provides a useful measure of concentration levels.[108]

Finding a *prima facie* violation of Section 7 creates a rebuttable presumption of anticompetitive effects and shifts the burden of going forward with evidence to the respondent.[109] The Commission has noted, however, that

> the analytical soundness of this evidentiary presumption is obviously weaker in cases in which C_4 falls in the 50 percent range (or HHI falls below 1000, for example) than in cases in which C_3 or C_4 exceeds 90 percent (or HHI exceeds, for example, 2500) . . . [T]he Commission will require less evidence to overcome this presumption when only moderate concentration—C_4 levels between 50–70 percent and HHI between 1000 and 1800—is found . . .[110] [48]

More recently, the Commission has reaffirmed that although market share evidence is "an important starting point in merger analysis, it alone is not conclusive in determining the legality of a merger under Section 7."[111]

Weyerhaeuser and *HCA* represent the Commission's most recent applications of Section 7. In *Weyerhaeuser*, as a result of the challenged acquisition, the respondent had become the largest firm in the relevant market, with a 20.64 percent share that was seven percentage points higher than the share of the second-largest firm. Moreover, the acquisition had increased the market HHI for actual production by 211 points, from 955 to 1166, and had increased four-firm concentration from 48.4 percent to 57.8 percent. The Commission determined that these data were sufficient to "suggest a *prima facie* violation."[112] However, the Commission observed that the acquisition fell

> within the lower end of the midrange of the Department of Justice Merger Guidelines, and calls for especially careful review of a [49] number of industry characteristics in addition to concentration in order meaningfully to assess the acquisition's effect on

[108] *Tenneco, Inc. v. Federal Trade Commission*, 689 F.2d 346, 359 (2d Cir. 1982) (Mansfield, J., dissenting); *Christian Schmidt Brewing Co. v. G. Heileman Brewing Co.*, 600 F.Supp. 1326, 1329–30 n.3 (E.D. Mich.), *aff'd*, 753 F.2d 1354 (6th Cir.), *cert. dismissed*, 105 S.Ct. 1155 (1985); *United States v. G. Heileman Brewing Co.*, 563 F. Supp. 643, 644 n.3 (D. Del. 1983); *Vial v. First Commerce Corp.*, 1983 Trade Cas. (CCH) 65,692 (E.D. La. 1983); *Marathon Oil Co. v. Mobil Corp.*, 530 F. Supp. 315, 323 n.15 (N.D. Ohio), *aff'd*, 669 F.2d 378 (6th Cir. 1981), *cert. denied*, 455 U.S. 982 (1982) (not used, however). *But see United States v. Black & Decker Mfg. Co.*, 430 F. Supp. 729, 748 n. 38 (D. Md. 1976).

[109] *United States v. Citizens & Southern National Bank*, 422 U.S. 86, 120 (1975); *Kaiser Aluminum & Chemical Corp. v. FTC*, 632 F.2d 1324, 1340 and n. 12 (7th Cir. 1981); *Weyerhaeuser Co.*, 106 FTC at 280 n. 50.

[110] *Grand Union Co.*, 102 FTC at 1055; *see FTC Statement*, ¶4516 at 6901–4. The *DOJ Guidelines* similarly characterize markets with HHI levels between 1000 and 1800 as moderately concentrated, and indicate that the Department of Justice will ordinarily challenge mergers in such markets that increase HHI levels by more than 100 points. *DOJ Guidelines* at ¶3.11. However, the presumption of anticompetitive effects arising from an acquisition that produces an HHI within the 1000–1800 range can be rebutted by evidence concerning any of a variety of other structural factors. *DOJ Guidelines* at ¶3.11(c).

[111] *AMI*, 104 FTC at 200; *accord Weyerhaeuser Co.*, 106 FTC at 278; *see also HCA*, 106 FTC at 474.

[112] *Weyerhaeuser*, 106 FTC at 280.

competition.[113]

Its analysis of these other factors led the Commission to conclude that the acquisition did not violate section 7 of the Clayton Act.[114]

In *HCA*, by contrast, the Commission considered a market with an HHI of 1900 before the acquisitions at issue that increased to over 2400 after the acquisitions; as a result, four-firm concentration increased to 92 percent. Moreover, HCA's market share increased from 14 percent to 26 percent. The Commission found these figures supported "an inference of harm to competition," *ceteris paribus*, and characterized the increase in concentration "in an already concentrated market to be of serious competitive concern."[115]

1. PVC Market

In 1981, prior to the acquisition, approximately 5.242 billion pounds of bulk and suspension PVC were produced in the United States.[116] In 1983, after the acquisition had been completed, approximately 5.635 billion pounds were produced [**50**] domestically.[117] The record includes three separate measures of concentration levels in the PVC market: nameplate (or "design") capacity, practical production capacity, and actual production levels.[118] Prior to the acquisition, Goodrich ranked first in all three measures, while Diamond ranked sixth in nameplate capacity, fourth in practical production capacity, and fifth in actual production. IDF 34–35. The following tables depict the market shares and ranks of the eighteen firms in the United States bulk and suspension PVC market—for each of the three concentration measures—prior to the acquisition, and the same data for the fourteen firms still in the industry as of January 1984. [**51**]

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[113] *Id.*

[114] *Id.*

[115] *HCA*, 106 FTC at 488.

[116] *See* Table I, *infra*.

[117] *See* Table II, *infra*.

[118] A plant's nameplate capacity is the level of capacity that it is designed to achieve, while its practical production capacity is its effective production capacity. CPF 5.22 *in camera*. Practical production capacity thus provides a better measure of actual production constraints. Actual production levels may occasionally exceed capacity estimates if, for example, a firm chooses to reduce inventory levels or produce at a point where marginal cost is very high.

The Justice Department has taken the position that if the relevant product is branded or relatively differentiated, dollar sales provide a better measure of concentration levels. By contrast, if the relevant product is relatively homogeneous, physical capacity may provide a better measure. *DOJ Guidelines* at ¶2.4. In this case, VCM is homogeneous, while PVC is more heterogeneous. As a result, two capacity measures and an actual production (in pounds rather than dollars) measure of concentration have been used.

TABLE I

Bulk and Suspension PVC Market Shares Before the Acquisition (Percentages) (United States)[119]

Firm	Nameplate Capacity (January 1982)	Practical Production Capacity (January 1982)	Actual Production (1981)
Goodrich	18.51 (1st)	17.79 (1st)	16.1 (1st)
Tenneco Polymers	12.35 (2nd)	11.72 (2nd)	12.9 (2nd)
Georgia Pacific	9.94 (3rd)	8.96 (5th)	7.8 (6th)
Shintech	9.37 (4th)	10.75 (3rd)	10.5 (3rd)
Occidental Chemical	8.60 (5th)	8.30 (7th)	7.0 (7th)
Diamond Shamrock			
Deer Park Plant #5	3.98	4.28	—
Deer Park Plants # 1–4X	3.08	3.21	—
Delaware City Plant	1.28	1.49	—
Total	8.33 (6th)	8.99 (4th)	8.3 (5th)
Conoco	8.31 (7th)	8.73 (6th)	8.6 (4th)
Borden	6.25 (8th)	6.27 (8th)	6.8 (8th)
Air Products and Chemicals	5.11 (9th)	4.63 (9th)	5.7 (9th)
CertainTeed	2.66 (10th)	3.28 (10th)	4.3 (10th)
Formosa Plastics	2.56 (11th)	2.93 (11th)	1.9 (14th)
Stauffer Chemical	1.99 (12th)	1.79 (12th)	3.0 (11th)

[119] CX 662D-G *in camera*; CX 664–O-V *in camera*; IDF 34–38 *in camera*.

GenCorp.	1.90 (13th)	1.78 (14th)	2.6 (12th)
Ethyl	1.70 (14th)	1.79 (12th)	2.0 (13th)
Great American Chemical Corp.	0.99 (15th)	0.90 (15th)	0.3 (17th)
Keysor-Century Corp.	0.71 (16th)	0.75 (16th)	0.3 (17th)
Pantasote	0.71 (16th)	0.67 (17th)	1.4 (15th)
Talleyrand Chemicals	—	—	0.6 (16th)
Total	7.043 billion pounds	6.700 billion pounds	5.242 billion pounds **[53]**

TABLE II

Bulk and Suspension PVC Market Shares After the Acquisition (Percentages) (United States)[120]

Firm	Nameplate Capacity (January 1984)	Practical Production Capacity (January 1984)	Actual Production (1983)
Goodrich	20.6 (1st)	19.4 (1st)	18.4 (1st)
Tenneco Polymers	12.0 (2nd)	11.4 (2nd)	11.8 (3rd)
Georgia Pacific	11.0 (3rd)	10.3 (6th)	8.4 (6th)
Formosa Plastics	10.5 (4th)	11.0 (3rd)	10.2 (5th)
Borden	10.2 (5th)	10.1 (7th)	7.7 (7th)
Conoco	9.9 (6th)	10.4 (4th)	11.0 (4th)
Shintech	9.1 (7th)	10.4 (4th)	12.7 (2nd)
Occidental Chemical	6.2 (8th)	6.1 (8th)	5.6 (8th)
Air Products			

[120] CX 664A-V *in camera;* IDF 34-38 *in camera.*

and Chemicals	5.0 (9th)	4.8 (9th)	3.6 (10th)
CertainTeed	2.6 (10th)	3.2 (10th)	4.0 (9th)
GenCorp.	1.7 (11th)	1.6 (11th)	1.7 (12th)
Keysor-Century Corp.	0.7 (12th)	0.7 (12th)	0.7 (13th)
Pantasote	0.7 (12th)	0.7 (12th)	0.1 (14th)
Ethyl	0.0	0.0	2.1 (11th)
Total	7.251 billion pounds	6.901 billion pounds	5.635 billion pounds **[54]**

The acquisition generated increases in all three concentration measures. First, it increased the HHI for nameplate capacity by approximately 113 points, to 1098 after the acquisition. IDF 49. After Diamond closed its remaining Deer Park plants, the HHI for nameplate capacity increased by another 53 points to 1151.[121] By 1985, the HHI for nameplate capacity had increased by an additional 52 points to 1203.[122]

Second, the acquisition increased the HHI for practical production capacity by 112 points, from 967 to 1079. IDF 49. After Diamond closed its Deer Park plants, the HHI increased to 1130.[123] After Diamond closed or sold its remaining plants, the HHI increased by an additional 132 points to 1211.[124] Third and finally, the acquisition—coupled with Diamond's closure of its remaining PVC plants—increased the HHI for actual production by 221 points, from 910 to 1131. The acquisition alone probably [**55**] increased the HHI for actual production by approximately 110 points, to approximately 1020.[125]

If the later closing of Diamond's other Deer Park plants is not attributed to the acquisition, it increased Goodrich's share of nameplate PVC capacity from 18.5 percent to 22.5 percent, and its share of practical production capacity from 17.8 percent to 22.1 percent. IDF

[121] CPF 5.27 *in camera*. This calculation is based upon treating the Delaware City facility as an independent entity.

[122] IDF 54. The use of post-acquisition structural evidence as a basis for evaluating the likelihood of anticompetitive effects from a merger or acquisition is well-established, as respondents recognize. *See* Rawson, Oral Argument at 46. The use of post-acquisition performance evidence is discussed in Part V, *infra*.

[123] CPF 5.28 *in camera*. This calculation is similarly based upon treating the Delaware City facility as a separate entity.

[124] CPF 5.28 *in camera*.

[125] IDF 53 *in camera, citing* CX 661Z–16 *in camera*. The record does not provide an explicit basis for assessing the effect of the acquisition of Deer Park plant number 5 alone upon the HHI for actual production levels because it does not indicate the share of actual production for which plant number 5 accounted. Kaserman, Tr. 2271. However, as Table I indicates, Deer Park Plant number 5 accounted for approximately one-half of Diamond's nameplate and practical PVC production capacities. The HHI increase in actual production actually attributable to the Goodrich acquisition is therefore probably only half of the 221 figure—assuming that plant number 5 also accounted for one-half of Diamond's actual production—or approximately 110.

52 *in camera; see* Table I, *supra.* Under the more traditional rubric of earlier cases, the acquisition increased four-firm concentration from 50.2 percent to 54.2 percent in nameplate capacity; from 49.3 percent to 53.6 percent in practical production capacity; and from 48.1 percent to over 50 percent (estimated) in actual production. *See* Table I, *supra.* The following table illustrates contemporaneous industrywide changes in both HHI levels and four-firm concentration levels:[126] **[56]**

TABLE III

Changes In Bulk and Suspension PVC HHI and Four-Firm Concentration 1980–1985

Concentration Measure	1980	1981	1982	1983	1984	1985
Nameplate Capacity[127]	897 (49.2)	928 (48.3)	985 (50.2)	1088* (53.3)	1156 (54.1)	1203 (56.1)
Practical Production Capacity[128]	871 (47.2)	940 (48.2)	967 (49.2)	1058* (52.9)	1126 (52.2)	—
Actual Production[129]	851 (45.6)	910 (48.1)	1131* (58.1)	1065 (53.8)	—	—

[57]

As the foregoing data suggest, the PVC market was not particularly concentrated prior to the acquisition, whether judged from the perspective of capacity or that of actual production levels. Under the *DOJ Guidelines,* the market after the acquisition would be classified as "moderately concentrated," but only by the barest of margins. Moreover, the 113 point, 112 point, and estimated 110 point changes in nameplate capacity, practical production capacity, and actual production barely exceed the 100 point threshold specified in the *DOJ Guide-*

[126] The concentration data in Table III differ to some degree from the data cited in the text because of other events in the industry. Because the acquisition occurred in January 1982, the 1983 capacity data and the 1982 production data, denoted by asterisks, are the first to reflect the effects of the acquisition.

[127] CX 664F-G *in camera.* The 1985 HHI for nameplate capacity is based on January 1985 capacity estimates, which were derived in turn by adjusting January 1984 capacity to reflect Shintech's expansion of its suspension PVC plant to 1 billion pounds of capacity during 1984; GenCorp's discontinuance of its PVC business in September 1984; and Pantasote's discontinuance of its PVC business in the fourth quarter of 1984. CPF 5.69 *in camera.*

[128] CX 664M-N *in camera.*

[129] CX 664V *in camera.*

lines.[130] The HHI figures also create only a weak presumption of competitive injury under previous court and Commission cases, particularly if—as the respondents maintain—the closure of the other Deer Park plants and the Delaware City plant should not be attributed to the acquisition. In *Weyerhaeuser,* for example, the Commission considered an acquisition that had increased the relevant HHI for actual production by about 100 points *more* than this acquisition to a level about 100 points *higher* than the post-acquisition HHI actually attributable to the acquisition in the PVC market. The [58] Commission concluded that these effects were barely sufficient to create a weak presumption of anticompetitive effects.[131] *A fortiori,* the concentration data for the PVC market create an even weaker presumption of anticompetitive effects. Even if the closure of the other Deer Park plants *is* attributed to the acquisition, the changes in HHI levels are barely comparable to those that occurred in *Weyerhaeuser.* As a result, the evidence from other structural factors needed to rebut that presumption need not be as strong as it was in *Weyerhaeuser.*

2. VCM Market

The record also includes market share data for nameplate capacity, practical production capacity, and actual production levels for VCM. Before the acquisition, Diamond ranked third along all of these dimensions, while Goodrich ranked third in nameplate capacity (tied with Diamond and Georgia Pacific), fifth in practical production capacity, and fourth in actual production. IDF 250 *in camera,* 251 *in camera.* The following tables depict the market shares of the twelve firms in the United States VCM market, and their ranks, for each of the three concentration measures before the acquisition, and for the nine firms still in the industry as of January, 1984: [59]

[130] In her concurring and dissenting opinion, Commissioner Azcuenaga states that the acquisition increased the actual production HHI by 221 points, to 1131, thereby placing the acquisition in the "moderately concentrated" range under the *DOJ Guidelines.* Opinion of Azcuenaga, Commissioner (*hereinafter Azcuenaga Opinion*), at 1. However, this assumes that the closure of Deer Park Plants numbers 1–4X, and the Delaware City plant, should be attributed to the acquisition, and the respondents vigorously dispute that assumption. The acquisition itself probably actually increased the HHI for actual production by only 110 points. *See* page 55 and note 125, *supra.*

[131] *Weyerhaeuser Co.,* 106 FTC at 280.

TABLE IV

VCM Market Shares
Before the Acquisition
(Percentages) (United States)[132]

Firm	Nameplate Capacity (January 1982)	Practical Production Capacity (January 1982)	Actual Production (1981)
Dow Chem.	22.52 (1st)	21.92 (1st)	22.85 (1st)[133]
Shell Oil	16.39 (2nd)	15.61 (2nd)	17.43 (2nd)
Diamond Shamrock	10.64 (3rd)	12.06 (3rd)	13.44 (3rd)
Goodrich	10.64 (3rd)	10.48 (5th)	11.30 (4th)
Ga. Pacific	10.64 (3rd)	11.27 (4th)	6.91 (6th)
PPG Industries	9.59 (6th)	9.41 (6th)	7.57 (5th)
Borden	6.48 (7th)	5.32 (8th)	4.82 (8th)
Conoco	6.39 (8th)	7.33 (7th)	6.79 (7th)
Ethyl	3.51 (9th)	3.38 (9th)	2.90 (9th)
Formosa Plas.	3.19 (10th)	3.22 (10th)	2.76 (10th)
Uniroyal	—	—	1.75 (11th)
Stauffer Chem.	—	—	1.33 (12th)
Imports (Excl. Dow)	—	—	0.14
Total	9.3965 billion pounds	8.873 billion pounds	6.856 billion pounds **[60]**

[132] CX 662A–C *in camera;* IDF 250–261 *in camera.*

[133] This share includes imports from Dow Canada accounting for 1.5 percent of the market.

TABLE V

VCM Market Shares After the Acquisition (Percentages) (United States)[134]

Firm	Nameplate Capacity (January 1984)	Practical Production Capacity (January 1984)	Actual Production (1983)
Dow Chemical	23.34 (1st)	22.55 (2nd)	28.25 (1st)[135]
Goodrich	22.61 (2nd)	23.73 (1st)	22.26 (2nd)
Georgia Pacific	11.31 (3rd)	11.87 (3rd)	7.89 (6th)
PPG Industries	10.20 (4th)	9.91 (4th)	9.01 (5th)
Shell Oil	9.50 (5th)	8.96 (6th)	12.85 (3rd)
Formosa Plastics	9.37 (6th)	9.67 (5th)	9.02 (4th)
Borden	6.89 (7th)	5.60 (8th)	2.65 (8th)
Conoco	6.78 (8th)	7.71 (7th)	6.99 (7th)
Ethyl	0.0	0.0	1.07 (9th)
Total	8.844 billion pounds	8.427 billion pounds	7.033 billion pounds **[61]**

The acquisition increased the HHI for nameplate VCM capacity by 226 points, from 1303 to 1529. IDF 262. By January 1985 the HHI had increased to 1632. IDF 266. The acquisition increased the HHI for practical production capacity by 253 points, from 1299 to 1552. IDF 262. By January 1985 the HHI had increased to 1650. IDF 266. The acquisition increased the HHI for actual production by 304 points, from 1359 to 1663. IDF 262. The following table illustrates contemporaneous industrywide changes in both HHI levels and four-firm concentration levels:[136] **[62]**

[134] CX 663A–F *in camera*. The decline in Shell's share occurred because it closed a plant (*see* note 97, *supra*), while the increase in Formosa's share occurred because it opened a plant after approximately five years of construction (*see* pages 34–35, *supra*).

[135] This share includes 128,300 pounds in imports from Dow Canada.

[136] The concentration data in Table VI differ to some degree from the data cited in the text because of other events in the industry. The acquisition occurred in January 1982. The 1983 capacity data and the 1982 production data, denoted by asterisks, are therefore the first to reflect the effects of the acquisition.

TABLE VI

Changes in VCM
HHI and Four-Firm Concentration
1981–1984

Concentration Measure	1981	1982	1983	1984	1985
Nameplate Capacity[137]	1318 (61.66)	1313 (60.19)	1433* (66.89)	1559 (67.46)	1632 (__)
Practical Production Capacity[138]	1293 (61.92)	1299 (60.86)	1468* (68.49)	1575 (68.06)	
Actual Production[139]	1330 (65.02)	1761* (76.14)	1741 (72.39)	—	**[63]**

The foregoing data indicate that the VCM market was substantially more concentrated prior to the acquisition than the PVC market, and that the acquisition produced a substantially greater increase in concentration in the VCM market. Under the *DOJ Guidelines*, the VCM market falls within the upper half of the moderately concentrated range after the acquisition for all three concentration measures. Moreover, the acquisition increased HHI levels along all three measures by 226 to 304 points, well above the 100 point threshold specified by the *DOJ Guidelines*. Under the more traditional rubric of earlier cases, the acquisition increased the four-firm concentration ratio from 60.2 percent to 70.8 percent in nameplate capacity; from 60.9 percent to 71.3 percent in practical production capacity; and from 65 percent to 72.6 percent in actual production. Furthermore, Goodrich increased its share from 10.6 percent to 21.3 percent in nameplate capacity; from 10.5 percent to 22.5 percent in practical production capacity; and from 11.3 percent to 24.7 percent in actual production. *See* Table IV, *supra*. These data are well above those that created a presumption of illegality in *United States v. General Dynamics* and *Weyerhaeuser*. *See* pages 44–48, *supra*. In short, the concentration data create a relatively strong presumption of anticompetitive effects in the VCM market, and relatively strong evidence from other factors is needed to rebut that presumption. **[64]**

[137] CX 663A-B *in camera*.
[138] CX 663C-D *in camera*.
[139] CX 663E-F *in camera*.

C. *Other Structural Factors*

1. Product Homogeneity

The extent to which products in a given industry are homogeneous helps to determine the likelihood of anticompetitive effects from an acquisition. As the *DOJ Guidelines* indicate:

> In a market with a homogeneous and undifferentiated product, a cartel need establish only a single price—a circumstance that facilitates reaching consensus and detecting deviation. As the products which constitute the relevant product market become more numerous, heterogeneous, or differentiated, however, the problems facing a cartel become more complex. Instead of a single price, it may be necessary to establish and enforce a complex schedule of prices corresponding to gradations in actual or perceived quality attributes among the competing products.[140]

Two dimensions of product heterogeneity are particularly relevant.[141] First, differences in product quality may make price differentials necessary to produce a stable market equilibrium, and achieving a consensus on such differentials is [**65**] likely to be difficult.[142] Moreover, 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.[143] Second, if transportation costs represent a substantial proportion of total product value, and if firms are located substantial distances from one another, coordination efforts must minimize or eliminate the competitive impact of these differences.[144]

a. *PVC Market*

The record provides mixed evidence concerning PVC heterogeneity. Judge Howder characterized the bulk and suspension PVC market as a "commodity" market, where purchasers generally select the lowest priced resin suitable for a particular end use. IDF 90. However, two factors—the presence of a variety of different grades of PVC resin (with [**66**] perceived differences within particular grades), and the complications arising from differing transportation costs—establish that PVC resin is in fact considerably more heterogeneous. First, there are three broad categories of PVC resin—pipe, general purpose,

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[140] *DOJ Guidelines* at ¶3.411; *accord, e.g., HCA v. FTC*, 807 F.2d at 1390; *United States v. Container Corp. of America*, 393 U.S. 333, 337 (1969); *United States v. FMC Corp.*, 306 F.Supp. 1106, 1111–12, 1143 (E.D. Pa. 1969); *FTC Statement*, ¶4516 at 6901–4.

[141] *See generally* Scherer, *supra* note 61, at 200–03; Posner, *supra* note 58, at 51.

[142] Scherer, *supra* note 61, at 201. If a significant level of product differentiation exists, each firm will probably confront significantly different demand and marginal revenue curves. Therefore, even if its marginal cost function is identical to those of the other firms in the industry, each firm will prefer to operate at a different point on that function, and hence will prefer a different price than its rivals. *Id.* at 158.

[143] *See* Hay, *supra* note 58, at 448.

[144] Scherer, *supra* note 61, at 201; Haddock, *Basing-Point Pricing: Competitive v. Collusive Theories*, 72 Am. Econ. Rev. 289 (1982); *see DOJ Guidelines* at ¶3.413. For a general discussion of product differentiation, *see* Scherer, *supra* note 61, at 375–405.

and specialty. Each category includes a number of PVC resin grades that are distinguished by differences in particle size, molecular weight, and purity.[145] Some PVC resin purchasers perceive differences in a given grade from one producer to another, or even from one plant of a given firm to another. As a result, they insist upon "qualifying" a particular PVC resin grade before purchasing it from a particular PVC producer.[146] The results of the testing, or subsequent use of the resin, on occasion lead purchasers to conclude that the resin grades involved cannot be used.[147] The need to qualify not only *grades* of resin, but also the grade of resin produced by a *particular* firm, makes PVC buyers reluctant to switch suppliers without price or quality concessions.

Pipe, siding and calendar grades of PVC resin, also characterized as "commodity" grades, account for about 75 percent [**67**] of bulk and suspension PVC sales.[148] Service with respect to these grades is considered to be relatively unimportant. The remaining 25 percent of bulk and suspension PVC resins are sold in several grades that differ in particle size, molecular weight, and purity as a function of purchaser end-use requirements.[149] Nevertheless, it is difficult to charge a significant price premium for any given grade of PVC. As one witness testified,

> 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.[150]

Commissioner Azcuenaga relies upon evidence of this sort to conclude that PVC resin buyers are willing to switch suppliers of a given grade in response to small price differences. *Azcuenaga Opinion* at 8. But switching suppliers of a given grade entails significant costs. *See* page 88, *infra*. Moreover, the fact that a given PVC grade may be relatively homogeneous does not alter [**68**] the fact that different PVC grades differ significantly from one another.[151]

Second, transportation cost differences are likely to complicate the determination and enforcement of consensus prices. Although several manufacturers operate PVC resin plants along the Gulf Coast, in

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[145] Disch, Tr. 632, 634–35; Becker, Tr. 1255–59; Klass, Tr. 4333; RX 2Z11–15.

[146] Becker, Tr. 1330–31, 1332–34; RX 875B *in camera;* RX 222D-E *in camera;* RX 589T; RX 1049A *in camera;* RX 258A *in camera;* RX 537B; RX 541A; *see* H. Wheeler, Tr. 1747–48.

[147] RX 221I *in camera;* RX 260B *in camera;* RX 545A; RX 1041A.

[148] Weber, Tr. 1795.

[149] IDF 85. For example, medical grade resins are considered to be specialty grades, and command a small price premium over commodity grades. IDF 88. Many customers find technical services offered in conjunction with the sale of specialty grades to be useful. IDF 89.

[150] Schaefer, Tr. 1203 (emphasis added); *accord* Becker, Tr. 1330–1332.

[151] The crucial point about product heterogeneity is that it substantially complicates the determination and enforcement of consensus prices. Instead 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.

Texas, Louisiana and Mississippi, others operate PVC resin plants in widely scattered locations. For example, as of October 1983 Air Products' only plant was located in Pensacola, Florida, while Borden's largest plant was in Illinois, and it operated another substantial plant in Massachusetts. Similarly, as of October 1983 Conoco, Formosa, Georgia Pacific, Occidental, and Tenneco respectively operated substantial plants in Oklahoma; Delaware; Delaware; New Jersey and Pennsylvania; and New Jersey. Finally, as noted above, Goodrich itself operates substantial plants in Ohio, Illinois, California, Kentucky, and [**69**] New Jersey.[152]

b. *VCM Market*

The VCM market is substantially more homogeneous than the PVC market. VCM is produced in only one grade, and there are only minor trace differences in impurity levels from one firm's product to another; there is no customized VCM production. IDF 283, 285. Diamond and Goodrich admit that VCM is an essentially fungible product.[153] Moreover, all except one VCM plant are located along the Gulf Coast, in either Texas or Louisiana. IDF 284 *in camera*. As a result, transportation costs are not a significant source of product differentiation. Furthermore, the VCM industry is technologically stable; significant process or product technological changes are unlikely to occur over the next few years. IDF 285. In addition, VCM firms secure product from one another through exchanges, tolling [**70**] agreements, and purchases, all for the purpose of resale;[154] that factor supports the conclusion that the product is homogeneous. As one witness testified:

> Most people would say you can't tell [VCM produced by different American manufacturers] apart. It is a true commodity chemical.[155]

2. Price Elasticity of Demand

The price elasticity of demand for a product measures the degree to which a change in its price will produce a change of opposite sign

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[152] RX 1204G *in camera;* RX 1168A-B *in camera*. Bulk and suspension PVC is generally sold on a delivered price basis (Diamond Admission 475 (CX 6T); Goodrich Admission 432 (CX 4Z28)), but it is not clear from the record whether the delivered price is *uniform* throughout the relevant geographic market. If delivered prices are not uniform, then detecting cheating becomes considerably more difficult.

As Commissioner Azcuenaga points out (*Azcuenaga Opinion* at 10), the relevant geographic market is national rather than regional. However, transportation cost differences need not be large enough to create regional markets in order to complicate the task of developing a single consensus price, particularly given the fact that PVC plants are scattered all over the country.

[153] Goodrich Admission 465 (CX 4Z33); Diamond Admission 505 (CX 6U); Taylor, Tr. 1565; Klass, Tr. 5363.

[154] CPF 24.09, *citing, e.g.*, CX 557Z11 *in camera;* L. Wheeler, Tr. 972–75 *in camera;* CX 88 *in camera*.

[155] Keinholz, Tr. 813. Respondents nevertheless describe VCM as "commercially heterogeneous" because of differences in sales terms from one producer to another, including price, credit terms, method of delivery (pipeline, rail tank car, or tolling arrangement), and contract length (short-term, long-term, or spot). IDF 286 *in camera;* RPF 403 *in camera*. These factors relate to industry performance, rather than structure, however, and performance factors are discussed in Part V, *infra*. In any event, as the Commission has previously indicated, "agreements as to all aspects of competition are not necessary for effective collusion to take place and to have a negative impact

(footnote cont'd)

in the quantity of the product that is demanded.[156] As the price elasticity of demand for a product declines, the [71] degree to which an increase in that product's price can be sustained without losing a significant number of sales increases, for two reasons. First, industry firms will find it easier to collude profitably, because an effort to raise prices to supracompetitive levels will not induce as many buyers to switch their purchases to alternative products.[157] Second, industry firms will have a greater incentive to collude, because the additional revenue that any given price increase produces will increase. In particular, when the price elasticity of demand is less than one—with costs held constant—an industrywide price increase will increase rather than reduce industrywide profits.[158]

The likelihood of anticompetitive effects from an acquisition thus increases as the price elasticity of demand for the product at issue declines.[159] Both PVC and VCM are intermediate products, used as inputs in manufacturing final [72] products. As a result, their respective price elasticities increase as (1) the degree to which other inputs can be substituted for them increases; (2) the proportion of total costs for which each account increases; and (3) the price elasticity of demand for PVC end products and PVC resin—the products for which they are respectively used—increases.[160]

a. *PVC Market*

Three factors establish that the price elasticity of demand for bulk and suspension PVC resin is relatively low. First, there are no practical substitutes for PVC resin in manufacturing PVC products. IDF 95. PVC resin is the primary raw material input for PVC end use products, and it "imparts essential properties to the product." Much of the fabrication equipment used for bulk and suspension PVC end use products can process only bulk or suspension PVC resins.[161]

Second, with the exception of PVC pipe, bulk and suspension PVC resins account for relatively small proportions of the cost of finished PVC products. All PVC resins must be compounded before they are processed, and at that stage, additives such as heat and light stabiliz-

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on competition." *HCA*, 106 F.T.C. at 508; *accord Catalano, Inc. v. Target Sales, Inc.*, 446 U.S. 648–650 (1980) (agreement to refuse to extend credit *per se* illegal).

[156] More formally, the price elasticity of demand can be expressed as the absolute value of the product of (1) price divided by quantity, and (2) quantity demanded differentiated with respect to price. *E.g.*, Scherer, *supra* note 61, at 157 n. 13.

[157] *HCA v. FTC*, 807 F.2d at 1388; HCA, 106 FTC at 499.

[158] *See HCA v. FTC*, 807 F.2d at 1388. A monopolist will ordinarily raise prices until the price elasticity of demand is greater than one. At that point, an increase in prices may or may not increase profits, depending upon whether costs are increasing faster or more slowly than revenues. Kaserman, Tr. 2354–55, 2363–64.

[159] *HCA v. FTC*, 807 F.2d at 1388, 1389; *Marathon Oil Corp. v. Mobil Oil Corp.*, 669 F.2d 378, 381 (6th Cir. 1981), *cert. denied*, 455 U.S. 982 (1982); *FTC Statement*, ¶4516 at 6901–3; *see also United States v. Container Corp. of America*, 393 U.S. at 337; *Wall Products Co. v. National Gypsum Co.*, 326 F.Supp. 295, 300 (N.D. Cal. 1971).

[160] *E.g.*, M. Friedman, *Price Theory* 158 (1976); IDF 287, *citing* Kaserman, Tr. 2369–71.

[161] H. Wheeler, Tr. 1751–52.

ers, impact modifiers, plasticizers and [73] pigments are added.[162] A variety of manufacturing processes—including extrusion, calendaring, blow molding, injection molding and compression molding—must then be used to convert PVC compounds into finished PVC products. IDF 96. The cost of PVC resin accounts for about 55 to 60 percent of the cost of PVC pipe sold to distributors, and a smaller percentage of its final cost installed.[163] However, it accounts for much lower percentages of the cost of all other finished PVC products. For example, it accounts for only about 25 percent of the cost of vinyl siding sold to distributors, and only about 5 percent of its final cost installed.[164] Similarly, it represents only about 13 to 14 cents of the cost of a finished phonograph record. IDF 186–188 *in camera;* Disch, Tr. 659. Finally, it accounts for only a small [74] percentage of the cost of most PVC end products manufactured from calendered PVC resin. IDF 193. For example, it represents 5.6 percent of the retail price of a $7.99 vinyl shower curtain, and 4.5 percent of the retail price of a $1.79 vinyl shower cap.[165] Because there are no substitutes for PVC resin in fabricating PVC end-use products, and because PVC resins generally account for only small percentages of the final costs of fabricating those products, the demand for bulk and suspension PVC resin is less price elastic than the demand for PVC end use products.[166]

Third, although the price elasticity of demand for different finished PVC products varies substantially, it is relatively low for most such products. It is lowest in the wire and cable segment, the packaging film and sheet segment, the phonograph record segment, and the medical end use segment. These segments together account for 21 to 23 percent of total domestic PVC consumption. *See* pages 18–19 and note 42, *supra.* The price elasticity of demand for PVC pipe, siding, floor tile, and window frames is higher because of competition from products manufactured from alternative materials, but is still relatively low. For example, a 1983 Goodrich analysis indicated:

> PVC pipe manufacturers appear to have plenty of room for price increases before approaching the price levels of most competing materials. (Even if the prices [75] were identical, PVC would still have the added advantage of lower installed cost.)

[162] For example, flexible PVC compounds used to manufacture wire, cable and flexible sheeting are produced by adding plasticizers to the resins. As a result, they frequently contain only 50 to 70 percent PVC resin by weight. By contrast, rigid PVC compounds do not contain plasticizers, and therefore contain as much as 80 to 95 percent resin by weight. IDF 96; Disch, Tr. 659.

[163] Yu, Tr. 2104; Disch, Tr. 663.

[164] IDF 163 *in camera;* Belt, Tr. 2026–27, 2040–41 *in camera;* CX 756Z59. Similarly, PVC resin accounts for only 15 to 20 percent of the cost of vinyl floor tiles (Disch, Tr. 673–74; IDF 168), and for no more than 30 to 50 percent of the cost of the PVC compounds used to fabricate bottles and wire and cable insulation. Becker, Tr. 1305–07, 1318–19; IDF 178; Disch, Tr. 660–61. It accounts for 15 percent of the price of vinyl window fabricators, and only 3 percent of the price of installed vinyl windows. Belt, Tr. 2058–61 *in camera.*

[165] IDF 193; DiLiddo, Tr. 3376–79.

[166] Kaserman, Tr. 2375–78.

CX 247A *in camera*. These segments together account for 53 to 55 percent of total domestic PVC consumption. *See* pages 18–19 and note 42, *supra*. Finally, the price elasticity of demand for rigid and flexible calendered products and bottles is considerably higher because of competition from products manufactured from alternative materials. These segments together account for 21 to 27 percent of total domestic PVC consumption. In short, the price elasticity of demand for products accounting for 73 to 79 percent of total domestic PVC consumption is relatively low.

On balance, the price elasticity of demand for most PVC resins appears to be relatively low. There are no practical substitutes in manufacturing PVC products; PVC resin generally accounts for only a small percentage of the final prices of those products; and the price elasticity of demand for most PVC end products is relatively low. One witness confirmed that for the bulk and suspension PVC market overall, there was very little price sensitivity,[167] and another stated that PVC is not a price elastic market.[168] **[76]**

b. *VCM Market*

The price elasticity of demand for VCM is very low, on the basis of the three criteria discussed *supra*. IDF 287, 288. First, no other input can be substituted in producing PVC.[169] As a result, VCM's price elasticity of demand is necessarily lower than that of PVC.[170] Second, the price elasticity of demand for PVC is itself relatively low. The third criterion is less conclusive; VCM accounts for 50 to 60 percent of the cost of producing PVC.[171] When considered together, these three **[77]** criteria indicate that the price elasticity of demand for VCM is lower than that of PVC resin, and hence very low in an absolute sense. This analysis is consistent with the views of a number of Goodrich employees and trial witnesses that the demand for VCM is "absolutely inelastic."[172]

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[167] Becker, Tr. 1325–26; *accord* CX 297Z1–Z2 *in camera*.

[168] Schaefer, Tr. 1141; *accord* CX 295Z53–Z54 *in camera*. Respondents' expert testified that

> very likely were there to be a sustained anticompetitive price increase in PVC, there would be a substantial degree of substitution.

Klass, Tr. 4151. However, most of the record evidence supports our conclusion that the price elasticity of demand for PVC is relatively low.

[169] Kaserman, Tr. 2484; Diamond Admission 57 (CX 6D).

[170] Kaserman, Tr. 2484–85; Klass, Tr. 4003–4006, 4533.

[171] In response to a question at oral argument from then-Acting Chairman Calvani, counsel for Goodrich indicated that in 1984, the cost of VCM represented 55.6 to 62.3 percent of the cost of producing suspension resin; 49.6 to 61.3 percent of the cost of producing pipe grade suspension resin; and 49.6 to 61.9 percent of the cost of producing flexible grade suspension resin. Letter from Robert H. Rawson to Acting Chairman Calvani (February 6, 1986), at 2 *in camera*. The Commission hereby makes the Rawson letter—and the response filed by complaint counsel—a part of the *in camera* record in this proceeding.

The Rawson letter estimates are consistent with other record evidence. One study indicates that in January 1983, VCM accounted for 54 to 62 percent—as an average among PVC producers—of the "total cash cost" of producing PVC. RX 1213H *in camera; see* CX 246 *in camera*. A second 1981 study conducted by Air Products suggests that VCM accounts for 65 to 75 percent of total PVC production costs. RX 57A *in camera*.

[172] Lefebvre, CX 296Z72 *in camera; accord* Schaefer, CX 295Z4 *in camera;* Becker, CX 297Z6–7 *in camera; see also* Kienholz, Tr. 811–12; Taylor, Tr. 1705.

3. Cost Functions

The similarity of cost functions among industry firms also affects the likelihood of anticompetitive effects from an acquisition. If cost functions vary widely from one firm to another, each will prefer a different industry price level, and developing a collusive consensus price will consequently be more difficult.[173] If there are only a few firms in the industry, cost differences nevertheless may not prevent firms from accepting price or output levels somewhat different from their optimal levels.

a. *PVC Market*

PVC production costs vary significantly among producers. These cost differences occur in two of three broad cost [**78**] categories: (1) the cost of converting VCM into PVC; and (2) the cost of transporting PVC to purchasers.[174] First, PVC production costs differ significantly from one firm to another. It is true that the technology needed to produce PVC is widely available to all producers, and no significant patents impede production by any particular firm. IDF 195. Moreover, the clear trend in the industry has been toward larger reactors. A Goodrich employee and another witness estimated that raw materials efficiency in these larger reactors is close to 100 [**79**] percent.[175] Several industry witnesses testified that producer manufacturing costs using large reactors were similar,[176] and about two-thirds of installed capacity is in the form of larger reactors. IDF 198; Disch, Tr. 641.

Nevertheless, the remainder of industry capacity is in the form of smaller reactors that produce a variety of specialty resins. As a result, production costs vary significantly from one PVC resin grade to another.[177] For example, pipe resins are usually produced in highly

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[173] *See FTC Statement*, ¶4516 at 6901–4. Profit maximization is a function of both marginal cost and marginal revenue. High-cost firms will usually prefer higher umbrella price levels and lower output levels than firms with lower costs. *See, e.g.*, Posner, *supra* note 58, at 51.

[174] The third broad category is the cost of acquiring (or producing) and transporting VCM. Respondents estimate that in 1980, integrated firms' cost of producing VCM varied by up to 3 cents per pound, when the new materials used are valued at market prices. RAB at 42–43. Of course, the allocation of joint costs in integrated firms is necessarily arbitrary, and presents a notoriously difficult accounting problem.

It seems unlikely that VCM cost differences between integrated and nonintegrated producers are either significant or persistent. As complaint counsel point out, the "opportunity cost" of VCM, rather than its actual production cost, should be attributed to vertically integrated PVC producers. The opportunity cost is the price at which an integrated firm could sell VCM if it did not use it internally. *See* Scherer, *supra* note 61, at 305; Stigler, *supra* note 61, at 105. If internal VCM costs were persistently lower than opportunity costs, nonintegrated producers would not be able to compete with integrated producers. *See, e.g., Azcuenaga Opinion* at 13 n.22, *citing* Klass, Tr. 5337–38; IDF 203. One would also expect entry into the PVC market to require simultaneous entry into the VCM market. Respondents make no such claim.

With respect to VCM transportation costs, PVC producers that receive VCM via pipeline realize a cost advantage of 0.5 cents to 1.0 cent per pound. RPF 292 *in camera, citing* RX 57Z62 *in camera.*

[175] DiLiddo, Tr. 3395; Disch, Tr. 641–43.

[176] IDF 199; Disch, Tr. 645; Schaefer, Tr. 1149.

[177] The cost of producing general purpose PVC resin may be as much as [ ] cents per pound lower in a large reactor than in a small reactor. RX 875V-W *in camera.* Most firms operate several different sizes of reactor. For example, Tenneco operates some 3,750 gallon reactors at its Burlington, New Jersey plant, and some 34,000 gallon reactors at its Pasadena, Texas plant. Disch, Tr. 638. Reactors with a capacity of 18,000 to 50,000 gallons are classified as large reactors. Disch, Tr. 640.

efficient large reactors, and require little or no technical customer service. RX 34R; Klass, Tr. 4322. By contrast, specialty resins are costlier to produce, because they tend to be manufactured in less efficient smaller reactors, and require more technical customer services.[178] [80] Because different firms use reactors of different sizes to produce different PVC resins, their production costs differ significantly. A 1982 Goodrich cost study of eight PVC producers indicated that "total plant operating costs" for producing PVC varied among plants from 14.30 cents per pound to 21.94 cents per pound.[179] These cost differences are accentuated by the fact that different PVC producers emphasize the production of different PVC grades.[180]

Second, as noted *supra*, transportation costs differ to some degree from one PVC producer to another. In particular, significant locational differences mean that PVC producers incur different costs in shipping PVC resin throughout the United States.[181] Complaint counsel maintain that most PVC is sold on a delivered price basis, and that price differences based on location have therefore effectively been eliminated. CPF 7.14. However, although uniform delivered pricing may have this effect, it is unclear whether delivered PVC prices are in fact uniform. [81] Thus, transportation cost differences may further complicate any effort at price and output coordination in the PVC market.[182]

b. *VCM Market*

VCM production costs are much more similar from one VCM producer to another. There are two basic categories of manufacturing costs: (1) the cost of ethylene and chlorine feedstocks; and (2) the cost of converting them into VCM. IDF 290 *in camera*. In addition, transportation costs must be considered. Raw material costs are virtually identical. Virtually all VCM plants produce VCM from ethylene and chlorine feedstocks.[183] Ethylene and chlorine must be used in fixed proportions to produce VCM (60 percent chlorine and 40 percent ethylene), all firms use them in those proportions, both are highly homogeneous products, and VCM producers therefore pay similar prices for them.[184]

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[178] Becker, Tr. 1330–32; Arp, Tr. 3519–20; RX 34R; RX 639E. Giles Disch testified that there would be no economic advantage to Tenneco to construct a new small reactor plant today. Disch, Tr. 640. No new small reactor plant has been built in the United States since the late 1960's. Disch, Tr. 642.

[179] RX 1168A-B *in camera;* RX 245–0 *in camera;* RAB at 43, *citing* RPF 290–92; *accord* DiLiddo, Tr. 3224–26. Of course, these differences are not surprising because the plants studied produce a wide variety of PVC resins. During the 1981–1983 period, the average selling price of "general purpose PVC resin" ranged from 17 cents per pound to 35 cents per pound. RPF 291, *citing* CX 671A-C, F-H; RX 244A.

[180] RX 1170A; Klass, Tr. 4321–22.

[181] RPF 295 *in camera, citing* RX 1168A; RX 13K; RX 13Z5; McMath, Tr. 1956–57; RX 34Q; RX 264B; RX 325H; RX 945A-O; *see* page 67, *supra*.

[182] Complaint counsel also argue that locational differences "cancel out;" that is, the cost of shipping incoming VCM cancels out the cost of shipping outgoing PVC. IDF 201; ID at 61 n. 42. However, the VCM may originate in a location different and distant from the destination of the PVC into which it is converted.

[183] IDF 292 *in camera*. The one exception is a plant owned by Borden which produces VCM using a much older acetylene process. That plant accounts for only 2 percent of practical production capacity. *Id.*

[184] IDF 293–294 *in camera;* Goodrich Admissions 59–60; CX 4I; L. Wheeler, Tr. 917–18.

Second, all producers have access to similar production technologies, which permit the production of large volumes at low [82] cost, because there are no significant patent barriers. IDF 291. Respondents' expert testified:

> [M]ost producers, if not all, have access to effective production technology which enables them to produce large volumes at low costs.[185]

Another witness testified that in the VCM market, no firm has

> a peculiar proprietary niche or some position that allowed [one firm] to achieve returns or earnings that somebody else couldn't . . .[186]

Furthermore, because VCM manufacturers produce only one grade of VCM, there is no reason—unlike the PVC market—to retain both large and small reactors. As a result, all VCM producers operate large, highly efficient plants. Several witnesses confirmed that all VCM producers have similar manufacturing costs. One estimated that short-run avoidable costs differed by only one-half cent per pound among firms in the industry.[187] Two other witnesses agreed that there is no significant cost disparity from one firm to another.[188] A 1981 Air Products [83] study similarly concluded that VCM processing costs varied little from one VCM firm to another.[189]

Third, transportation costs do not differ significantly from one VCM producer to another, primarily because all except one domestic VCM plant are located along the Gulf Coast in Texas and Louisiana.[190] On balance, the record evidence establishes that VCM production costs are relatively similar across firms. Although respondents have identified some minor differences,[191] absolute congruence is not needed to heighten the likelihood of anticompetitive effects from the acquisition. [84]

4. Size Distribution of Purchasers

The size distribution of purchasers of the relevant product may also affect the likelihood of anticompetitive effects from an acquisition. If a small number of buyers accounts for a large percentage of total

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[185] Klass, Tr. 4009.

[186] Kienholz, Tr. 884.

[187] L. Wheeler, Tr. 936–38.

[188] Kienholz, Tr. 814; Taylor, Tr. 1570.

[189] RX 57Z29, Z131 *in camera; accord* RX 877B *in camera.*

[190] RX 57Z6 *in camera.* The only exception is Goodrich's Calvert, Kentucky plant. *Id.*

[191] *See* RPF 410 *in camera, citing* RX 877D; RPF 411–412 *in camera;* RAB at 42–43. For example, respondents argue that VCM producers confront dissimilar raw materials costs as a function of whether or not they are integrated upstream into chlorine and caustic soda production. RPF 411 *in camera.* However, as discussed in note 174 *supra,* the appropriate cost at which to evaluate an internally transferred input is its market price (opportunity cost), because that is the value the integrated firm gives up by using the input internally instead of selling it on the open market. Moreover, even if upstream integration could be a source of differentiation, it would have little significance in this case because in 1983 firms accounting for nearly 80 percent of total VCM practical production capacity *were* integrated into chlorine production. Only Borden, Shell and Conoco were not so integrated. RX 246.

product purchases, that may constrain the pricing discretion of product manufacturers to some degree.[192] By contrast, a large number of buyers are not likely to be able to constrain manufacturer pricing discretion.

a. *PVC Market*

It seems unlikely that PVC purchasers could, by virtue of their size, constrain the exercise of market power by PVC producers. One 1979 Goodrich study indicated that the largest PVC buyer (Carlon) accounted for less than 7 percent of the PVC market, and that 300 PVC buyers together accounted for 80 percent of the market. The study indicated that the

> 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.

CX 53J-K; *accord,* CX 64P,S. That pattern is also present in many of the product market segments. For example, Goodrich studies from the late 1970's identify 136 wire and cable purchasers (purchasing 8.4 percent of total PVC production); 166 flexible [85] resin purchasers (18.1 percent); and 263 specialty resin purchasers (2 percent). IDF 216. The pipe segment is somewhat more concentrated on the buyer side. Although 100 buyers purchase pipe resin (accounting for 40 percent of total PVC production), the four largest purchasers account for 60 percent of that total, or 24 percent of total PVC production.[193]

b. *VCM Market*

The level of concentration among VCM purchasers is considerably greater. Seven PVC producers—Air Products, CertainTeed, Keysor-Century, Occidental, Pantasote, Shintech and Tenneco—do not produce VCM, and therefore must purchase it from other firms.[194] Nevertheless, concentration levels are substantially higher among VCM producers than among VCM buyers; only three nonintegrated VCM producers accounted for approximately one-half of VCM production in 1982. It therefore seems unlikely that VCM buyers could constrain the pricing discretion of VCM sellers to any significant degree.

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[192] *HCA v. FTC,* 807 F.2d at 1391, *citing* Stigler, *supra* note 61 at 39, 43–44; *see FTC Statement,* ¶4516 at 6901–4; *DOJ Guidelines* at ¶3.42.

[193] IDF 216–217; Disch, Tr. 683; *see* RPF 336 *in camera, citing* RX 35E; RX 639D; RX 669B.

[194] IDF 78. The remaining five PVC producers—Goodrich, Formosa, Georgia Pacific, Borden and Conoco—are fully integrated upstream into VCM production. *Id.* The three remaining VCM producers are not integrated downstream into PVC production. *Id.*

5. Transaction Characteristics

The manner in which sales are typically made in an industry also affects the likelihood of anticompetitive effects from an [86] acquisition, for two reasons. First, if most firms make only a few sales each year, their incentives to cheat are likely to be high. Each additional sale contributes substantially to income, and the risk of effective retaliation from competitors is correspondingly reduced. On the other hand, if the typical firm makes many sales each year, the value of cheating on a given transaction is not substantial and the prospect of effective retaliation may be correspondingly greater.[195] Second, when sales are made openly, cheating can be detected quickly and easily, and retaliation by rival firms is consequently more likely. On the other hand, when sales are made through private negotiations, it is much more difficult to detect and punish secret price concessions.[196]

a. *PVC Market*

Approximately 50 to 60 percent of bulk and suspension PVC resin is sold pursuant to written contracts, normally one year in duration.[197] Although the contracts may specify an expected volume for the entire year, buyers typically advise sellers each [87] month of the amount they will purchase the following month.[198] Thus, in practical effect, buyers purchase product on a monthly or even daily basis.[199]

PVC sales contracts also typically do not specify the prices that are to prevail throughout the contract term. Instead, they rely upon "competitive price provisions," in which a buyer notifies the seller when it has

> a competitive offer for equal terms, equal quantities, equal time situations, which allows us as the seller to generally either meet that new criterion or decline. . . . [and] not supply that volume stipulated.[200]

In short, pursuant to these clauses, buyers are permitted to cancel purchases if they can secure lower prices elsewhere, but are required to give sellers the opportunity to meet competing offers. IDF 211 *in camera.* The competitive price provisions ensure that PVC sellers quickly discover price concessions offered by competing firms. *See* IDF 237.

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[195] *DOJ Guidelines* at ¶3.42; Scherer, *supra* note 61, at 220–22; Hay, *supra* note 58, at 450.

[196] Scherer, *supra* note 61, at 222–25; Hay, *supra* note 58, at 450–51.

[197] IDF 211 *in camera*, 219 *in camera;* DiLiddo, Tr. 3253 (Goodrich: 60 percent contract business; 20 percent "handshake type of relationship;" 20 percent "spot basis"); Weber, Tr. 1790 (Diamond: "Well over 50 percent was sold under contract."); Disch, Tr. 685.

[198] *E.g.*, Disch, Tr. 685.

[199] IDF 218; Disch, Tr. 707, 728; McMath, Tr. 1897, 1951; Schaefer, Tr. 1140, 1200; *see* RX 899A.

[200] Disch, Tr. 684; *accord* DiLiddo, Tr. 3254–55; Weber, Tr. 1789–90. On the significance of similar provisions for facilitating collusion, *see generally* Salop, *supra* note 58; Clark, *supra* note 58.

A significant proportion of the remaining 40 to 50 percent of PVC sales is made pursuant to an ongoing customer-supplier "handshake" relationship, in which orders are placed and filled [88] on a "current market conditions" basis.[201] These relationships are relatively secure because of certain peculiarities associated with any given brand of PVC resin. A particular supplier's PVC resin must be tested on a customer's fabricating equipment, and the equipment must be adjusted to the resin's formulation before that customer can use it.[202] Customers are therefore reluctant to switch suppliers, and will not do so when competing prices are identical. IDF 220. Moreover, although some firms buy PVC from more than one supplier, they fill their requirements for a given plant from one supplier, in order to ensure plantwide consistency. IDF 221. These considerations lead customers buying on a "handshake" basis to notify their sellers of competitive offers, so that suppliers regularly receive information concerning lower prices from these buyers as well. IDF 237.

These factors together suggest that the frequency and size of transactions in the PVC market increase the likelihood of anticompetitive effects from the acquisition in that market. [89]

b. *VCM Market*

Contracts for the purchase of VCM are typically quite similar to PVC purchase contracts; they are discussed in detail in Part IV.C.7, *infra*. As a result, the frequency and size of VCM purchase transactions similarly increase the likelihood of anticompetitive effects in the VCM market. Of course, a substantial proportion of VCM production is manufactured by firms that are integrated into PVC production. The significance of that fact is also discussed in detail in Part IV.C.7, *infra*.

6. Stability and Predictability of Demand and Supply Conditions

The stability and predictability of demand and supply conditions also help to determine the likelihood of anticompetitive effects from an acquisition. Greater stability and predictability make it easier to create and sustain a collusive arrangement. By contrast, shocks that suddenly alter demand or supply conditions may complicate collusion. In industries in which fixed costs are a high percentage of total costs, the presence of substantial excess capacity—as a result of a sudden decline in demand—may place strong downward pressure on prices.[203] Firms may in the short run be willing to sell at prices below their average total costs, because prices at such levels, in addition to

[201] IDF 219 *in camera*. The remaining proportion of PVC sales is made on the spot market.

[202] Yu, Tr. 2159; DiLiddo, Tr. 3371–72; H. Wheeler, Tr. 1747–48.

[203] *See, e.g.*, Hay, *supra* note 58 at 450; Scherer, *supra* note 61, at 209.

covering all variable costs, cover at least a portion of their fixed costs. However, fixed costs are not a particularly large proportion of total costs in either the PVC or the VCM market. *See* note 171, *supra,* and pages 92 and 94, *infra.* Moreover, during periods of demand growth, such as the period beginning in 1983 and continuing today, any pressure to [**90**] reduce PVC or VCM prices that producers' fixed costs might have created has disappeared, because capacity utilization has returned to high levels.

a. *PVC Market*

Demand for PVC grew rapidly in the 1960's and 1970's, largely because of growth associated with construction applications. In the 1960's, the industry grew at an average annual rate of 13 to 15 percent, but that rate declined to 10 to 11 percent in the early 1970's. IDF 233; IDF 234 *in camera.* The average annual growth rate then fell to 8 percent by the end of the 1970's, and since 1979 the industry has grown at an average rate of 3 to 4 percent annually. IDF 234. A number of witnesses testified that PVC resin is a "mature product," and that annual growth will approximate annual GNP growth (3 to 4 percent annually) for the foreseeable future. IDF 235; Disch, Tr. 692.

Capacity utilization levels in the PVC market vary with general economic conditions, particularly conditions in the construction industry. Respondents note that in the 1980's, construction has accounted for "well over 50%" of PVC consumption.[204] The most relevant measure of capacity is practical production capacity, because it determines the amount of capacity that can be placed in production at little additional marginal cost. Between 1970 and 1974, practical production [**91**] capacity ranged from 96 percent in 1970 to 94 percent in 1973, and never fell below 93 percent. In 1974, with the onset of the recession, capacity utilization fell to 89 percent, and to 64 percent in 1975, before climbing to 78 percent in 1976, 86 percent in 1977, 94 percent in 1978, and 93 percent in 1979. In 1980, when interest rates rose and construction declined, capacity utilization fell to 80 percent. It remained at 80 percent in 1981, fell with the recession to 75 percent in 1982, increased to 84 percent in 1983, and increased again to an estimated 91 percent in 1984.[205] A number of witnesses testified that capacity utilization levels would continue to increase gradually dur-

[204] RPF 103 *in camera, citing* RX 1173A. Construction applications include pipe, wire and cable, siding, and floor tile. *See* pages 18–19, *supra.*

[205] CX 666H *in camera.* The cited capacity utilization levels are for January of each year cited. The 1984 figure is based upon the assumption that bulk and suspension PVC production increased by 12 percent in 1984, as reported by the Society of the Plastics Industry (*see* CX 778C), while capacity did not increase. CPF 17.08 n. 1 *in camera.* Nameplate capacity utilization levels exhibit a similar association with economic conditions, ranging from 88 percent in 1970 to a low of 56 percent in 1975, to a peak of 88 percent in 1978, to a low of 71 percent in 1982, and to an estimated high of 87 percent in 1984. CPF 17.03 *in camera, citing* CX 666H *in camera.*

ing the 1980's.[206] Several record documents indicate that an 80 percent capacity utilization level makes PVC resin prices profitable. For example, a 1983 Goodrich document indicates that "industry capacity utilization around 80% . . . [92] [h]istorically . . . has supported price increases . . ."[207]

Respondents argue that there is substantial excess capacity in the PVC industry, as a consequence of producer forecasting errors and the severity of the recent recession. IDF 241–242. Although this was apparently true during the recession, capacity utilization has recently rebounded to a high level. As a result, any incentive to cheat on consensus prices in response to depressed demand is not likely to persist over the next several years. That is particularly true because fixed costs do not generally represent a particularly large percentage of total costs in the PVC market. A 1983 study, for example, estimates that variable costs account for approximately 69 to 76 percent of the total cost of producing PVC resin.[208]

Supply conditions are similarly likely to remain relatively stable and predictable over the next several years. VCM is the primary input used to manufacture PVC, and ethylene and chlorine are in turn the primary inputs used to manufacture VCM. Ethylene is a petroleum compound, and its price is not likely to increase significantly over the next several years, given the fact that petroleum prices have recently declined and are likely to remain low for the foreseeable future. Chlorine prices are also relatively stable, and are likely to remain so for the next several years. [93]

b. *VCM Market*

Because 96 percent of all VCM production is used to produce PVC, demand for VCM is closely tied to demand for PVC. In the 1960's, the VCM market grew at an average annual rate of 12 to 15 percent, but that rate declined to 8 to 10 percent in the early 1970's. IDF 313–14; Kienholz, Tr. 792. Industry witnesses indicated that they expect the VCM growth rate to approximate GNP growth (3 to 4 percent annually) for the foreseeable future. IDF 315 *in camera;* IDF 316; Kienholz, Tr. 792.

Capacity utilization levels in the VCM market also vary with general economic conditions, and in particular with conditions in the construction industry. In 1979 the VCM market operated at 96 percent of its practical production capacity, but that level fell to 83 percent in 1980, 77 percent in 1981, and 74 percent in 1982, before increasing

[206] Disch, Tr. 691–92; Schaefer, Tr. 1123; Eades, Tr. 1473–74, 1480; H. Wheeler, Tr. 1736–37; CX 220C.

[207] CX 185Z6–Z7 *in camera; accord* Schaefer, Tr. 1124; RX 840B.

[208] RX 1213H *in camera; see* RX 428P *in camera.*

to 75 percent in 1983 and to an estimated 92 percent in 1984.[209] Historically, an 80 percent operating rate has permitted VCM producers to earn small profits, while a 90 percent operating rate has permitted them to achieve "longterm reasonable return objectives." Kienholz, Tr. 807.

Respondents contend that VCM producers currently confront substantial excess capacity, and that it will persist for the [94] foreseeable future. IDF 323. However, several witnesses testified that the excess capacity developed because of the recession; that capacity utilization improved in 1984; and that it is expected to further improve over the next few years to such an extent that new capacity may be needed by 1990. IDF 325 *in camera;* IDF 326; *see* Kienholz, Tr. 796–97. The 1984 capacity utilization data support that conclusion. Moreover, even lower capacity utilization levels are not likely to place strong downward pressure on prices because fixed costs do not represent a very large percentage of total costs. For example, the 1981 Air Products study indicates that at least 50 percent of total VCM production costs are variable costs. *See* RX 57Z30 *in camera.*

Supply conditions are also likely to remain stable for the next few years. As we observed *supra,* chlorine and ethylene are the primary components of VCM, and prices for both are likely to remain relatively stable for the foreseeable future.

7. Significance of Vertical Integration

The degree to which firms within an input ("primary" or "upstream") industry are integrated into a "secondary" (or "downstream") industry may affect both their incentives to create a coordinated price and output strategy, and their ability to maintain that strategy by detecting and punishing efforts to deviate from it. These two concepts are closely related. For example, firm incentives to coordinate prices and output are likely to be higher if firms believe they will be able to monitor the behavior of their competitors. An acquisition involving one or more integrated firms [95] in either the primary or the secondary market may alter that balance for the firms involved, and thereby frustrate or facilitate collusion in either market.[210]

[209] CX 665A-F *in camera.* The cited capacity utilization levels are for January of each year cited. The 1984 figure is based upon the assumption that VCM production, like PVC production, increased by 12 percent in 1984. *See* note 205, *supra.* Nameplate VCM capacity utilization levels changed in a similar fashion, from 92 percent in 1979 to a low of 70 percent in 1982 and 1983, and then to an estimated 87 percent in 1984. CX 665A-F *in camera.*

[210] The presence of vertical integration may also affect firm incentives to engage in anticompetitive conduct other than collusion, such as the anticompetitive foreclosure of unintegrated downstream producers from purchasing an input manufactured by previously unintegrated upstream producers. *See* Krattenmaker & Salop, *Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power Over Price,* 96 Yale L.J. 209 (1986); Salinger, *Vertical Mergers and Market Foreclosure* (Working Paper No. FB–84–17, Graduate School of Business, Columbia University 1985). We do not need to consider other anticompetitive mechanisms in the present case in view of our finding of liability based upon an increase in the likelihood of collusion in the VCM market. In addition, a vertical

(footnote cont'd)

a. *Effects on Firm Incentives to Cooperate*

The effects of vertical integration upon firm incentives to collude will depend upon whether any given integrated firm on balance will benefit from or be harmed by collusion. It is perhaps easiest to appreciate these effects by considering the incentives favoring collusion in the primary (upstream) market—in this case, the VCM market. The foregoing analysis establishes that collusion would be both possible and profitable in the VCM market. Firms that are *not* integrated downstream into the secondary (PVC) market will therefore have a strong incentive to increase primary market prices to supracompetitive levels. VCM producers that *are* integrated downstream are likely to have an equally strong incentive to **[96]** increase VCM market prices, because they can produce either as much VCM as they need—or more than they need—to supply their PVC operations.

First, if integrated VCM producers can manufacture only enough VCM to supply their own PVC operations, then an industrywide increase in VCM market prices will permit them to increase their PVC prices, because nonintegrated PVC producers will have to increase their prices in order to accommodate the VCM price increase.[211] Thus, these integrated firms may actively participate by *reducing* their own captive production. Alternatively, they may passively welcome collusion in the primary market—in the sense that they will profit from declining to increase VCM production in response to higher VCM prices—thereby allowing unintegrated VCM producers to reduce their output and secure higher VCM prices. Second, if integrated firms can produce more VCM than they need for PVC production—and hence can make some open market VCM sales—they will secure additional revenues from an increase in VCM prices. In both of these situations, therefore, integrated firms will have an incentive to support an increase in VCM market prices, and hence to **[97]** support a collusive effort in that market.[212] All integrated VCM producers now fall into one of these two categories (*see* Table II and Table V, *supra*),

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acquisition may reduce the type of inefficiency described in the economic literature on successive monopolies. *See, e.g.*, Waterson, *Vertical Integration, Variable Proportions, and Oligopoly*, 92 Econ. J. 129 (1982). However, this case focuses on a horizontal, rather than a vertical, acquisition.

[211] If the price elasticity of demand for the output is low—as it is for both VCM and PVC—then it will be possible to pass along most or all of the increase in input prices. The increase in VCM market prices will not actually increase the VCM costs of integrated firms, except that the opportunity cost of devoting VCM production to captive PVC output instead of VCM open market sales will increase. The cost of diverting VCM production in this fashion may be substantial, however, especially if no excess VCM capacity is available.

[212] If integrated producers have no incentive to compete away primary market price increases, then unintegrated primary market firms can be fairly sure that their integrated rivals will acquiesce in or support collusion by the unintegrated subset. In this situation, collusion is likely if the number of unintegrated firms is small, even if there are a large number of producers when the integrated firms are also counted. Hence, an acquisition that makes an integrated firm more likely to facilitate or passively accept collusion will increase the likelihood of collusion by unintegrated firms in the primary market. *See* Krattenmaker & Salop, *supra* note 210, at 262 (discussing "Frankenstein Monster").

and therefore have the incentive to support a collusive effort to raise VCM market prices.

If, by contrast, an integrated firm produces more of the secondary market product than it can sustain with its own primary market production, and hence must purchase additional primary market inputs from other firms, that may reduce its interest in higher primary market prices, although its secondary market revenues would still benefit from higher primary market prices. Goodrich found itself in this position prior to the acquisition, when it controlled 1.192 billion pounds of PVC practical production capacity, but only 930 million pounds of VCM practical production capacity. *See* Table VII, *infra.* If some integrated firms can produce more of the primary product than they need while others cannot, their incentives with respect to primary product price levels will differ [98] to some degree.[213] None of the integrated VCM producers currently fall in the latter category.

b. *Effects on Firm Monitoring Efforts*

Any firm that participates in a collusive effort—whether it is integrated or not—will prefer to see its competitors keep their prices uniformly and persistently at supracompetitive levels, so that it can both sell its output at supracompetitive prices and secure additional profits by cheating on the consensus. Colluding firms must therefore be able to enforce their consensus by detecting and retaliating against cheating on the consensus.

Vertical integration may affect the extent to which colluding firms can enforce their consensus in two ways. First, if some integrated firms produce more of the primary product than they use internally, nonintegrated primary producers must be able to monitor open market sales of the primary product by integrated firms. This monitoring task is no different from the monitoring required to sustain a collusive arrangement among nonintegrated firms, and conditions in the VCM market permit VCM producers to monitor integrated firm VCM sales. [99]

Second, the colluding firms must be able to monitor secondary market sales by integrated firms, because cheating through "reductions" in the "price" of the primary product that integrated firms use internally can take the form of additional secondary market sales. In general, the colluding firms can rely on the integrated firms as a group to monitor their integrated competitors. More precisely, if several firms accounting for a substantial percentage of primary market

[213] However, when downstream producers cannot substitute other inputs for the upstream product, when downstream production is characterized by constant returns to scale, and when downstream markets are competitive, a firm's incentive to collude in the upstream market will not depend upon its downstream market position. *See* White, *Antitrust and Video Markets: The Merger of Showtime and the Movie Channel As a Case Study,* in *Video Media Competition* (E. Noam ed. 1985) (significance of variable proportions production technology).

output are vertically integrated, each can be expected to monitor carefully the secondary market prices of its integrated competitors, and to retaliate quickly if cheating in that market or in the primary market occurs.[214] The speed with which price reduction information reaches nonintegrated producers will increase as the integrated producers' collective share of secondary market share increases. Integrated VCM producers currently account for approximately 50 percent of VCM production.

A second monitoring mechanism allows information on the downstream behavior of the integrated firms to reach nonintegrated upstream producers, so that the nonintegrated firms may participate in policing secondary market cheating by integrated firms. If the nonintegrated VCM producers observe a reduction in orders from their [**100**] nonintegrated PVC producer customers—accompanied by customer complaints of a price squeeze (or complaints that their PVC fabrication customers report a price squeeze)—they can infer that the integrated firms are cheating on the VCM cartel by lowering prices in the PVC market. Moreover, because VCM is such a standardized product, nonintegrated VCM producers are familiar with the cost functions of their integrated rivals, facilitating their ability to distinguish integrated firm cheating from price changes occasioned by changing cost conditions.

c. The Effects of Vertical Integration Upon the VCM and PVC Markets

Table VII describes the degree of integration by ownership into PVC production of VCM producers.[215] Prior to the acquisition, [**101**] firms *not* integrated forward into PVC production controlled 46.9 percent of total VCM practical production capacity (4.165 billion pounds); integrated firms controlled the remaining 53.1 percent. Prior to the acquisition, firms *not* integrated backward into VCM produc-

[214] Retaliation in the form of increased sales at reduced prices will be most feasible if the retaliating firms are operating along a horizontal section of their marginal cost curves. In that situation, there are no significant capacity constraints upon production increases. Because VCM producers are currently operating at an estimated 90 percent of practical production capacity (*see* page 93, *supra*), there is enough slack—approximately 10 percent of practical production capacity—to make effective retaliation feasible.

[215] In this industry, the crucial stages of production are (a) the manufacture of ethylene dichloride from ethylene and chlorine, (b) its transformation into VCM, (c) the production of PVC resin, and (d) the fabrication of PVC-based industrial and consumer products. The fabrication stage includes the production of PVC compounds from PVC resins.

The significance of vertical integration for competition in the VCM and the PVC markets need only be evaluated with respect to integration by ownership. Respondents contend that the three unintegrated VCM producers have ceded control over major parts of their VCM capacity to unintegrated PVC producers through long term VCM supply contracts. RAB at 76–77; RPF 372 *in camera*. Although firms can transfer corporate control by contract short of integration by ownership, such a result would require the contractual allocation of the great majority of firm capacity. Functional integration is not created by long term contracts involving much smaller percentages of capacity. *Compare* RPF 371 *in camera with* RPF 374 *in camera*. Moreover, these contracts typically give the firms the cover independent discretion as to the quantities they will buy or sell, and their customers and sources of supply. *See* pages 21–22, *supra*.

tion controlled 44.6 percent of total PVC practical production capacity (2.985 billion pounds); integrated firms controlled the remainder. Prior to the acquisition, Goodrich was the only integrated firm that controlled *less* VCM practical production capacity (930 million pounds) than PVC practical production capacity (1.192 billion pounds).[216] By contrast, Diamond controlled substantially *more* VCM capacity (1.070 billion pounds) than PVC capacity (602 million pounds). After the acquisition, five integrated producers (Diamond and Ethyl exited) accounted for 58.08 percent of total VCM practical production capacity, and 61.2 percent of total PVC practical production capacity. *See* Tables II and V, *supra.* [102]

TABLE VII

Vertical Integration
January, 1982

Firm[217]	VCM Practical Production Capacity	PVC Practical Production Capacity
Dow	1.945 (1st)	—
Shell	1.385 (2nd)	—
Diamond Shamrock	1.070 (3rd)	0.602 (4th)
Ga. Pacific	1.000 (4th)	0.600 (5th)
Goodrich	0.930 (5th)	1.192 (1st)
PPG	0.835 (6th)	—
Conoco	0.650 (7th)	0.585 (6th)
Borden	0.472 (8th)	0.420 (8th)
Ethyl	0.300 (9th)	0.120 (12th)
Formosa	0.286 (10th)	0.196 (11th)
Tenneco Polymers	—	0.785 (2nd)
Shintech	—	0.720 (3rd)

[216] Because it takes 1.02 to 1.04 pounds of VCM to produce 1 pound of PVC resin (Disch, Tr. 643), VCM and PVC practical production capacities can be compared essentially on a one for one basis.

[217] The listed firms are those that were producing VCM and/or PVC as of 1982. The capacity figures are expressed as billions of pounds. The data are derived from Table I and Table IV, *supra.*

Occidental Chemical	—	0.556 (7th)
Air Products	—	0.310 (9th)
CertainTeed	—	0.220 (10th)
Other	—	0.394
Total	8.873	6.700 **[103]**

The acquisition strengthened the incentives of VCM producers to collude, and improved their ability to enforce such a consensus. Prior to the transaction, Goodrich and Diamond were both vertically integrated producers, but Goodrich was a net VCM buyer—with less VCM capacity than PVC capacity—while Diamond was a net VCM seller—with more VCM capacity than PVC capacity.[218] As a result, Goodrich had a significant interest in somewhat lower VCM prices that conflicted to some degree—but did not override—its interest in higher PVC prices. After the acquisition, Goodrich controlled 23.7 percent of VCM practical production capacity (1.997 billion pounds), and 19.4 percent of PVC practical production capacity (1.34 billion pounds). The merged entity became a substantial net VCM *seller*—with greater VCM capacity than PVC capacity—to an even greater degree than Diamond had been before the acquisition.[219] By removing Goodrich as an integrated net buyer of VCM, and any incentive it might otherwise have had to secure lower VCM prices, the acquisition increased the incentive of the merged entity to collude in the VCM market, or at least to passively **[104]** welcome collusion by the unintegrated VCM producers.[220] Removing Goodrich's incentive to thwart a collusive VCM price increase is of particular concern because there are only three unintegrated VCM firms. Coordinated action by the unintegrated VCM producers is therefore substantially more likely to occur.

In order to establish that vertical integration will not defeat collusion in the primary market, it is not enough, however, to establish that nonintegrated VCM producers have a strong incentive to collude and that integrated producers have an incentive to actively support or acquiesce in such a collusive effort. In addition, participating firms

[218] In 1981, Goodrich produced 843.962 million pounds of PVC (16.1 percent of 5.242 billion pounds), and 774.728 million pounds of VCM (11.3 percent of 6.856 billion pounds). By contrast, Diamond produced 435 million pounds of PVC (8.3 percent of 5.242 billion), and 921.446 million pounds of VCM. *See* Tables I and IV, *supra*.

[219] In 1983, Goodrich produced 1.0368 billion pounds of PVC (18.4 percent of 5.635 billion pounds), and 1.5655 billion pounds of VCM (22.26 percent of 7.033 billion pounds). *See* Tables II and V, *supra*.

[220] Even if the PVC market were perfectly competitive, anticompetitive conduct in the VCM market could create power over price in the PVC market by in effect creating an involuntary PVC cartel; that is, by forcing all PVC producers to raise price in a coordinated fashion, whether or not a voluntary PVC cartel could have formed. *See generally* Salop and Scheffman, *infra* note 240. In other words, the increase in PVC prices requires a downward sloping *market* demand curve but not downward sloping *firm* demand curves.

must be able to enforce the terms of their collusive effort, and as a part of that effort must be able to monitor the conduct of their competitors. As the *DOJ Guidelines* indicate,

> [c]ollusive agreements are more likely to persist if participating firms can quickly detect and retaliate against deviations from the agreed prices or other conditions. Such deviations are easiest to detect, and therefore less likely to occur, in markets where detailed information about specific transactions or individual price or output levels is readily available to competitors.

DOJ Guidelines at ¶3.42. **[105]**

The record evidence suggests that VCM producers could successfully enforce the terms of a collusive arrangement. Nonintegrated and integrated VCM producers can and do successfully monitor VCM market prices. Most VCM is sold pursuant to written long-term contracts at least one year in length.[221] Most such contracts permit the seller to reset the contract price over the contract term, and most of them also require the seller to provide notice of price increases a prescribed number of days in advance.[222] In some VCM contracts, the price to be charged is determined with reference to VCM prices charged by other firms in the VCM market.[223] Most VCM contracts also contain meeting competition clauses, pursuant to which a buyer that receives an offer of a lower price from a competing seller is obligated to report that price to the contracting seller and give the contracting seller an opportunity to match it.[224] Moreover, in VCM sales relationships not **[106]** involving written contracts, buyers frequently permit current suppliers to meet competitive offers. IDF 298. These provisions—whether formally contractual or not—give VCM buyers a strong incentive to monitor industry transactions for price concessions, and increase the likelihood that whenever a seller offers a concession to a buyer, other sellers will discover it and retaliate. Industrywide use of these clauses therefore discourages price reductions or other concessions in the VCM market.[225] As a result of these contractual provisions, VCM suppliers secure a considerable amount of price information through their customers. IDF 298, *citing* Kienholz, Tr. 810–811.

VCM suppliers also learn of competitive price changes through

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[221] IDF 296 *in camera, citing* Taylor, Tr. 1663–68; L. Wheeler, Tr. 958 *in camera;* IDF 305 *in camera, citing* Weber, Tr. 1839–40; Kienholz, Tr. 811–812; Taylor, Tr. 1592–93; Schaefer, Tr. 1145.

[222] IDF 296 *in camera, citing* Goodrich Admissions 507, 509; CX 4Z–40; IDF 300 *in camera, citing* Wheeler, Tr. 958–960 *in camera;* CX 702; CX 705; CX 707; CX 735; CX 736; CX 739; IDF 317; Taylor, Tr. 1596.

[223] IDF 297 *in camera, citing* Schaefer, Tr. 1223 *in camera;* CX 88X-Y *in camera.*

[224] IDF 296 *in camera, citing* Wheeler, Tr. 958–960 *in camera;* CX 88X-Y *in camera;* IDF 317; Kienholz, Tr. 811–813; *see* Taylor, Tr. 1596–97.

[225] *See* Kienholz, Tr. 811; *see also* Schaefer, CX 295Z30 *in camera; see generally United States v. FMC Corp.*, 306 F.Supp. 1106, 1112 (E.D. Pa. 1969); Salop, *supra* note 58 at 27–30; Clark, *supra* note 58 at 934–935.

public announcements in the trade press.[226] In addition, many VCM sales are made pursuant to sales, tolling and exchange agreements between VCM competitors,[227] in part because integrated VCM sellers both buy and sell VCM. These agreements facilitate the exchange of price information among VCM producers.[228] In [**107**] particular, because VCM contract prices are frequently subject to negotiation based upon changes in market prices, sales, tolling, and exchange agreements between VCM sellers create a forum for discussing industry prices. For example, one Goodrich document indicates that an employee of a competing VCM seller called in late 1982 "to discuss the average VCM prices now prevailing in the marketplace . . ." CX 217C *in camera.*

As a consequence of the wide availability of price information, particularly through meeting competition clauses and supply interrelationships, VCM firms are generally able to secure relatively reliable and accurate VCM price information.[229] Hence, for example, a number of VCM sellers were familiar with the terms of a specific VCM supply contract between Dow and Air Products.[230] Furthermore, VCM producers monitor the market shares, capacity, and changes in capacity of their VCM competitors.[231]

It is conceivable in some industries that purchasing firms will recognize that meeting competition clauses may facilitate [**108**] seller collusion, and will therefore prefer to switch suppliers—in response to offers of lower prices from rivals—rather than report the offers to existing suppliers. Such conduct is unlikely in the VCM market, primarily because it is costly to switch from one supplier to another. VCM is a highly volatile gaseous chemical. Approximately 50 percent of the VCM sold in the United States is transported by pipeline from suppliers' plants to their customers' premises.[232] Pipeline transportation is cheaper and safer than transportation by barge or tank car.[233] As a result, once such a pipeline is in place, the cost savings it produces make it highly unlikely that a VCM customer will switch to another supplier.[234] The record evidence also establishes that non-pipeline customer/supplier relationships tend to be stable over

[226] IDF 299, *citing* CX 736; CX 737; CX 739.

[227] L. Wheeler, Tr. 972–75 *in camera;* CX 557Z11 *in camera.*

[228] IDF 301 *in camera, citing* DiLiddo, Tr. 3295 *in camera,* Tr. 3299; CX 88 *in camera;* CX 24 *in camera;* CX 26 *in camera;* CX 206A; CX 207; CX 208; CX 212; CX 213; CX 214; CX 215; CX 217 *in camera.*

[229] IDF 302, *citing* Diamond Admission 535; CX 6V, Z67.

[230] IDF 303, *citing* Kienholz, Tr. 853–56; H. Wheeler, Tr. 1020–24 *in camera;* Schaefer, Tr. 1193–95; DiLiddo, Tr. 3306–09.

[231] IDF 304, *citing* Diamond Admission 523; CX 6V, Z–66; CX 169F; CX 971 *in camera;* CX 146; CX 215; CX 238E; CX 425.

[232] IDF 307, *citing* H. Wheeler, Tr. 989; Taylor, Tr. 1564.

[233] IDF 307, *citing* Kienholz, Tr. 756, 759–60; 789; L. Wheeler, Tr. 980–981; Taylor, Tr. 1563–64; Schaefer, Tr. 1129.

[234] IDF 307, *citing* Kienholz, Tr. 787–88, 790, 868–70; Taylor, Tr. 1566–67.

time.[235] In short, most VCM buyers prefer to stay with their current suppliers.[236] Thus, most VCM buyers will report offers of lower prices to their current suppliers so [**109**] that they can match them. In conjunction with the supply interrelationships described above, the active assistance of VCM purchasers permits VCM producers easily to detect cheating on *external* VCM prices in the open VCM market by competing VCM producers—whether integrated or not.

Both integrated and nonintegrated VCM producers can also monitor cheating by integrated VCM producers—with respect to *internal* VCM "prices"—by observing the prices of PVC. Because they are intimately familiar with both VCM and PVC production processes, and are participants in both the PVC and VCM markets, integrated firms can easily detect cheating with respect to either VCM or PVC prices by their rivals. Nonintegrated VCM producers can rely upon their customers to quickly detect and report PVC price reductions.[237] As noted *supra,* most PVC is sold pursuant to long term contractual or "handshake" relationships that typically contemplate price and output changes on a monthly basis.[238] These arrangements almost invariably provide—either expressly or implicitly—that PVC purchasers are to notify their suppliers of offers of lower prices by competing suppliers, and are to give their suppliers an opportunity to [**110**] match those prices.[239] In addition, suppliers are aware of other suppliers' prices because they frequently exchange or toll PVC with one another. CPF 7.15. PVC suppliers are very likely, in turn, to report any PVC price reductions to their VCM suppliers.

Additional upstream or downstream integration on the part of any of these producers might make price and output monitoring somewhat more difficult. However, that does not appear to be the case in this industry. On the upstream side, integration into chlorine production is unlikely to complicate monitoring. In 1983, firms accounting for 80 percent of total VCM practical production capacity were integrated backward into chlorine production; only Borden, Shell and Conoco were not so integrated. RX 246. On the downstream side, it is true that most PVC resin producers have some facilities for compounding and/or fabricating PVC. However, respondents have adduced no evidence indicating that these facilities together account for more than a small proportion of total PVC resin. [**111**]

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[235] IDF 308 *in camera, citing* Kaserman, Tr. 2500; Schaefer, Tr. 1145; CX 523T *in camera;* CX 419.

[236] IDF 306 *in camera, citing* Taylor, Tr. 1567–68; Schaefer, Tr. 1145.

[237] As noted *supra,* the fact that integrated producers account for a large percentage of PVC market sales makes it more likely that nonintegrated PVC producers will receive PVC price information concerning integrated producers quickly.

[238] IDF 211 *in camera;* IDF 219 *in camera;* Disch, Tr. 685.

[239] IDF 211 *in camera,* 237 *in camera;* Disch, Tr. 684; DiLiddo, Tr. 3254–55, Weber Tr. 1789–90. PVC buyers are very likely to report such offers to their suppliers because it is costly to switch suppliers, and they will therefore prefer to remain with their current suppliers. *See* page 88 and note 202, *supra.*

In short, both integrated and nonintegrated VCM producers have strong incentives to create and maintain a collusive arrangement, and can readily detect cheating from that arrangement and retaliate accordingly. In reaching this conclusion, it is important to emphasize and summarize the mechanism through which VCM producers could collude successfully. They collectively control an input that is essential to PVC production; that is highly homogeneous; that has a low price elasticity of demand; and that can be produced pursuant to a standardized technology available to all incumbent producers. In particular, the demand for PVC is sufficiently inelastic to make it likely that an increase in VCM prices can profitably be passed along to PVC customers. Anticompetitive conduct in the VCM market that raises the VCM price to all PVC producers will shift the supply curve of each downstream firm upward, and thereby increase the equilibrium price of PVC, because the demand curve for PVC is downward sloping.[240] This will occur even if the PVC market is perfectly competitive (and the record evidence does not in any event support that view).[241] **[112]**

As a result, VCM producers can effectively manage a collusive arrangement not only within the VCM market, but within the PVC market as well. This is true despite the fact that it would be difficult to collude successfully in the PVC market alone, for the reasons summarized below. It is therefore incorrect to argue, as the respondents do, that it is impossible to collude in the VCM market because it is impossible to collude in the PVC market. It is rather possible for VCM producers to create and maintain a collusive arrangement in the PVC market, notwithstanding some of its structural characteristics, because it is possible to create and maintain a collusive arrangement in the VCM market.

D. *Conclusion*

1. PVC Market

The HHIs and four-firm concentration ratios for the PVC market after the acquisition were just barely high enough to surpass the thresholds specified in earlier Supreme Court and Commission cases, as well as the thresholds at the lower end of the "moderately concentrated" range of the *DOJ Guidelines*. The concentration levels therefore create only a weak presumption of anticompetitive effects from

[240] This is true because, as noted *supra*, all current and potential PVC producers need VCM as an input. *See generally* Krattenmaker & Salop, *supra* note 210; Salop and Scheffman, *Raising Rivals' Costs*, 73 Am. Econ. Rev. 267 (1983). *Compare DOJ Vertical Restraints Guidelines* ¶3.21 (facilitating collusion).

[241] Even if the PVC market were perfectly competitive, anticompetitive conduct in the VCM market could create power over price in the PVC market by in effect creating an involuntary PVC cartel; that is, by forcing all PVC producers to raise price in a coordinated fashion, whether or not a voluntary PVC cartel could have formed. *See generally* Salop and Scheffman, *supra* note 240. In other words, the increase in PVC prices requires a downward sloping *market* demand curve but not downward sloping *firm* demand curves.

the acquisition in the PVC market. [113] We are persuaded that the structural evidence, on balance, rebuts this weak presumption and establishes that the acquisition is unlikely to lessen competition substantially in the PVC market, for three reasons. First, PVC resin is relatively heterogeneous. Several grades of PVC resin are needed for different end use applications, different PVC producers manufacture different amounts of each grade, and an effective collusive strategy would require reaching an agreement on price and output levels for each grade. Moreover, even within any particular PVC resin grade, quality varies from one PVC producer to another, making effective collusion even more difficult.

Second, costs vary significantly from one firm to another, primarily because different firms' operating costs vary as a function of the use of large and small reactors, and the fact that different firms emphasize the production of different PVC resin grades. Transportation cost differences represent an additional complicating factor. Third, although the price elasticity of demand for PVC is, on balance, relatively low, an effort on the part of PVC producers to raise PVC prices to supracompetitive levels may be constrained to some degree by the higher price elasticity of demand for many PVC end use products, and made more difficult by variations in price elasticity from one PVC end product to another.[242] [114]

2. VCM Market

The record evidence indicates that the HHIs and four-firm concentration ratios for the VCM market after the acquisition lay well above the concentration levels specified in earlier Supreme Court and Commission cases, and reached the upper end of the "moderately concentrated" range in the *DOJ Guidelines*. Moreover, the acquisition increased three different measures of HHI levels by 226 to 304 points. The concentration levels therefore create a relatively strong presumption that the acquisition substantially lessened competition in the VCM market.

The structural factors in the VCM market described above strengthen rather than rebut this presumption. First, impediments and one barrier to entry into the VCM market are sufficiently high to permit incumbent firms with market power to sustain supracompetitive prices for several years. Second, VCM is a highly homogeneous product; only one grade is used to produce PVC resin. Third, the

[242] Commissioner Azcuenaga points out that because the price elasticity of demand for PVC is relatively low, PVC producers—as well as VCM producers—"could pass on a collusive PVC price increase." *Azcuenaga Opinion* at 15. That in fact is an important reason why *VCM* producers could collude successfully. *See* pages 110-111, *supra*. However, the fact that *PVC* producers *could* pass on a cost increase does not mean that they will be able to determine and maintain a set of consensus prices, in light of the heterogeneity of PVC resins, and cost differences from one PVC producer to another.

price elasticity of demand for VCM is very low. Fourth, cost functions and raw materials and transportation costs do not differ significantly from one VCM producer to another. Fifth, the size and distribution of VCM buyers are not likely to constrain the pricing discretion of VCM producers. Sixth, although contracts in the VCM market typically [**115**] cover at least one year, prices and output levels are renegotiated frequently—pursuant to both contractual and "handshake" relationships—and meeting competition clauses in the contracts keep sellers informed of the pricing behavior of their rivals. Seventh, although some excess capacity confronted VCM producers during the recession, capacity utilization levels have now approached their pre-recession levels, and most experts expect any remaining disparity to disappear completely by the 1990's. Demand is expected to grow at a relatively healthy annual rate of 3 to 4 percent. As a result, capacity utilization levels are likely to remain well above the 80 percent "break even" level for the foreseeable future. Supply conditions are also likely to remain stable. Finally, vertical integration between VCM and PVC producers is likely to facilitate efforts to collude in the VCM market. These factors strengthen the conclusion that the acquisition is likely to substantially lessen competition in the VCM market.

V. PERFORMANCE FACTORS

An important part of the respondents' defense to the allegations in the complaint in this matter is summarized in their answering brief:

> Throughout these proceedings an undeniable truth has stymied complaint counsel: the PVC industry was intensely competitive before The BFGoodrich Company (Goodrich) acquired one polyvinyl chloride (PVC) plant and one vinyl chloride monomer (VCM) plant from Diamond [**116**] Shamrock Chemicals Company (Diamond) in January 1982 and has been intensely competitive since the acquisition.

RAB at 1. Respondents recognize that a finding of actual anticompetitive effects is not needed to establish that the acquisition violates section 7 of the Clayton Act (*id.* at 2); establishing that the acquisition may substantially lessen competition is sufficient. However, respondents argue that actual post-acquisition evidence of industry performance is sufficient to rebut other evidence satisfying the latter standard. *Id.* at 3–8.

The Commission has concluded that the respondents' performance evidence does not rebut its finding of liability in the VCM market. Post-acquisition performance evidence must be evaluated very carefully, because of its potential for manipulation. Much of the record evidence of competition respondents adduce is not persuasive, particularly with respect to the VCM market. Moreover, there is no guarantee that the limited price competition that respondents have

identified will continue now that demand and supply conditions in both the VCM and the PVC markets have improved. Furthermore, whatever probative value respondents' post-acquisition performance evidence might have is outweighed by the probative value of the post-acquisition structural evidence in the record.

The Supreme Court has determined that post-acquisition evidence tending to diminish the [117] probability or impact of anticompetitive effects might be considered in a Section 7 case.[243]

However, in making that determination, the Court has noted that the "probative value" of such evidence is "extremely limited." As the Court observed:

If a demonstration that no anticompetitive effects had occurred at the time of trial or of judgment constituted a permissible defense to a Section 7 divestiture suit, violators could stave off such actions merely by refraining from aggressive or anticompetitive behavior when such a suit was threatened or pending.[244]

The Seventh Circuit has more recently confirmed that "[p]ost acquisition evidence that is subject to manipulation by the party seeking to use it is entitled to little or no weight."[245] Similarly, the Commission has determined that it is inappropriate to consider "exculpatory post-acquisition evidence of voluntary actions by the acquiring firm" in determining the legality of an acquisition.[246] For similar reasons, the conclusory testimony of [118] industry executives to the effect that their industry is "competitive" is not particularly useful and cannot be given much weight.[247] The probative value of performance evidence is also limited by its susceptibility to transitory economic conditions, such as a recession. For example, the fact that profits are low in an industry with excess capacity does not necessarily mean that industry pricing is competitive.[248] Furthermore, the absence of "concrete anticompetitive symptoms" does not mean that

competition has not already been affected, "for once the two companies are united no one knows what the fate of the acquired company and its competitors would have been

[243] *United States v. General Dynamics Corp.*, 415 U.S. 486, 504 (1974), *citing FTC v. Consolidated Foods Corp.*, 380 U.S. 592, 598 (1965); *United States v. E.I. du Pont de Nemours & Co.*, 353 U.S. 586, 597 *et seq.*, 602 *et seq.* (1957); *United States v. Continental Can Co.*, 378 U.S. 441, 463 (1964); *accord, Weyerhaeuser Co.*, 06 FTC at 284 n.59.

[244] *United States v. General Dynamics Corp.*, 415 U.S. at 504–05.

[245] *HCA v. FTC*, 007 F.2d at 1384, *citing Lektro-Vend Corp. v. Vendo Co.*, 660 F.2d 255, 276 (7th Cir. 1981).

[246] *HCA*, 106 FTC at 486 n.17.

[247] *British Oxygen Co.*, 86 FTC 1241, 1365 n.26 (1975), *rev'd and remanded on other grounds sub nom. BOC International Ltd. v. FTC*, 557 F.2d 24 (2d Cir. 1977); *see also United States v. Philadelphia National Bank*, 374 U.S. at 366–67.

[248] Klass, Tr. 5725–27; Kaserman, Tr. 2446–48. An additional complication is that the accounting profit data usually available from industry firms is much less accurate measure of industry performance than economic profits data, and frequently diverges quite significantly from economic profit data. *B.A.T. Industries, Ltd.*, 104 FTC 852 (1984).

but for the merger."[249]

Recent Commission decisions have carefully followed these principles in evaluating post-acquisition performance evidence. In *Champion Spark Plug,* in evaluating a potential competition case, Judge Timony considered evidence suggesting that the [**119**] acquired firm had been suffering from low and declining profits, but only in conjunction with structural evidence showing that (1) its share of the relevant market had declined from 45.1 percent to 34.3 percent during the same period; and (2) entry barriers were low, and seven new firms had recently entered the relevant market.[250] Similarly, in *BASF Wyandotte Corp.,* another potential competition case, Judge Hyun relied heavily upon structural evidence that "entry of new firms" was unimpeded; small firms in the relevant market were growing rapidly; and the acquisition eliminated only *de minimis* potential competition.[251]

Still more recently, the Commission has confirmed that the presence of some degree of competition does not necessarily refute the inference of the likelihood of anticompetitive effects created by relevant structural and behavioral evidence. In *HCA,* the Commission stated:

> It is true that the undisputed evidence shows that more vigorous competition, including more direct price competition, is emerging in the health care industry, but it is a fallacy to conclude that growing competition in health care markets means that these acquisitions pose no threat to that competition. In fact, it is just that emerging competition that must be protected from mergers that facilitate the suppression of such competition.[252] [**120**]

Similarly, the *DOJ Guidelines* advise that "[t]he fact that the market is currently competitive casts little light on the likely effect of the merger." *DOJ Guidelines* at ¶3.45.

A. *PVC Market*

Judge Howder concluded with respondents that the PVC industry performed in a relatively competitive fashion prior to the acquisition, and has continued to perform in that fashion since the acquisition. For example, Judge Howder noted that in a 1982 document, Goodrich informed its sales people that the

> PVC industry is not healthy. Red ink continues to flow.[253]

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[249] *United States v. General Dynamics Corp.,* 415 U.S. at 505, *quoting FTC v. Consolidated Foods Corp.,* 380 U.S. at 598.

[250] *Champion Spark Plug,* 103 FTC 546, 628–30 (1984). The Commission adopted Judge Timony's decision and order as its own. *Id.* at 639–40.

[251] *BASF Wyandotte Corp.,* 100 FTC 261, 428–429 (1982).

[252] *HCA,* 106 FTC at 501–02.

[253] IDF 247 *in camera, quoting* RX 186F *in camera.*

Respondents similarly maintain that during the recession, the PVC market suffered from "substantial excess capacity and poor financial returns" (RPF 353 *in camera*), and that profits in the PVC industry have been poor since the acquisition.[254] A number of industry witnesses testified that the PVC industry is highly competitive. IDF 248.

Two factors limit the probative value of this evidence. First, respondents' basis for their conclusion that the PVC industry is competitive is for the most part simply the testimony [**121**] of industry representatives. Industry executives, well aware of the antitrust laws, are unlikely to testify otherwise. Second, much if not all of the "excess capacity and poor financial returns" respondents identify is probably attributable to the 1982 recession. *See* IDF 74. There is no guarantee that the price competition that respondents have identified will continue, now that industry demand is expanding again, and PVC producers are once again operating at relatively high capacity levels. *See* IDF 75.

We need not evaluate respondents' performance evidence for the PVC market in any greater detail, however, because we have concluded that the acquisition is not likely to lessen competition substantially in the PVC market.

B. *VCM Market*

Respondents similarly argue that the VCM market is "highly competitive," and that the VCM business has been characterized by intense competitive pricing, and "has been unprofitable in the recent past."[255] However, respondents' performance evidence does not rebut the Commission's finding of liability in the VCM market, for three reasons. First, respondents' primary basis for these conclusions is the generalized testimony of VCM industry representatives that the industry is competitive and the [**122**] acquisition "did not enhance the likelihood of anticompetitive behavior." RPF 460–66 *in camera.* Given the interest of industry participants in establishing that their industry is highly competitive, this sort of generalized testimony is not particularly probative.

Second, the dramatic effects of the recession make it difficult to rely upon respondents' performance evidence, because the business downturn probably would have forced even a monopolist to reduce prices. There is no guarantee that the limited competition that respondents assert exists will continue now that demand conditions have im-

[254] RPF 355 *in camera, citing* CX 527; CX 186F; RX 132C; RX 7160; Disch, Tr. 706–07; H. Wheeler, Tr. 1736; DiLiddo, Tr. 3250, 3419.

[255] RPF 460–463 *in camera, citing* RX 428E *in camera;* Disch (Tenneco), Tr. 697–99; Kienholz (PPG), Tr. 849–50; L. Wheeler (Shell), Tr. 991, 1025, 1051; Taylor (Dow), Tr. 1672; H. Wheeler (GenCorp), Tr. 1766–67; DiLiddo (Goodrich), Tr. 3327.

proved substantially. Evidence from earlier periods suggests that the recession probably had only transitory effects on price and profit levels. For example, a 1977 Goodrich document states:

> The market conditions are such that the suppliers of EDC [ethylene dichloride] and VCM are in a strong position to control the price and terms under which these materials are purchased.

CX 17Z14 *in camera*. Similarly, a 1978 Occidental document complains about "[s]trong market place discipline by the VCM producers." CX 524V *in camera*. And a 1980 Firestone document concludes that

> the Company's monomer [VCM] suppliers were able to demand prices resulting in high profits for themselves regardless of the conditions of the polymer market upon which the Plastics Division was dependent for its profit.

CX 503B. **[123]**

Third, the post-acquisition structural evidence makes respondents' post-acquisition performance evidence less persuasive. Since the acquisition, the number of firms in the VCM market has declined from eleven to nine; the HHI for nameplate capacity has increased from 1529 to 1632 as of January 1985; and practical production capacity has increased from 1552 to 1650.[256] For these reasons, respondents' performance evidence does not rebut the presumption of anticompetitive effects drawn from the structural data.

VI. RELIEF

The attached final order is designed to remedy the anticompetitive effects arising from the acquisition. More particularly, paragraph II of the order directs Goodrich to divest the VCM Plant located at La Porte, Texas—together with associated assets, rights and privileges secured from Diamond, and all additions and improvements added by Goodrich—within one year of the effective date of the order. Divestiture is to be made subject to the prior approval of the Commission. Paragraph III requires Goodrich to provide the acquirer with technology relating to the plant, and to provide VCM know-how for a period of one year. These requirements are reasonably related to ensuring that the La Porte VCM Plant is reestablished as a **[124]** viable competitive entity.[257] Paragraph IV requires Goodrich to assign all sales and supply contracts for the plant to the acquirer. Para-

[256] *See* pages 58–61, *supra;* IDF 266.

[257] *See, e.g., Kaiser Alum. & Chem. Corp.*, 93 FTC 764, 855–58 (1979), *remanded on other grounds*, 652 F.2d 1324 (7th Cir. 1981); *Ekco Products Co.*, 65 FTC 1163, 1212–15 (1964), *aff'd*, 347 F.2d 745 (7th Cir. 1965).

graph V provides for the appointment of a trustee to divest the plant if Goodrich fails to comply with the divestiture requirements.

Paragraph VI prohibits Diamond from interfering with the relief the order prescribes, and for a period of five years requires Diamond to continue to provide utilities and other support services previously provided to the La Porte VCM Plant, and to afford the plant continued access to and use of the pipelines connected to the plant. Paragraph VII requires Goodrich—for a ten-year period—to secure Commission approval prior to making certain acquisitions of VCM manufacturing assets in the United States. Paragraph IX provides in particular that prior Commission approval is required prior to retransfer of the VCM plant from Goodrich to Diamond, and—for a period of three years—prior to its divestiture by Diamond to a third party. Finally, paragraphs VIII, X, and XI impose notification and reporting requirements upon both respondents.

The relief embodied in the order is reasonably related to the violation of section 7 of the Clayton Act that the Commission has identified. In section 7 cases, the principal [**125**] purpose of relief "is to restore competition to the state in which it existed prior to, and would have continued to exist but for, the illegal merger."[258] In this case, divestiture of the La Porte VCM plant represents the most effective means of achieving that objective.[259] As long as Goodrich continues to operate the La Porte VCM Plant, the anticompetitive effects identified *supra* will persist. For similar reasons, the Commission directed the divestiture of the acquired assets in *AMI* and *HCA*.[260]

A ten-year prior approval provision is warranted in this case with respect to Goodrich because of the structural characteristics of the VCM market. If Goodrich divests the La Porte VCM Plant to a firm not currently in the United States VCM market—the divestiture that would reduce market concentration most significantly—the HHI for nameplate capacity would fall to approximately 1350. *See* Table V, *supra*. Without the La Porte VCM Plant, Goodrich will own one VCM plant—located at Calvert City, Kentucky—with a nameplate capacity of one billion pounds. *See* page 5, *supra*. In 1984, this represented [**126**] approximately 11 percent of total domestic VCM nameplate capacity. If Goodrich were then to acquire the smallest domestic VCM producer —and in 1984 that was Conoco (now Vista), with a nameplate capacity of 6.78 percent (*see* Table V, *supra*)—its share would rise to 17.78 percent, and the relevant HHI for nameplate capacity would increase

[258] *RSR Corp.*, 88 FTC 800, 893 (1976), *aff'd*, 602 F.2d 1317 (9th Cir. 1979), *cert. denied*, 445 U.S. 927 (1980); *see Brunswick Corp.*, 96 FTC 151, 155 (1980), *aff'd sub nom. Yamaha Motor Co., Ltd. v. FTC*, 657 F.2d 971 (8th Cir. 1981), *cert. denied*, 456 U.S. 915 (1982).

[259] *See Ford Motor Co. v. United States*, 405 U.S. 562, 573 (1972); *HCA*, 106 FTC at 513; *AMI*, 104 FTC at 221; *RSR Corp.*, 88 FTC at 893.

[260] *HCA*, 106 FTC at 513; *AMI*, 104 FTC at 226–27.

by approximately 150 points, to 1500. Such an acquisition would almost certainly violate section 7 of the Clayton Act, for essentially the same reasons that Goodrich's acquisition of the La Porte VCM plant constitutes a violation of section 7. As the Commission has previously indicated, "it is industry market structure and market conditions . . . that determine the appropriateness of imposing a prior approval requirement in a section 7 case."[261] Here, the prospect that *any* acquisition by Goodrich of any firm in the United States VCM market would almost certainly violate section 7 warrants the prior approval requirement.

Several factors make it essential to require Diamond to comply with certain provisions of the order. Pursuant to the Goodrich/Diamond purchase agreement, a Commission order requiring Goodrich to divest the La Porte VCM plant will permit Goodrich to require Diamond to reacquire the plant. CX3Z505–Z507, cl. 4 *in camera*. The agreement also gives Diamond a right of first refusal to purchase the stock or assets of DSPC, including the La Porte VCM plant, in the event of a divestiture order. *Id.* **[127]** Diamond has indicated that if it were required to reacquire the assets it sold to Goodrich, it would operate them "only until [it] could resell the assets to someone who is committed to being in the plastics business . . ."[262] Because the La Porte plant is approximately the same size as Goodrich's Calvert City VCM plant, its conveyance to any firm in the VCM market would raise concerns similar to those that would be attributable to any other acquisition by Goodrich in that market. The order therefore requires prior Commission approval of any subsequent divestiture of the La Porte plant by Diamond within three years after Diamond reacquires the plant. The order also prohibits Diamond from interfering with the divestiture because, through its right of first refusal, Diamond could theoretically prevent Goodrich from divesting the La Porte VCM plant to another buyer.[263] Order provisions of this sort—directed against the seller in an acquisition that violates section 7 of the Clayton Act—may be imposed when necessary to implement effective relief.[264] **[128]**

The Commission believes that the foregoing order provisions lie well within its authority. The general standard is that "the courts will not interfere [with a Commission order] except where the remedy

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[261] *HCA*, 106 FTC at 514; *accord*, *AMI*, 104 FTC at 221–227.

[262] Diamond Shamrock Chemicals Company Motion for Dismissal and Supporting Argument (Aug. 31, 1984), at 12.

[263] If Diamond has accurately portrayed its disinterest in reacquiring the plant, then it is unlikely, however, to interfere with the sale of the plant to another party.

[264] *See Dean Foods Co.*, 70 FTC 1146, 1293–94 (1966), *modified as to order*, 71 FTC 731 (1967); *see also United States v. Coca Cola*, 575 F.2d 222, 227–31 (9th Cir.), *cert. denied*, 439 U.S. 959 (1978) (sellers may be included in section 7 remedies). There is thus no need to address complaint counsel's alternative argument (*see* CAB at 71) that the agreement to "dismantle" DSPC violated section 5 of the Federal Trade Commission Act.

selected has no reasonable relation to the unlawful practices found to exist."[265] Once "the government has successfully borne the considerable burden of establishing a violation of law, all doubts as to the remedy are to be resolved in its favor."[266]

VII. CONCLUSION

A. *PVC Market*

The Commission has determined to affirm the decision of Judge Howder with respect to the PVC market. Environmental restrictions have created higher costs for new entrants and expansion than confronted incumbent capacity, and thus constitute a barrier to entry sufficiently substantial to make collusion within the PVC market feasible.[267] However, other structural factors establish that, on balance, the acquisition is not likely to have anticompetitive effects in the PVC market. The [**129**] acquisition increased market HHIs to only 1098 for nameplate capacity, 1079 for practical production capacity, and an estimated 1020 for actual production levels. *See* pages 54–55, *supra.* As we noted *supra,* these post-acquisition concentration data are only barely sufficient to create a presumption of anticompetitive effects in the PVC market. Because they fall within the lower end of the mid-range of the Department of Justice Merger Guidelines, the Commission must carefully evaluate a number of other industry characteristics in order to determine whether the acquisition may in fact substantially lessen competition.[268]

On balance, other industry characteristics refute the weak presumption of anticompetitive effects in the PVC market created by the concentration data. First, PVC is relatively heterogeneous. Second, costs vary significantly from one PVC producer to another, as a consequence of differing reactor sizes, resin production emphases, and transportation costs. Third, the higher price elasticity of demand for some PVC end products may constrain any effort among PVC producers to collude. These industry characteristics make it unlikely that the acquisition had any anticompetitive effects in the PVC market.

B. *VCM Market*

The Commission has determined to reverse the decision of Judge Howder with respect to the VCM market. Environmental [**130**] restrictions that create higher costs for new entrants and expansion than confronted incumbent capacity constitute a barrier to entry.

[265] *Jacob Siegel Co. v. FTC,* 327 U.S. 608, 613 (1946); *accord, e.g., HCA v. FTC,* 807 F.2d at 1393.

[266] *United States v. E.I. DuPont de Nemours & Co.,* 366 U.S. 316, 334 (1961).

[267] *E.g., FTC v. Warner Communications, Inc.,* 742 F.2d 1156, 1163–64 (9th Cir. 1984); *Marathon Oil Corp. v. Mobil Corp.,* 669 F.2d 378, 380–81 (6th Cir. 1981); *see Weyerhaeuser Co.,* 106 FTC at 287.

[268] *Weyerhaeuser Co.,* 106 FTC at 280.

Moreover, the substantial time required to enter, the need to capture a substantial share of industry sales in order to achieve minimum economies of scale, and the sunk character of an entry investment constitute impediments to entry. These constraints are sufficiently substantial to make collusion within the VCM market feasible.[269] Moreover, the acquisition substantially increased concentration in the VCM market: by 226 points to 1529 for nameplate capacity; by 253 points to1552 for practical production capacity; and by 304 points to 1663 for actual production levels. *See* page 61, *supra.* The acquisition raised four-firm concentration levels to 70.8 percent for nameplate capacity, 71.3 percent for practical production capacity, and 72.59 percent for actual production levels. *See* Table V, *supra.* These concentration data create a relatively strong presumption of anticompetitive effects.[270] **[131]**

The other structural evidence in the record strengthens this presumption. First, a low price elasticity of demand strengthens that inference,[271] and the record evidence establishes that the price elasticity of demand for VCM is low. Second, VCM is a highly homogeneous product, with few if any differences from one firm to another. Third, cost functions for producing VCM are relatively similar from one firm to another. Fourth, the number and size of VCM buyers are not likely to constrain the pricing discretion of VCM producers. Fifth, the frequency, size and public character of VCM transactions are not likely to complicate collusive efforts. Sixth, demand and supply conditions in the VCM market are likely to remain relatively stable over the next few years. Seventh, vertical integration between VCM and PVC producers facilitates efforts to collude in the VCM market.

The foregoing structural factors strengthen the presumption that the acquisition is likely to have anticompetitive effects in the VCM market. The generalized and self-serving testimony of industry members that the industry is competitive does not rebut the strong evidence that the acquisition is likely to have anticompetitive effects. The attached order will remedy the anticompetitive effects of the acquisition by requiring Goodrich to divest the VCM plant it acquired from Diamond.

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[269] *E.g., FTC v. Warner Communications, Inc.*, 742 F.2d 1156, 1163–64 (9th Cir. 1984); *Marathon Oil Corp. v. Mobil Corp.*, 669 F.2d 378, 380–81 (6th Cir. 1981); *see Weyerhaeuser Co.*, 106 FTC at 287.

[270] *E.g., United States v. Philadelphia National Bank*, 374 U.S. 321, 363 (1963) (increased C_4 to 78 percent); *United States v. Waste Management, Inc.*, 743 F.2d 976, 981 (increased C_4 to 67.1 percent); *FTC v. Warner Communications, Inc.*, 742 F.2d 1156, 1163 (9th Cir. 1984) (increased C_4 to 75 percent); *Weyerhaeuser Co.*, 106 FTC at 279 (increased C_4 to 57.8 percent); *Grand Union Co.*, 102 FTC at 1056–58 (increased C_4 in thirteen markets to levels ranging from 49 percent to 72 percent) (*dictum*).

[271] *Marathon Oil Corp. v. Mobil Corp.*, 669 F.2d at 381.

STATEMENT OF CHAIRMAN DANIEL OLIVER CONCURRING IN PART AND DISSENTING IN PART

I. INTRODUCTION

I concur with the majority in its determination that "the acquisition is not likely to have anticompetitive effects in the PVC market." Although PVC appears to define a relevant antitrust market, a PVC conspiracy is unlikely because, *inter alia*, the PVC market is relatively unconcentrated, PVC is heterogeneous, production cost functions vary from one PVC producer to another, and successful monitoring would necessarily extend to the market for PVC products. Moreover, the acquisition does nothing that would substantially increase the likelihood of a PVC conspiracy.[1] However, I disagree with the majority's conclusion that the Goodrich acquisition may substantially lessen competition by creating an appreciably increased danger of collusion in the VCM market, and would affirm the Administrative Law Judge's order dismissing the case.

The VCM and PVC markets are closely related. PVC can be produced only from VCM, and almost all VCM is used to produce [2] PVC. VCM produced and used by integrated firms is internally produced, internally shipped (often by pipeline) and internally priced. Because some VCM producers are integrated downstream into PVC production and others are not, there are basically three different groups that would be directly affected by collusion in either of these markets. First, there are the integrated VCM/PVC producers.[2] Approximately one half of VCM and PVC production comes from this group. Second, some firms produce only VCM for sale (nonintegrated VCM producers).[3] Third, there are nonintegrated PVC producers that must have a supply of VCM in order to operate.[4]

Tacit collusion in the VCM market would be difficult to achieve or maintain for several reasons. First, the incentives of the two groups of VCM producers in that market, integrated and nonintegrated firms differ materially, despite the majority's assumptions to the contrary.[5] The integrated VCM/PVC producers have a common interest in undercutting the PVC sales of the nonintegrated PVC producers which, if successful, would also erode any cartel price tacitly agreed on by the nonintegrated VCM [3] producers. Second, collusion is only possible

[1] When there is no threat of single firm market power, the controlling question is "whether the challenged acquisition is likely to hurt consumers by making it easier for the firms in the market to collude, expressly or tacitly, and therefore force prices above or further above the competitive level." *Hospital Corporation of America*, 106 FTC 361, 464 (1985), *aff'd* 807 F.2d 1381 (7th Cir. 1986), *cert. denied*, __ U.S. __, 107 S.Ct. 1975, (1987).

[2] After the acquisition, these included Goodrich, Formosa, Georgia Pacific, Borden and Conoco.

[3] This group included Dow, Shell, and PPG after the acquisition at issue here.

[4] There were eight principal firms in this category after the acquisition: Air Products, CertainTeed, Keysor-Century, Occidental, Pantasote, Shintech, GenCorp, and Tenneco.

[5] *See* Majority Opinion at 94–96, 103–104.

where price or output restrictions can be effectively monitored. For a VCM conspiracy to be successful in this case, all participants would have to be assured that the others were not cheating on the cartel price. However, the quantity of VCM produced and used by integrated firms cannot be directly observed by other firms. Levels of VCM output from integrated firms may only be monitored indirectly, from the sales of PVC resins and other PVC end products that the integrated firms market. But many of the same factors that make collusion difficult in the PVC market are also present in the VCM market, making the efforts of the nonintegrated VCM producers to monitor the integrated VCM PVC/VCM producers in their sales of PVC sufficiently difficult to defeat an attempt to cartelize the VCM market.

In evaluating whether a merger may substantially lessen competition, we necessarily attempt to make a prediction of the potential for certain future conduct. We need not achieve complete certainty in this predictive process, but unless we have a plausible theory and credible evidence explaining why a merger is likely to increase substantially the risk of collusion (or the degree of effective collusion) we have no basis under Section 7 of the Clayton Act to find the merger illegal. Lacking any theory or evidence apart from somewhat increased levels of concentration, we have no basis for reversing the ALJ's holding [4] that the acquisition is not likely to substantially lessen competition.

II. INCENTIVES OF INTEGRATED AND NONINTEGRATED FIRMS TO COLLUDE

The majority opinion concedes that an effective collusive strategy to obtain supracompetitive prices in the VCM market would require the participation of both the integrated VCM/PVC producers and the nonintegrated VCM producers.[6] The majority recognizes, however, that the nonintegrated VCM firms are at a disadvantage in reaching and enforcing tacit collusion because they cannot directly monitor the output or price of VCM that is internally consumed by the integrated VCM/PVC producers.[7] As a result, the majority opinion suggests that the nonintegrated VCM producers "can rely on the integrated firms as a group to monitor their integrated competitors."[8] In effect, then, the majority posits dual cartels, one among the nonintegrated VCM firms and another with the integrated VCM/PVC firms monitoring the PVC [5] sales of one another, reaching overall agreement on VCM

[6] Majority Opinion at 94.

[7] *See* Majority Opinion at 99.

[8] Majority Opinion at 99. In effect, the collusive effort proposed by the majority would include agreement on open market sales among all VCM producers and a separate collusive agreement among the integrated VCM/PVC producers at the PVC level. For the whole scheme to work this latter agreement would have to consist of agreed upon prices and output levels of PVC that incorporated the cartel's "market" price for VCM.

prices and output. Because of the adverse effect a collusive agreement would be likely to have on the nonintegrated PVC producers, however, the integrated VCM/PVC producers would have a significant incentive to undercut any collusive efforts.[9]

As the majority recognizes, to remain in the market the nonintegrated PVC firms would have to accept increases in the price of VCM imposed by the cartel. Because VCM is used in a fixed proportion with other inputs to produce PVC, and there is no commercially available substitute for VCM, nonintegrated PVC producers could not shift to another input. They would be forced to pay any supracompetitive price for VCM.[10] Since the demand [6] for PVC is relatively inelastic, the nonintegrated PVC producers would probably be able to pass along much of the price increase. Unless they were able to pass along all of the price increase, however, their profit margins would necessarily decline, as would their sales volume.[11]

The nonintegrated PVC producers compete, of course, with the integrated VCM/PVC producers. Because the integrated VCM/PVC producers need not charge themselves the same VCM prices that would be forced on the nonintegrated PVC producers, they have the ability to undersell the nonintegrated PVC producers.[12] If the price of VCM rose, integrated VCM/PVC firms would have an incentive to raise PVC prices, but by a smaller amount than the nonintegrated PVC producers would have to charge to take account of the higher cartel price of VCM. In this way, integrated [7] producers could enjoy both increased profits per unit and increased market share.

Integrated producers would face such incentives until the conspiracy failed, with nonintegrated PVC producers, squeezed by higher VCM costs and price competition in the PVC market, reducing VCM

[9] Another point where the incentives of the VCM producers vary is in the situation where VCM producers are integrated further upstream into production of chlorine (and caustic soda). Other VCM firms have long term contracts to purchase chlorine at a fixed price.

VCM is produced from ethylene, a petroleum product, and chlorine. Chlorine is itself produced by applying an electrical current to brine, yielding 1.1 pound of caustic soda for every pound of chlorine. When there is a large demand and high price for caustic soda, as there was in 1980, excess chlorine is produced. As a result, chlorine costs for this group of integrated firms (e.g. PPG and Dow) will vary with the demand for caustic soda. *See, e.g.*, RX 57230 (Diamond Shamrock's cost for chlorine estimated to be a negative .1 cents per pound). Chlorine cannot be easily stored, and when excess chlorine is produced there is a strong incentive to use it in VCM production.

VCM production costs may therefore differ significantly between firms that purchase chlorine at prices set in long term contracts and integrated firms subject to fluctuations in chlorine production and chlorine prices. This factor increases the difficulty of colluding on VCM prices and output.

[10] Of course cartels in both the VCM and PVC markets are extremely unlikely to arise, because an entity controlling one stage of a multi-stage production process will earn the largest profit when the other stages perform competitively. *See, e.g.*, R. Posner and F. Easterbrook, *Antitrust Cases, Economic Notes and Other Materials* 803–07, 875–86 (2d ed. 1981).

[11] In the hypothetical case in which the demand for PVC was perfectly inelastic, PVC producers could pass on all of the price increase and would not experience a decline in their sales volume. The majority does not suggest that this hypothetical case exists in the real world.

[12] The integrated VCM/PVC firms also enjoy an advantage over a VCM cartel because they can vary the prices of the different grades of PVC that they sell. The nonintegrated VCM firms, by contrast, must sell all of their VCM at the supracompetitive price, and the nonintegrated PVC firms will have to pay for, and pass along, an increased price for all grades of PVC that they produce.

purchases and PVC sales or exiting the industry. A decrease in the market share of nonintegrated PVC firms would ultimately reduce the market of the nonintegrated VCM firms. As a result, the nonintegrated VCM firms only have an incentive to increase the price of VCM if they can be assured that the integrated VCM/PVC producers will not undersell the nonintegrated PVC producers. Unless there are strong assurances that this will be the case, nonintegrated VCM firms will not undertake a collusive strategy that results in eroding their own market share.

III. ABILITY OF NONINTEGRATED VCM FIRMS TO MONITOR INTEGRATED FIRMS

In order for a collusive strategy to succeed, VCM producers would not only have to develop a consensus on price and output levels,[13] they must also be able to enforce that tacit agreement. [8] The necessary prerequisite for any retaliatory conduct is the ability to monitor the conduct of competitors and detect cheating on the cartel. The task of monitoring a collusive arrangement in the VCM market would be extremely difficult, and would fail for many of the same reasons the majority concludes that collusion in the PVC market is unlikely in this case.[14] In order to be successful, a VCM cartel would be required to observe the actions of the integrated VCM/PVC producers at three stages of the production process: first, open market sales of VCM; second, sales of PVC; and third, sales of products fabricated from PVC by those firms integrated further downstream into that stage.

Perhaps the easiest task of monitoring involves open market sales of VCM. If a consensus price could be established, nonintegrated VCM firms would be able to detect cheating by integrated firms selling to nonintegrated PVC producers at less than the cartel price. The opposite is also true, however. Integrated firms would be able to determine the market price [9] being charged to nonintegrated PVC producers. To the extent that integrated firms can obtain some of these sales, they can obtain the benefits of the supracompetitive pricing being charged to the nonintegrated PVC producers. Similarly, knowing the market price for VCM, they are in a better position to undercut the price that the nonintegrated PVC firms ultimately charge.

As the majority recognizes, the nonintegrated firms are at a rela-

[13] The majority suggests that the integrated VCM/PVC producers would "passively welcome collusion in the [VCM] market—in the sense that they will profit from declining to increase VCM production in response to higher VCM prices. . . ." Majority Opinion at 96. They might profit even more by increasing their output, a step they are quite likely to take if that output cannot be readily observed.

[14] This presumes that a collusive strategy would be successful in raising prices in the first place. As the majority points out, pp. 85–89, the sales arrangements among the firms in the VCM and PVC market make them very sensitive to price fluctuations. If a group of firms attempted to create a cartel price for VCM, these efforts would be detected very quickly. Even if successful, however, the integrated VCM/PVC firms would still have an incentive to undercut the cartel price in their PVC sales.

tive disadvantage in monitoring the integrated VCM/PVC producers. Because most of the VCM produced by the integrated firms is not sold on the market but consumed internally,[15] the only recourse of the nonintegrated VCM producers is to attempt to determine whether the integrated VCM/PVC firms are including the consensus VCM price in their PVC prices and producing the appropriate amount of PVC.

This task is likely to be quite difficult for the nonintegrated VCM producers to accomplish. First, there are a large number of purchasers of PVC resin that must be monitored.[16] Moreover, many PVC costs and outputs must be monitored. There are different grades of PVC and different quality levels within [10] grades. In addition, individual plant operating costs and transportation costs vary. Thus the opportunities for the integrated firms to cheat are very great.[17]

The majority suggests that the nonintegrated VCM producers can use the nonintegrated PVC producers to assist in their efforts to monitor the PVC sales of the integrated VCM/PVC firms. However, if the nonintegrated PVC producers learn that they are being undersold, they would be likely to report that fact to the nonintegrated VCM producers. The nonintegrated PVC producers' only alternative to losing market share would be to demand lower prices from the VCM producers, which, if successful, would itself defeat the cartel.[18]

The final stage at which monitoring would be necessary in order to detect cheating on the cartel is in fabrication of products from PVC resins. Four of the five integrated VCM/PVC producers are vertically integrated further downstream into [11] fabrication of products from PVC.[19] As long as these integrated firms have the capability of substantially increasing their output of PVC fabricated products, successful implicit collusion in the VCM market would have to include agreement on the optimal amount of PVC to be produced, as well as the output and pricing of PVC fabricated products and concomitant monitoring. Unless the nonintegrated VCM producers are able to monitor price cutting by integrated firms at that stage, there is a significant opportunity for the integrated VCM/PVC firms to expand

[15] The use of pipelines contributes to the difficulty of determining directly the amount of VCM produced by the integrated VCM/PVC firms.

[16] A 1979 Goodrich study indicated that 300 PVC resin buyers accounted for 80% of the market. CX 53J-K.

[17] Even if the integrated firms can determine that other integrated firms are cheating (which may be quite difficult), it is still to their advantage to do so if the nonintegrated firms do not also learn this fact.

[18] The nonintegrated PVC producers have an incentive to seek lower prices in order to maintain or increase their competitive position in any event, and might well claim that they are being undersold even if they are not.

[19] Goodrich estimated that Borden utilized 39% of its PVC capacity internally. RX 200D. Borden's internal use of PVC consisted primarily of the production of PVC film for meat and produce packaging and pallet stretch wrap. Approximately 29% of Borden's 1982 PVC capacity was devoted to this use. The remaining 10% of captive PVC production was utilized in the production of coated fabrics. RX 200E.

Goodrich's own captive PVC production was used to make pipe, windows, packaging, siding, wire and cable. In 1981 Goodrich had 46.6% of the siding market, 15.6% of the pipe market, 16.5% of the window market, 3.4% of the packaging market, and 30.0% of the wire and cable market.

Formosa's captive production of PVC is used to make pipe, film, and sheet. RX 247A.

production of those end products and increase market share at the expense of the nonintegrated PVC producers. This is likely to be very difficult to monitor.

As a result, tacit collusion among all VCM producers would fail unless it is possible to monitor not only all open market sales of VCM to nonintegrated PVC producers, but also the PVC output of the integrated VCM/PVC producers, as well as their production of materials fabricated from PVC. The same factors [12] that lead the majority to conclude that collusion is not a threat at the PVC level lead me to conclude that collusion at the VCM level is also not feasible.

IV. CONCLUSION

Unlike the majority, I believe that the vertical integration present in the VCM and PVC markets makes collusion on VCM extremely difficult, if not impossible. Not only do the integrated VCM/PVC producers have strong incentives to jointly undercut any cartel price for VCM, the process of detecting any cheating would be so complicated that it would not be likely to succeed. I would affirm the ALJ and dismiss the complaint.

SEPARATE STATEMENT OF COMMISSIONER MARY L. AZCUENAGA, WITH WHOM COMMISSIONER PATRICIA P. BAILEY JOINS, CONCURRING IN PART AND DISSENTING IN PART

I concur in the opinion of the majority insofar as it finds that the acquisition by B.F. Goodrich of Diamond Shamrock Plastics Corporation from Diamond Shamrock Chemicals Company may substantially lessen competition in the market for vinyl chloride monomer ("VCM") in violation of Section 7 of the Clayton Act. Unlike the majority, I would also find liability in the market for polyvinyl chloride ("PVC"). I disagree with the presumptions based on concentration data that the majority employs and with their analysis of competitive conditions in the market for PVC.

As the majority recognizes, the level of and increase in concentration resulting from this acquisition in both the VCM and PVC markets create a rebuttable presumption of anticompetitive effects. The Department of Justice 1984 Merger Guidelines divide the range of concentration as measured by the Herfindahl-Hirschman Index ("HHI") into three tiers: unconcentrated, moderately concentrated and highly concentrated. Goodrich's acquisition increased the HHI by 221 points to 1131[1] in the PVC [2] market and by 304 points to 1663

[1] I.D.F. 53 *in camera;* slip op. at 54 (based on actual production). These figures correctly attribute all of Diamond Shamrock's Deer Park PVC plants to Goodrich, because the sale of Deer Park #5 to Goodrich precluded the sale

(footnote cont'd)

in the VCM market.[2] Both markets fall within the moderately concentrated range (post-acquisition HHI between 1000 and 1800), in which the Department has said it is more likely than not to challenge acquisitions that increase the HHI by 100 points or more. When an acquisition falls in this middle range, the Guidelines anticipate a careful review of competitive conditions, and the Commission has said that an "especially careful review of a number of industry characteristics in addition to concentration" is needed to assess the likely competitive effects of the transaction. *Weyerhaeuser Co.*, 106 FTC 172, 280 (1985).[3]

Having established that the concentration in each market falls within the middle tier, the majority then subdivides that tier and assigns to each segment a different presumption of liability before proceeding to an analysis of other competitive conditions. Although both markets are moderately concentrated, the majority concludes that because the PVC market is moderately concentrated "only by the barest of margins," the presumption of anticompetitive effects in that market is "even weaker." Slip op. at 57–58. The slightly higher numbers in the VCM market create a "relatively strong presumption of anticompetitive effects," according to the majority, which can be rebutted only [3] by "relatively strong evidence from other factors." Slip op. at 63. This emphasis by the majority on relatively minor differences in concentration statistics suggests that the numbers have a scientific predictive value that does not exist.

The Commission often has qualified the significance of concentration data as a predictor of market power, *e.g.*, FTC Statement Concerning Horizontal Mergers, 2 Trade Reg. Rep. (CCH) ¶ 4516, at 6901–3 (June 14, 1982) ("FTC Statement"), and the Merger Guidelines also make clear that "the numerical divisions suggest greater precision than is possible with the available economic tools and information." Section 3.1. We use market share data in a Section 7 case "as an important preliminary surrogate measure of market power," FTC Statement at 6901–3, but statistics "provide only the starting point for analyzing the competitive impact of a merger." Merger Guidelines § 3.11. Because of the limited predictive power of market share and concentration data, a careful evaluation of other indicators of market power usually is necessary.

Although the Commission has said that "more persuasive" evidence will be needed to rebut a *prima facie* case when a market is highly concentrated than when the market is moderately concentrat-

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of the other Deer Park plants to another firm and Diamond agreed, until the plants were closed, to operate them for Goodrich. I.D.F. 10–14; slip op. at 7–10 & n.12. Goodrich perceived the arrangement as "the only option that keeps Diamond from being a disruptive force in the market place." *Id.* at 10.

[2] I.D.F. 262; slip op. at 61 (based on actual production).

[3] In *Weyerhaeuser*, the challenged acquisition increased the HHI by 211 points to 1166, "within the lower end of the mid-range of the Department of Justice Merger Guidelines." 106 FTC at 280.

ed, *Grand Union Co.*, 102 FTC 812, 1055 (1983) (dicta),[4] I know of no authority to support the majority's differing presumptions when concentration data in two separate [4] markets, both of which are moderately concentrated, are similar to the two before us. The Merger Guidelines do not establish a different standard of review for mergers with different market share data, except to suggest, as the Commission did in *Grand Union,* that the presumption of anticompetitive effects based on statistics will be difficult to rebut when the market is highly concentrated.[5]

The majority's presumptions add nothing to merger analysis in terms of predictability or ease of application. The majority infers that in the *Weyerhaeuser* case, the Commission decided that the concentration data created only a weak presumption of anticompetitive effects, and the majority suggests that non-statistical evidence to rebut the presumption of illegality in the PVC market "need not be as strong as it was in *Weyerhaeuser.*" Slip op. at 58. In *Weyerhaeuser,* the Commission dismissed the complaint based on an evaluation of several market characteristics including, in particular, ease of entry. I see no easy or useful way to compare the weight of evidence in *Weyerhaeuser* concerning industry characteristics such as ease of entry in the west coast market for corrugating medium (a paper product) with the weight of the non-statistical evidence concerning the PVC market, in which the majority finds [5] substantial barriers and impediments to entry. Slip op. at 31. Simply to attempt such a comparison between highly fact-specific cases would complicate merger analysis even further without any apparent off-setting benefits.

The terms used by the majority may well raise more questions than they put to rest. Is the presumption of liability in the market for VCM "relatively strong" only as compared to the "even weaker" presumption in the PVC market? In the context of the Herfindahl-Hirschman Index, does "relatively strong" mean "slightly weak," "somewhat strong," "quite strong" or plain old everyday "average?" How does the "relatively strong" presumption for VCM compare to the presumption that applies when the HHI rises 100 points and exceeds 1800? It might be possible to work through this exercise, but further attempts to refine the presumptions stemming from concentration figures are unlikely to be useful until those figures can be shown to correspond more precisely to market power. The temptation to seek comfort from

[4] In *Grand Union Co.*, the Commission found no Section 7 violation "for reasons other than the level of concentration and . . . market share." 102 FTC at 1056.

[5] Merger Guidelines § 3.11(c). The Commission has said that the value of non-market share evidence will be high when it consistently points in the same direction, particularly when the market shares are in the low and moderate ranges, and that nonmarket share factors may be given less weight when concentration is high. FTC Statement at 6901–4.

the apparent certainty of numbers is understandable, but we should be wary of false comforts.

In addition to finding that the PVC and VCM markets are moderately concentrated, the majority finds "substantial barriers and impediments to entry" in both markets and finds that "fringe firms are unlikely to constrain collusive conduct" in either market. Slip op. at 31. The only significant difference between the two markets for the purpose of merger analysis is the number of customers. PVC purchasers number in the hundreds, I.D.F. 216; [6] the only purchasers of 96% of VCM consumed in the United States are the small number of firms that produce PVC. I.D.F. 289. These facts suggest that collusion would be easier in the PVC market than in the VCM market, if, as the majority correctly assumes, slip op. at 84–85, collusion is easier for sellers in markets with a large number of buyers.

The majority nevertheless identifies three reasons (in addition to lower concentration) for concluding that there is no violation in the market for PVC. First, PVC is said to be "relatively heterogeneous." Second, the majority finds that costs "vary significantly" among PVC producers. Finally, although the price elasticity of PVC is "relatively low," the majority concludes that the ability of PVC producers to raise prices "may be constrained to some degree by the higher price elasticity of demand" for PVC end products. Slip op. at 113. None of these conclusions is supported by the record. In fact, PVC is a homogeneous product, the costs of producing PVC do not vary significantly among firms and the elasticity of demand for PVC is low and unlikely to constrain collusion.

We are charged with responsibility for making predictive judgments under Section 7 on the basis of all the relevant facts.[6] The fact-specific analysis of the two markets at issue here discloses no material differences between them and shows [7] that anticompetitive effects are likely in each. Indeed, unless one accepts the majority's differing presumptions based on market share and concentration data, the case for liability in the PVC market is at least as strong as the case for liability in the VCM market.[7]

1. Homogeneity of PVC

The majority concludes that PVC is "considerably more heterogeneous" (compared, presumably, to VCM), because it is produced in three grades and because producers face differing transportation

[6] "[C]onsiderations [other than concentration statistics] often do not lend themselves to precise mathematical expression, but they can be more important than quantitative measures of concentration." Echlin Manufacturing Co., 105 FTC 410, 483–84 (1985).

[7] If this were an exercise in prosecutorial discretion, the practical effect of the majority's decision in the PVC market would be to raise the dividing line identified in the Merger Guidelines between unconcentrated and moderately concentrated markets.

costs. Slip op. at 65–66. This heterogeneity, according to the majority, is one of the reasons collusion is unlikely in the PVC market. I disagree. On this record, the PVC market is not one in which product differentiation is important.

In terms of its physical characteristics, PVC is boringly homogeneous. PVC is classified in three general, differently priced categories—pipe, general purpose and specialty PVC. Pipe grade PVC historically has been the lowest priced of the three grades. General purpose PVC sells at a small premium over pipe resin, and specialty resin usually commands a small premium over general purpose PVC.[8] More than 75% of bulk and suspension PVC is considered by industry members to be a "commodity" [8] product, with no significant quality differences among producers. I.D.F. 87 & 90. Although there may be some quality differences among specialty resins produced by different firms, industry witnesses testified that any producer could deliver an acceptable substitute specialty resin.[9]

Industry witnesses also testified that buyers of commodity grade PVC will switch suppliers over small differences in price, I.D.F. 87 & 90; R.A.B. at 36, and that no specialty resin supplier can command a price higher than that of competing suppliers of the same grade. I.D.F. 88. The willingness to switch suppliers over small price differences and the inability of any supplier to obtain a price premium tend to confirm that PVC is homogeneous within grades.[10] Buyers would be unwilling to switch suppliers to gain small price advantages if there were other important differences in the PVC produced by different firms, and firms could command price premiums if they offered a unique product.[11] The record shows that the physical qualities [9] of PVC place it at the homogeneous end of the product spectrum and do not impair the ability of PVC firms to collude.[12]

The majority also treats the cost of transporting PVC as an aspect of heterogeneity and concludes that transportation cost differences among PVC firms are likely to complicate collusion. Slip op. at 68 & 80. To support its conclusion, the majority simply recites the fact that PVC plants are situated in various locations around the country. Slip op. at 68–69.[13] This information, however, tells us nothing, because

[8] H. Wheeler 1750–51; DiLiddo 3268; Schaefer 1076; R.A.B. at 36.

[9] Schaefer 1076; Becker 1331–33.

[10] DiLiddo 3372; Disch 707–09; Schaefer 1200–02; McMath 1951. These witnesses testified that PVC buyers will change suppliers for price differences as low as one-quarter and one-half cent per pound.

[11] The respondents' economic expert testified that the physical heterogeneity of PVC was "not severe," as evidenced by the lack of systematic price discrimination. Klass 5363.

[12] *See* United States v. Container Corp., 393 U.S. 333, 336 (1969) ("While containers vary as to dimensions, weight, color, and so on, they are substantially identical, no matter who produces them, when made to particular specifications."); FTC v. Bass Brothers Enterprises, Inc., 1984–1 Trade Cas. (CCH) ¶ 66,041, at 68,612 (N.D. Ohio 1984) ("Carbon black is a homogeneous, fungible product. Although it is produced in numerous different grades . . . in fact nearly all of the producers produce basically the same grades and types.").

[13] The majority also cites RX 1168, slip op. at 69 n.152, but this document is based on RX 245 and does not show the actual costs of firms. *See* notes 19 & 21 *infra* & accompanying text.

the record does not show the locations of the PVC customers served by the PVC plants. In fact, the record is largely silent as to the cost of shipping PVC to customers. In more than 5000 pages of testimony, one witness testified that "freight and other things" could provide "small differences in pricing,"[14] and the respondents' economic expert asserted, without citing any supporting material, that locational differences were "likely to affect" the cost of serving customers.[15] [10]

Even if the cost of shipping PVC to customers differs among firms, any differences are unlikely to be sufficient to diminish the likelihood of collusion in the industry. If transportation cost differences were significant, we would expect to see a series of regional markets. Instead, the record shows that the market is national,[16] that PVC producers sell in the national market on the basis of delivered price and that price differences among suppliers are as small as one-quarter to one-half cent per pound. These facts suggest that transportation costs do not cause substantial cost differences among firms that would complicate collusion.

2. Costs of Producing PVC

The majority concludes that the costs of producing PVC vary significantly among firms, making collusion more complicated and, therefore, less likely. The differing costs identified by the majority are the costs of operating reactors of different sizes and the costs of transporting PVC to customers. Slip op. at 77–78. As discussed in the section above, differences in the cost of transporting PVC, which are also treated by the majority as an aspect of heterogeneity, are insignificant. Although operating costs may vary among firms, the record also does not support the majority's conclusion that the differences are significant. [11]

PVC reactors of different sizes have different production costs, but, as the majority recognizes, production costs do not vary within grade but "from one PVC resin grade to another." Slip op. at 79. Commodity PVC, which accounts for about 75% of industry sales, is produced in large reactors. Industry witnesses testified that the costs of producing PVC in large reactors are similar among firms. *See* slip op. at 78–79. Smaller reactors operate at a cost disadvantage when compared to large reactors, but smaller reactors produce specialty PVC resins, which occupy a special niche in the market and enjoy a price premium over commodity PVC resins. Indeed, one of Diamond Shamrock's goals in the PVC market was to occupy the higher priced specialty

[14] H. Wheeler 1749; *see also* Weber 1800.

[15] Klass 4311.

[16] The parties stipulated that the appropriate market is national, and the majority found that a national market "is consistent with the record evidence." Slip op. at 15.

market niches,[17] and Diamond Shamrock's position in the specialty resin market was an attribute that made the acquisition attractive to B.F. Goodrich.[18] The cost differences related to different size reactors are likely to be significant, but those cost differences are unlikely to frustrate collusion when firms face similar costs for the same grades of PVC.

To show that PVC firms face significantly different operating costs, the majority cites RX 1168A-B, *in camera*. This exhibit is based on a "cost study" prepared by a Goodrich employee, who estimated the costs of other firms but did not have **[12]** access to actual cost data from any firm except Goodrich itself.[19] Not surprisingly, the study shows a range of operating costs for PVC plants that is virtually identical to the range of actual costs at Goodrich's PVC plants. The range of costs shown for competing firms (and cited by the majority) is 14.30 cents per pound to 21.94 cents per pound. The same document shows that Goodrich's operating costs for its PVC plants ranged from 14.30 cents to 21.53 cents per pound.[20] This document at best supports a conclusion that there may be substantial intra-firm cost variations, but it tells us nothing about cost differences among firms or their impact on competition.[21]

The record shows that PVC producers consistently agree to meet the lower prices of their competitors, which a firm presumably would not do if it suffered a persistent and significant cost disadvantage. On this record, I conclude that although the costs of producing PVC may differ among firms, the **[13]** differences are not significant and are not likely to make collusion difficult.[22] As the majority observes in discussing the costs of producing VCM, "[a]lthough respondents have identified some minor differences [among firms], absolute congruence is not needed to heighten the likelihood of" collusion. Slip op. at 83.

3. Price Elasticity of Demand for PVC

The majority also concludes that "although the price elasticity of demand for PVC is . . . relatively low," attempts to collude on the price

[17] Becker 1327–28; Weber 1794–96; Arp 3519.

[18] DiLiddo 3205–06, 3209, 3211–13 *in camera; see* slip op. at 8–10.

[19] RX 245 *in camera*, which contains neither calculations nor method of calculation, was based on unspecified information from "public sources" and an employee's "best estimates" from those sources. DiLiddo 3225. RX 1168A-B, cited by the majority to show different PVC production costs, slip op. at 80 n.179, is based on and has the same deficiencies as RX 245.

[20] This difference of 7.64 cents apparently reflects the difference between operating large reactors in which commodity resins are produced and operating smaller reactors in which specialty resins are produced. *See* slip op. at 79 n.177.

[21] Even the respondents' economic expert testified that the numbers provided on RX 245 *in camera* should not be viewed as "hard numbers." Klass 5323.

[22] Nor do differing degrees of vertical integration suggest different production costs. In discussing PVC production costs, the respondents' economic expert said that if costs for integrated firms were clearly lower, then nonintegrated firms would not be able to survive. He concluded that the data in the record "clearly indicate that there is not such a uniform advantage." Klass 5337–38.

of PVC may be constrained by the elasticity of demand for end products manufactured from PVC. Slip op. at 113.[23] The record, however, shows not only that the elasticity of demand for PVC is low, but also that the price of PVC could be raised above competitive levels without causing the purchasers of end products to switch to other products. Industry witnesses testified that changes in PVC prices do not affect the [14] demand for products made from PVC.[24] For example, a 1983 B.F. Goodrich study, quoted by the majority, slip op. at 74–75, stated:

> PVC pipe manufacturers appear to have plenty of room for price increases before approaching the price levels of most competing materials. (Even if the prices were identical, PVC would still have the added advantage of lower installed cost.)

CX 247A, *in camera*.

At some point, it is no doubt true that an increase in the price of PVC would cause some consumers to substitute cheaper products for products made from PVC, but the record suggests there is ample room before that point is reached for a successful agreement to raise prices above competitive levels.

4. Vertical Integration

The respondents maintain that the different degrees of vertical integration among PVC firms and among VCM firms would make collusion more difficult in either market.[25] Aspects of vertical integration, like other aspects of market structure, may indeed affect the ease of reaching or enforcing a collusive [15] agreement. *See* R. Posner, *Antitrust Law* 60 (1976); F. Scherer, *Industrial Market Structure and Economic Performance* 204–05 (2d ed. 1980). The respondents, however, have not gone appreciably beyond general assertions of theory to show why in this case, where other relevant facts consistently point to the ease of collusion in both the PVC and VCM markets, vertical integration nevertheless makes collusion unlikely.

I find confusing the majority's lengthy response to the respondents' vertical integration argument, which gives the argument more credit than is due.[26] I do agree, however, with the majority's conclusion that

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[23] This conclusion is inconsistent with the majority's statements that "the price elasticity of demand for most PVC end products is relatively low," slip op. at 75, and that "the demand for PVC is sufficiently inelastic to make it likely that an increase in VCM prices can profitably be passed along to PVC customers." Slip op. at 111. If PVC producers can pass on a cost increase (such as a VCM price increase), then presumably they could also profitably pass on a collusive PVC price increase.

[24] Schaefer 1141; Disch 664–80; Becker 1325–36; H. Wheeler 1753–54; Weber 1811–12, 1828. The majority is correct in rejecting the assertion of the respondent's expert witness that PVC is price elastic. Slip op. at 75 n.168.

[25] The respondents argue that differing degrees of vertical integration increase the number of areas with respect to which a consensus would have to be reached, complicate price and output monitoring and contribute to an environment of differing goals, incentives, costs and profit opportunities among firms. R.A.B. at 40 & 69.

[26] We are concerned in this case with horizontal market power, the ability to raise price above competitive levels. Vertical integration does not affect horizontal market power, which can be exercised in either or both of the vertically related markets. *See, e.g.*, R. Bork, "Vertical Integration and the Sherman Act: The Legal History of an Economic Misconception," 22 U. Chi. L. Rev. 157, 195–98 (1954).

both integrated and nonintegrated producers of VCM have strong incentives to collude and could readily detect cheating from a collusive agreement. If, as the majority concludes, PVC firms could accept and pass on to their customers a collusive VCM price increase, slip op. at 111, it must also be true that they could pass on a collusive PVC price increase.[27] The majority opinion therefore suggests, and I agree, that vertical integration does not deter the ability of PVC firms to collude. [16]

An analysis of the record shows conditions that are conducive to collusion in the PVC market and in the VCM market. Although we can speculate on the extent to which the interests of integrated and nonintegrated firms might complicate collusion, the record shows nothing about differing incentives or other differences stemming from vertical integration that suggests that collusion would be unlikely in either market.

With respect to the market for PVC, I dissent.

FINAL ORDER

This matter has been heard by the Commission upon the appeal of complaint counsel from the initial decision and upon briefs and oral argument in support of and in opposition to the appeal. For the reasons stated in the accompanying opinion, the Commission has determined to deny the appeal in part and to grant the appeal in part. Accordingly, [2]

It is ordered, That the findings of fact and initial decision of the Administrative Law Judge be adopted insofar as not inconsistent with the findings of fact and conclusions contained in the accompanying opinion.

It is further ordered, That the following order be and the same hereby is entered:

I.

Definitions

It is ordered, That for purposes of this order the following definitions shall apply:

A. *"Goodrich"* means The B.F. Goodrich Company, a corporation organized under the laws of New York with its principal place of business in Akron, Ohio, and its directors, officers, agents, and employees, and its subsidiaries, divisions, affiliates, successors, and assigns.

[27] *See* R. Bork, *supra* note 26, at 196 n.128; F. Warren-Boulton, *Vertical Control of Markets* 51–55 (1978).

B. *"Diamond Shamrock"* means Diamond Shamrock Chemicals Company, a corporation organized under the laws of Delaware with its principal place of business in Dallas, Texas, and its directors, officers, agents, employees, subsidiaries, divisions, affiliates, successors, and assigns.

C. *"La Porte VCM Plant"* means the VCM manufacturing facility located at La Porte, Texas, and all assets, titles, properties, interests, rights and privileges, tangible and intangible, related to the VCM business, [3] that were acquired by Goodrich from Diamond Shamrock pursuant to the January 4, 1982, agreement between Goodrich and Diamond Shamrock, together with all improvements thereto.

D. *"VCM"* means vinyl chloride monomer, a gaseous, reactive, acyclic intermediate chemical, with chemical identity $CH_2=CHCl$, also called chloroethylene or monochloroethylene.

II.

It is ordered, That within twelve (12) months from the date this order becomes final, Goodrich shall divest, absolutely and in good faith, at no minimum price, the La Porte VCM Plant. The purpose of the divestiture is to establish the La Porte VCM Plant as a viable competitor in VCM, by insuring its continuation as an ongoing, viable enterprise in the VCM industry; and to remedy the lessening of competition resulting from the acquisition of the La Porte VCM Plant by Goodrich. The divestiture shall be made only to an acquirer or acquirers, and only in a manner, that receives the prior approval of the Federal Trade Commission.

Pending divestiture, Goodrich shall take all measures necessary to maintain the La Porte VCM Plant in its present condition and to prevent any deterioration, except for normal wear and tear, of any part of the La Porte VCM Plant, so as not to impair the La Porte VCM Plant's present operating viability or market value. [4]

III.

It is further ordered, That at the time of the divestiture required by this order, Goodrich shall provide to the acquirer of the La Porte VCM Plant, on a nonexclusive basis, all VCM technology (including patent licenses and know-how) used by Goodrich, or developed by Goodrich, for use in the La Porte VCM Plant; and

For a period of one (1) year following the divestiture required by this order, Goodrich shall provide the acquirer of the La Porte VCM Plant, if the acquirer so requests, such additional know-how as may reasonably be required to enable such acquirer to manufacture and sell VCM.

Goodrich shall charge the acquirer no more than its own costs for providing such additional know-how.

IV.

It is further ordered, That at the time of the divestiture required by this order, Goodrich shall assign to the acquirer of the La Porte VCM Plant all chlorine and ethylene feedstock supply agreements; all VCM supply, sales, toll, or exchange agreements; and all VCM customer records and files relating to VCM produced in (or supplied by Goodrich at any time since January 1, 1985 from) the La Porte VCM Plant.

V.

It is further ordered, That if Goodrich has not divested the La Porte VCM Plant within the twelve-month period provided in [5] paragraph II of this order, the Federal Trade Commission may appoint a trustee to effect the divestiture. The trustee shall be a person with experience and expertise in acquisitions and divestitures. Neither the appointment of a trustee nor a Commission decision not to appoint a trustee under this paragraph V of the order shall preclude the Commission from seeking civil penalties and other relief available to it, including a court-appointed trustee, for any failure by Goodrich to comply with this order.

Any trustee appointed by the Commission pursuant to this paragraph V shall have the following powers, authority, duties, and responsibilities:

A. The trustee shall have the exclusive power and authority, subject to the prior approval of the Commission, to divest the La Porte VCM Plant. The trustee shall have twelve (12) months from the date of appointment to accomplish the divestiture. If, however, at the end of the twelve-month period, the trustee has submitted a plan of divestiture or believes that divestiture can be accomplished within a reasonable time, the divestiture period may be extended by the Commission.

B. The trustee shall have full and complete access to the personnel, books, records and facilities of the La Porte VCM Plant, and Goodrich shall develop such financial or other information relevant to the La Porte VCM Plant as [6] the trustee may reasonably request. Goodrich and Diamond Shamrock shall cooperate with the trustee, and shall take no action to interfere with or impede the trustee's accomplishment of the divestiture. Any delays in divestiture caused by Goodrich or Diamond Shamrock shall extend the time for divestiture under this

paragraph V in an amount equal to the delay, as determined by the Commission.

C. The power and authority of the trustee to divest shall be at the most favorable price and terms available consistent with this order's absolute and unconditional obligation to divest at no minimum price, and with the purposes of the divestiture as stated in paragraph II of this order, subject to the prior approval of the Commission.

D. The trustee shall serve, without bond or other security, at the cost and expense of Goodrich on such reasonable and customary terms and conditions as the Commission may set. The trustee shall have authority to retain, at the cost and expense of Goodrich, such consultants, attorneys, investment bankers, business brokers, accountants, appraisers, and other representatives and assistants as are reasonably necessary to assist in the divestiture. The trustee shall account for all monies derived from the divestiture and for all expenses incurred. After approval by the Commission of the [7] account of the trustee, including fees for his or her services, all remaining monies shall be paid to Goodrich, and the trustee's power shall be terminated. The trustee's compensation shall be based at least in significant part on a commission arrangement contingent on the trustee divesting the La Porte VCM Plant.

E. Goodrich shall indemnify the trustee and hold the trustee harmless against any losses, claims, damages, or liabilities arising in any manner out of, or in connection with, the trustee's duties under this order, unless the Commission determines that such losses, claims, damages, or liabilities arose out of the misfeasance, gross negligence, or the willful or wanton acts or bad faith of the trustee.

F. Promptly upon appointment of the trustee and subject to the approval of the Federal Trade Commission, Goodrich shall, subject to the Federal Trade Commission's prior approval and consistent with provisions of this order, transfer to the trustee all rights and powers necessary to permit the trustee to effect the divestiture required by this order.

G. If the trustee ceases to act or fails to act diligently, the Commission may appoint a substitute trustee.

H. The Commission may on its own initiative or at the request of the trustee issue such [8] additional orders or directions as may be necessary or appropriate to accomplish the divestiture required by this order.

I. The trustee shall have no obligation or authority to operate or maintain the La Porte VCM Plant.

J. The trustee shall report in writing to Goodrich and to the Commission every sixty (60) days concerning the trustee's efforts to accomplish divestiture.

VI.

It is further ordered, That Diamond Shamrock shall take no action that may interfere with the divestiture required by this order and shall assert no right or claim, arising by contract or otherwise, against the stock or assets of the La Porte VCM Plant that may impair its operating abilities or market value; and

For a period of five (5) years from the date this order becomes final, Diamond Shamrock shall:

A. Provide to the La Porte VCM Plant all utilities, services, and feedstock supplies (including chlorine or ethylene) requested for operation of the La Porte VCM Plant, to the same extent and on the same terms and conditions that such utilities, services or feedstock supplies were supplied by Diamond Shamrock to Goodrich at any time after January 1, 1982; and

B. Make available to the La Porte VCM Plant without charge, for its use in connection with any purchase, toll, sale, or exchange incident [9] to the ordinary operation of a VCM plant all pipelines for transporting VCM, chlorine, or ethylene that are connected to the La Porte VCM Plant and that are owned by Diamond Shamrock.

VII.

It is further ordered, That for a period of ten (10) years from the date this order becomes final, Goodrich shall not directly or indirectly acquire—other than the acquisition of manufactured product in the ordinary course of business—all or any part of the stock or assets of, or any interest in, any producer of VCM located in the United States without the prior approval of the Federal Trade Commission.

VIII.

It is further ordered, That Goodrich shall, within sixty (60) days after the date this order becomes final and every sixty (60) days thereafter until it has fully complied with the provisions of paragraph II of this order, submit in writing to the Commission a report setting forth in detail the manner and form in which it intends to comply, is complying, or has complied with that provision. Such compliance reports shall include, among other things that may be required from time to time, a full description of all contacts and negotiations relating to the divestiture of the La Porte VCM Plant, including the name and address of all parties contacted, copies of all written communica-

tions to and from such parties, and all internal [10] memoranda, reports and recommendations concerning divestiture; and

Goodrich shall submit such further written reports of its compliance as the staff of the Commission may from time to time request in writing.

IX.

It is further ordered, That any reacquisition of all or any part of the La Porte VCM Plant by Diamond Shamrock from Goodrich shall be subject to the provisions of this order; and if Diamond Shamrock reacquires the La Porte VCM Plant, it shall:

A. For a period of three years following such reacquisition, maintain the marketability and viability of any such reacquired assets, consistent with paragraph II of this order; and

B. For a period of three years following such reacquisition, obtain the prior approval of the Commission before selling all or any part of such reacquired assets, other than the sale of manufactured VCM in the ordinary course of business.

Diamond shall not, for a period of ten (10) years from the date of any such reacquisition, convey any such reacquired assets or any part thereof to Goodrich.

X.

It is further ordered, That Goodrich and Diamond Shamrock, upon written request and on reasonable notice, for the purpose of securing compliance with this order, and subject to any legally [11] recognized privilege, shall permit duly authorized representatives of the Commission or of the Director of the Bureau of Competition:

A. Reasonable access during the office hours of Goodrich or Diamond Shamrock, which may have counsel present, to inspect and copy books, ledgers, accounts, correspondence, memoranda, reports, and other records and documents in the possession or control of Goodrich or Diamond Shamrock that relate to any matter contained in this order; and

B. Subject to the reasonable convenience of Goodrich or Diamond Shamrock, an opportunity to interview officers or employees of Goodrich or Diamond Shamrock, who may have counsel present, regarding such matters.

XI.

It is further ordered, That Goodrich and Diamond Shamrock shall notify the Federal Trade Commission at least thirty (30) days prior to any proposed corporate change, such as dissolution, assignment or sale resulting in the emergence of a successor corporation, the creation or dissolution of subsidiaries or any other change in the corporation, which may affect compliance with the obligations arising out of this order.