CHEMICAL HERITAGE FOUNDATION

DEXTER F. BAKER

Transcript of an Interview
Conducted by

James J. Bohning

in

Naples, Florida

on

27 January 1995

(With Subsequent Corrections and Additions)

ACKNOWLEDGMENT

This oral history is one in a series initiated by the Chemical Heritage Foundation on behalf of the Society of Chemical Industry (American Section). The series documents the personal perspectives of Perkin and the Chemical Industry Award recipients and records the human dimensions of the growth of the chemical sciences and chemical process industries during the twentieth century.

This project is made possible through the generosity of Society of Chemical Industry member companies.

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Oral History Program
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Rev. 3/21/97

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DEXTER F. BAKER

1927 Born in Worcester, Massachusetts, on 16 April

Education

1950 B.S., mechanical engineering, Lehigh University
1957 M.B.A., Lehigh University

Professional Experience

1945-1946 Seaman First Class, U.S. Navy

1950-1952 Corps Engineer, Private First Class, U.S. Army

Air Products and Chemicals, Inc.
1952-1956 Sales Engineer
1956-1957 General Sales Manager, Process Equipment Division
1957-1964 Managing Director, Air Products Limited
1964-1967 Chief Executive of Air Products Operations in Europe
1964- Board of Directors
1967-1978 Executive Vice President
1978-1986 President
1986-1992 Chairman and Chief Executive Officer
1990-1992 Chairman of the Board, President
1992-1998 Chairman, Executive Committee, Board of Directors

Honors

1991 Chemical Industry Award, Society of Chemical Industry

ABSTRACT

Dexter Baker begins the interview by discussing his childhood and early education in the suburbs of Philadelphia. After graduating from Upper Darby High in 1945, Baker was drafted into the navy and admitted to the naval academy prep. program. Before he completed the program, however, World War II ended and Baker was discharged. He then enrolled at Lehigh University, where he studied mechanical engineering and developed an interest in turbines. After graduating in 1950, Baker took a job with Allis-Chalmers, but was soon drafted into the army and served in the Korean War. While in the army, Baker was appointed to the engineering research and development laboratories, where he worked on the development of high-speed, small-size gas turbine engines. After he had completed his two years in the army, Baker accepted a position with Air Products and Chemicals in Emmaus, Pennsylvania. He worked in sales while attending night school at Lehigh to get his MBA. He was soon sent to England to begin an Air Products division in Europe. A decade later, Baker returned to the United States and completed his climb up the corporate ladder, becoming president of Air Products in 1978 and Chairman of the Board in 1986.

INTERVIEWER

James J. Bohning is currently a professor at Lehigh University. He has served as Professor of Chemistry Emeritus at Wilkes University, where he was a faculty member from 1959 to 1990. He served there as chemistry department chair from 1970 to 1986 and environmental science department chair from 1987 to 1990. He was chair of the American Chemical Society's Division of the History of Chemistry in 1986, received the Division's outstanding paper award in 1989, and presented more than twenty-five papers before the Division at national meetings of the Society. He has written for the American Chemical Society News Service, and he has been on the advisory committee of the Society's National Historic Chemical Landmarks committee since its inception in 1992. He developed the oral history program of the Chemical Heritage Foundation beginning in 1985, and was the Foundation's Director of Oral History from 1990 to 1995.

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INTERVIEWER: **James J. Bohning**

LOCATION: **Naples, Florida**

DATE: **27 January 1995**

BOHNING: I know that you were born in Worcester, Massachusetts, on April 16, 1927. Could you tell me a little bit about your parents and your family background?

BAKER: My father was an engineer with a wire goods company. His company manufactured a variety of wire products from hardware to kitchenware. He was a graduate engineer, but started his career in sales—in his case, it was consumer products sales. We moved from Worcester when I was seven—in 1934—to suburban Philadelphia. The Philadelphia, mid-Atlantic area became his territory for this Worcester-based company.

BOHNING: Did the Depression have any effect on that?

BAKER: I really didn't observe too much hardship. We had a pleasant home in the suburbs of Philadelphia. My father never made a lot of money. My father and mother divorced after we moved to Philadelphia. My father raised me and my younger brother and did his travelling. He subsequently did remarry again, but it was many years after the divorce.

I grew up in suburban Philadelphia. I went to Upper Darby High, played basketball, was in the band, and tried out for baseball. I wasn't good on grounders. So I stuck to basketball. [laughter] I enjoyed music as well. I sang in the glee club.

I was always keen on becoming an engineer, probably because my father had been an engineer. He had graduated in electrical engineering from Harvard in 1922. That was his class year. Because he was interested in engineering and selling that was also an area I became interested in. Of course, I wanted to build things and then sell them.

When I graduated from high school in 1945, World War II was still on. I was drafted into the navy and went through basic training. Ultimately, I was assigned as a seaman to the War College at Newport, Rhode Island. I said then, "If I'm going to be in the navy, I might as

well be an officer." So I applied for a fleet appointment to the naval academy. I was accepted into the navy's prep school for the naval academy and transferred to Williamsburg, Virginia.

That was a nice assignment because William and Mary College was there. During the war, there weren't many men around. So the navy boys were much in demand, although we did study hard. We didn't have a lot of spare time. But Williamsburg is a nice place. This study lasted until the spring of 1946. Then the naval academy prep program dried up because World War II was now over. Japan had surrendered on the decks of the *Missouri*. The Navy was not now looking for future admirals.

The Navy offered me an opportunity to obtain an early discharge. When the navy offers you something nice, you don't argue. So I took the discharge. I completed eleven months and thirteen days of active service. I said, "Well, maybe the lack of a full year will deny me benefits, however, I'll make that up by working this summer." I had been accepted to Lehigh University as an incoming freshman. So I said, "I'll go ahead and take the discharge, work this summer, and be ready to go to Lehigh in September."

I started as a civil engineer at Lehigh, then switched to mechanical engineering because I was more interested in equipment than structures. I developed an interest in gas turbines. Gas turbines were just being developed as a result of the jet engine development in World War II. They were beginning to develop commercial applications.

After I graduated from Lehigh in 1950 I took my first job with Allis-Chalmers. In the summer of 1950, the Korean War broke out. I'd been at Allis-Chalmers about four months, working on gas turbines and steam turbines, when Uncle Sam invited me to come back and join the Army this time. I became a really popular draftee. Because I was within a qualifying age, and because I did not have a full twelve months of active service, I was invited to join the army for two years. I went through Fort Belvoir, Virginia, base training and became a corps engineer PFC [private first class]. I was able to arrange an appointment to the Engineering Research and Development Laboratories. They had a great demand for engineers. The fact that I was PFC didn't make any difference. I was a graduate engineer. They had to pay college graduates four hundred dollars a month. But they could assign me for seventy-five dollars a month as a PFC.

I married Dottie [Dorothy E. Hess], whom I had met in my senior year at Lehigh. She was now working for my commanding officer at Fort Belvoir as a secretary. I worked as an engineer in the engine branch, developing high-speed, lightweight gas turbine engines for power sources to drive pumps and generators. These were to replace heavy diesel engines.

One of the applications of those gas turbines that I was developing at the research laboratories of the army was to drive the air compressors for oxygen plants. The oxygen plant division next door to our engine branch was a customer of the engines we were developing. I learned a little bit about oxygen plants, so I always had that knowledge in my mind.

I spent two years at Fort Belvoir as a PFC. The military developed some special job classifications (Military Occupational Specialties) that qualified all of these engineers whom they had drafted into the army. We were no longer classified as tank mechanics, but as graduate engineers.

BOHNING: Could I back up for a moment?

BAKER: Sure.

BOHNING: I'd like to know a little bit more about the Lehigh engineering curriculum, and what it was like when you were there in the late 1940s.

BAKER: It was a good program. Lehigh, like many other engineering schools, was very, very crowded in 1946. They had to accept many of the people they'd offered to who were regularly coming for the 1946 freshman class. Then they had to accept all the offers they'd had outstanding during the war. So the campus was crowded. I had a lab mate who was forty years old, married, two children. We had a great age diversity. My class at Lehigh was the largest.

It was a good time. Our spirits were good. We were the first class really after the war. So all their regular programs were back in place. I had great professors in thermodynamics and machine design. I had some time for music. I played college basketball for one year. I joined a fraternity and developed good relationships there. Lehigh was an all-male school while I was there.

BOHNING: That's right.

BAKER: As were many prominent men's schools. They stayed a single-sex school until the late 1950s. Now, of course, Lehigh is fully coed, like most schools are today.

We didn't have many distractions on campus. We had two weekend parties a year, where we could invite our girlfriends to come and spend the weekend with us.

Lehigh was good for me. It was not a large school (two thousand five hundred, then), so you developed good relationships with your professors and good relationships with your classmates. You knew everybody. You had to interact with everybody in your class. My

graduating class at Lehigh was around six hundred. They were all men. Today, it's over one thousand. I developed good loyalties, an education and good relations that have really lasted throughout my life. I had a very pleasant experience at Lehigh University.

BOHNING: Was there any particular reason you selected Lehigh over, let's say, Drexel?

BAKER: A good friend of my father's was Ed Blackman, who had been an outstanding wrestler at Lehigh. Lehigh had one of the nationally ranked wrestling programs in the country. Ed was a proud Lehigh graduate. He was a colleague of my father's. He said, "In looking around, make sure you go up to Lehigh."

When we visited Lehigh, I liked the campus. I liked the environment. I liked the size, and we took Ed's word. Quite frankly, I didn't apply anyplace else. They accepted me in 1945, before I went in the service the first time, I just said, "That's fine." But it wasn't a decision I had to make at that time. I had twelve months to think about it, as it turned out. Having decided not to go to Annapolis, Lehigh was great. It was relatively near my home in Philadelphia—Lehigh is in Bethlehem, PA.

In 1952, my two years in Fort Belvoir were up. I had to start looking for a job. I had decided that I didn't want to go back to Allis-Chalmers Allis-Chalmers had gone through a big strike when the communist trade unions took over. So, I looked elsewhere.

BOHNING: How did you hook up with them in the first place?

BAKER: In 1950, I was in the first post-graduate war class that was now graduating. There really weren't that many jobs around. I interviewed, and Allis-Chalmers offered me a job that would be designing gas turbines, engines. So I took it. I wanted to go live in other parts of the country. Milwaukee, Wisconsin looked to be a nice place. Allis-Chalmers made me a good offer so I took it. I was one of the first in my class to get a job offer. I felt very good about that.

It turned out that my wife, Dottie—she wasn't my wife at the time—was running the placement office at Lehigh. She met me there, pushed my resume, I guess, a little bit. [laughter] At least she knew what my resume said. I think with my military experience I was a little bit more mature than the average graduate. I'd been in the navy. I'd been in the naval academy prep program. I was a bit older, maybe a little bit more experienced. I expressed an interest in sales and marketing. Allis-Chalmers was looking for somebody with that kind of a background.

In June of 1951 Dottie and I were married. We had our first daughter, the first of four, a year later. I was earning ninety dollars a month at Fort Belvoir. We went back to Dottie's home outside of Bethlehem, and I started looking for a new job. I sent out resumes to Lycoming Engine, to Allison and Westinghouse and GE—still believing that the big thing was going to be gas turbines, and if you were a mechanical engineer, you should be involved. I received job offers from most of those companies. Westinghouse was in the Philadelphia area—Lester, Pennsylvania, down by the river near the Philadelphia Airport. I received a good offer, if I recall—four hundred sixty-five dollars a month, or something like that. I had only been making three hundred dollars a month when I was at Allis-Chalmers. So I thought that offer was pretty nice. I had only been making ninety dollars a month in the army.

I went to visit Lester, Pennsylvania. It is along the Delaware River, and had a lot of old buildings. Dottie and I couldn't find any decent apartments in the area. I'm sure if we'd kept looking and had traveled farther, we would have found something. We didn't have very much money, so it had to be a rental place. I was kind of discouraged about the housing.

Then, I was thumbing through *Mechanical Engineering*. In the back of the magazine was a little tiny ad for a sales engineer for oxygen plants in a company called Air Products in Emmaus, Pennsylvania. That was Lehigh Valley. I liked the Lehigh Valley. Dottie's family was there. We had a little child. Dottie's folks liked the grandchild. So, since Dottie had been the assistant director of placement at Lehigh University, I went over to Lehigh to talk to Everett Till, the placement director.

I said, "What can you tell me about this firm, Air Products, over in Emmaus, Pennsylvania?" He said, "Oh, they're a <u>terrible</u> company. They'll get a contract; they'll hire engineers. They'll finish the contract and let the engineers go. They're always hiring and firing." I said, "Well, what should I do? There's an ad here." He said, "Take the job with Westinghouse. Take that job." [laughter] Now, Everett used to be wined and dined by the recruiters from the big companies. So he was somewhat partial; Dottie kind of explained that to me.

I said, "Look, they're offering me a sales engineer job right away. I go to Westinghouse, I have to start on the drawing board. I'd really rather get out and sell on the market, help bring customers and suppliers together." I visited Air Products and the first person I met was Ed [Edward W.] Donley. He had just been made sales manager. He was in his thirties at the time. I was twenty-four, maybe. He'd been sales manager for the equipment sales, selling the <u>plants</u>—not the gases, but selling big plants to the government and to the private sector. Air Products had a couple big orders. They had several prospects. They were looking for an additional sales engineer because Ed had moved up, and Air Products had to fill that position. I was impressed with Ed. I took a whole battery of sales engineering aptitude tests. I guess I scored very well on those tests. They invited me back for a follow-up interview. The personnel

officer, Mrs. Reimuller, said, "You had the best scores of anybody who has ever taken these tests here." [laughter]

Ed was called out of town on the second interview, so I was asked to meet Frank [E.] Pavlis. Frank was the first employee of the company whom Leonard [P.] Pool, founder of Air Products, had hired. Frank was a very frugal guy. Air Products had to be frugal, because they were totally dependent upon the government. At this time, Air Products was publicly owned. They had been privately owned all through the war. Of course, they lost all contracts after the war. I think even Ed took a layoff, but came back and was in the company in 1952 when I was interviewing there.

Pavlis finally interviewed me. He tried to negotiate me down. He said, "We can't pay you what Westinghouse was going to pay you. You don't have any experience in oxygen plants. Look, if you live with your in-laws, you could save all the rent money and you could afford to come to work for Air Products for seventy-five dollars a month less"—well, it was one hundred dollars a month—less, at that time. [laughter] I said, "Well gee whiz, I've gone through the war. I've spent two years, and here now I'm starting out at essentially the same place where I was two years ago."

But Ed had impressed me. Air Products' growth plans had impressed me. The company only had two hundred people. We were two and one-half million dollars in sales. I was young. It was all upside. Westinghouse was structured and organized—everything had to be done by the numbers. There wasn't that kind of easy entrepreneurial gung-ho spirit, which is such an attractive environment, I think, for a company. The freedom to act, the freedom to test yourself and your ideas and your concepts.

Anyway, based more on Donley's selling skill but Frank's idea of taking a pay cut, I went to Dottie's folks and said, "Well, what do you think about it?" Well, they'd love to have us in the area, and liked their granddaughter. "Sure, we'll put you up for a while."

[END OF TAPE, SIDE 1]

BAKER: I accepted the deal with my in-laws and Air Products and started there in the fall of 1952. Air Products had sales of about two and one-half million dollars in that year. I have spent the last forty years at Air Products. One of the things I kid people about is I said that Pavlis negotiated such a tough early year deal that I've been trying to make it up ever since. [laughter] (And I have.)

One of the interesting things in my aptitude tests was they said, "What would you like to do at Air Products? What are your career ambitions?" There were seven lines on the page. I

said, “I’d like to be a sales engineer. I’d like to become a sales manager. Then I’d like to become vice president of sales. Then a general manager. Then an executive vice president, then president, and then Chairman of the board.” I filled out all the seven lines. Guess what, that’s precisely what I did with my career.

So, when young recruits come to Air Products, either right out of college or as summer interns, I tell the story. I say, “Now remember, when you fill out an application for Air Products, make sure you fill up all the lines.” It does make the point that you can do anything you want to do—assuming that the opportunities exist and the climate exists. If you want to become chairman, and you do all the things that are necessary, there’s a possibility that you can be chairman and CEO of a company someday. You just have to set goals. You have to set targets for yourself, and then do all the things that are necessary.

I believe many people never set those goals. The goals don’t have to be expansive. They don’t have to be complicated. When I went to England, after I’d been with the company for five years, to start Air Products in Europe, I put a strategic plan on one side of one piece of paper. I wanted twenty-five percent of the UK market, and I wanted ten percent of the continental European market. I wanted to achieve this within ten years.

When I became CEO of Air Products in 1986, I wrote the annual report for the year 1996. We had two billion dollars in sales. I said, “By 1996, we’re going to be six billion dollars in sales. We’re going to have earnings of five dollars a share. We’re going to have fifty percent of our sales outside the United States. We’re going to have an environmental business. We’re going to have a chemical business. We’re going to have a big gas business. We’re going to be the leading industrial gas company in the world.” Well, we are well on our way to that goal. Partly, I think as compliment to myself, our new CEO who gave his speech at the annual meeting yesterday—Hap [Harold A.] Wagner, my successor—said we are right on our plan.

It says to me that you can, if you set stretching goals and drive yourself towards lofty goals that employees share, you will always achieve more and become better than you otherwise would be without those goals, if you only responded to events. People really like to respond to clearly defined challenges—but not so precise and so restrictive that they don’t have room to maneuver. The great thing about my relationship with Ed Donley—I don’t know whether it was deliberate, or it was just his style—but he gave me the latitude to develop the business as I thought it could be developed. He would provide guidance and act as a referral source, somebody whom you could bounce ideas off of, but you set the goals. You set the targets. You organized, and you were then accountable.

Now, goals can be unrealistic so that nobody will buy into them, because they don’t believe in them. But I tell you, when we said, “We’re going to be three times our size in ten years,” there were an awful lot of skeptics at Air Products, too. [laughter] Everybody needs to

feel that they're part of something that potentially can become bigger and better, and that they will be rewarded as a consequence. It's the driving forces that cause people to excel.

I filled out all the lines on that application form, and I hit every target. It just took me forty years to do it. It's just been a wonderful experience.

BOHNING: Did you meet Leonard Pool before you signed on?

BAKER: Yes, I met him just briefly in the hall, and his brother George [Pool]. We were in a building smaller than this house. This is a seven-thousand-square-foot house. I don't think our office was that big. We had a dirt-floor factory in the back. Yes, I met him. I am a young PFC out of the army, and here's the guy who founded the company. He was a strong, clear-focused, clear-thinking, futures-oriented kind of guy. Here I'm a young potential sales engineer. It's hard to make quick impressions, but everybody spoke well of Leonard—his entrepreneurial spirit, his drive, his concern for people.

I think it was Ed who influenced me the most. Pavlis will take credit for hiring me. But Ed was really my mentor for the first five years, until I was asked to go to Europe.

I became head of the sales of oxygen plants for the chemical industry. That was the area that I carved out as my early niche. Then we had another sales manager who looked after government. Somebody else looked after the steel industry. Those were the three major markets. Then we also had an export business. That was a fourth area. I operated in the export business to start with, because it was small package plants.

Then the chemical industry started showing interest in air-separation plants for a variety of ammonia plants and other applications. Then I succeeded Ed as sales manager for all of the process equipment, when he became general manager of Process Group. Then he had engineering, purchasing, design and manufacturing all reporting to him. I had the sales function. I was still only maybe twenty-nine years old.

BOHNING: That's a lot of responsibility for someone that age.

BAKER: Yes. It was a job that had to be done. It was fun doing it. There were lots of opportunities. We were building relationships. We were very, very small—by any rights, we should never have existed. Union Carbide ignored us, to their horror. [laughter]

They were king of the hill. They were one hundred times our size. They were the leader in this field—just as Linde was the leader in Germany and British Oxygen was the leader in Britain, L'air Liquide the leader in France and Union Carbide in the United States. They were in a club. They didn't compete with others. This was a cartel. Four firms dominated the world markets for industrial gases and equipment technology. They'd cross-license each other. It was an absolutely incestuous club. There were a few other distributors and producers—Air Reduction, which had been the original L'air Liquide company in the United States. We would sell equipment to other gas companies—but we would have to compete with Linde and L'air Liquide. Messer was another German company for equipment sale.

I decided that because I was an engineer, I really ought to understand the business side better—finance and marketing. So I signed up to get my MBA degree at Lehigh. I couldn't go full time, I had a family and travels. But Air Products did have an education extension program. We've kept that up, and it's really worked very well. I took my MBA degree at night at Lehigh. It took me about four and one-half years to complete.

One requirement at Lehigh was a thesis on a major business project. I said, "Gee whiz, Air Products is eighty-five percent dependent on the federal government." We were selling plants for the rocket program, and package oxygen plants for the breathing and aviation, for both the navy and the air force. We had some business to the steel industry. The federal government business was up and down. They want something this year, they don't want anything next year. Our company had gone through that cycle after World War II. So I said, "What we really ought to do is create a third leg, which is the international market." I did my thesis on the establishment of an international division for Air Products.

I did the thesis. Lehigh was impressed with it, and I got my MBA degree. Professor Moore, who was chairman of accounting, was my advisor. He was the one who reviewed my thesis work. He said, "I think this is so good, I'm going to send it to Leonard Pool."

Leonard Pool got my thesis. Along about the summer of 1957 when I got my degree—I was now twenty-nine years old—Leonard called me in the office with Ed Donley. He said, "I've been reading your thesis here, Dexter. How'd you like to go to England and start Air Products in Europe?" Leonard had the idea we should also be international as well. We, in fact, had licensed a small company that had been spun out of the old British coal industry, The Butterley Company, and had licensed them to manufacture package oxygen plants. He said, "We've been thinking about doing a joint venture, with our becoming the majority owner. We'd like you go over and be the managing director. Here's a one-way airplane ticket. You have to earn the return trip."

So, you know, I'm twenty-nine years old. Donley was six years older than I am, so he was thirty-five. I wasn't going to get around him very quickly. How could I continue to grow? How could I continue to develop? Taking on Union Carbide was interesting, but now here was

an opportunity to take on the other three members of the cartel in Europe. [laughter] So I talked to Dottie. Then Dottie's dad said, "Well, these opportunities only come once, you'd better take it." Dottie was keen. Ed encouraged it. So we went abroad to England.

I asked Leonard, "Where should the office be?" He said, "You decide." I knew about Wimbledon. That was about the only place I knew. I loved tennis and I was a keen tennis player. We decided to live in Wimbledon. The office was initially in London, and then finally, we moved it out to the suburbs near Wimbledon. Just about the time the office was built, we got transferred back to the United States after ten years.

We went to the U.K. on a two-year assignment. It took me ten years to complete it. We were there from 1957 to 1967. We started Air Products in Europe. That was fun. I mean, to start a company from scratch, and to take on three of the leaders in your business—in their own backyard—and to challenge them for customers. I mean, there isn't a greater challenge or opportunity that a young man can have. Today you'd say it was foolhardy, but we did it. We hired one person at a time. We landed one customer at a time.

Our licensee had screwed up two of the designs they were working on—one for the steel industry, and one for the chemical. Our two biggest markets. One plant wouldn't work and the other one blew up. AP [Air Products] Europe didn't even start on the goal line. We were in the back of the end zone. "We made a mistake. Our licensee screwed it up. We didn't supervise them well. We're going to put it right," we decided. Leonard and Ed and that whole team of people said, "Whatever it takes. Whatever it costs. There's only one way of doing things, and that's the right way. We're going to put it right." We did, and they worked fine, and AP Europe grew from there.

The other thing we learned was that when you go overseas, you must to send your best people, because they have to operate independently from head office. There are too many decisions that have to be made on the spot. You just have to have the confidence that the people whom you're sending abroad have what it takes to make the right decisions. It's a hard thing for companies to do at times. If they're really good, you need them at home to deal with the big new things you're doing at home. To send them to a small operation overseas is inconsistent with the demands for their experience. But you'll never succeed unless you send your best, because there are just too many issues to be decided locally.

I learned a lot. I considered, even though I was twenty-nine, that I was probably the best marketing guy Air Products had. I wasn't afraid of taking on British Oxygen, then L'air Liquide, then German Messer, and German Linde in their own backyards.

BOHNING: When you wanted to expand into the continental market, you bought out Butterley's.

BAKER: Yes, we did. We had these problems. Butterley's were "coal" people; they didn't understand the problems. All they were doing was signing checks. You felt sorry for them. We said, "Look, we'll take them out." Again, we were taking the long view. They couldn't help. They were in fact a hindrance, because we had to get their permission every time we spent money. You know, two plants had blown up—their reputation was hurt, so they gave them their money back. But it got AP started. It got us moving forward.

BOHNING: You and the home office also had conflict over the power aspects. European power wasn't as cheap as American power.

BAKER: Exactly. I wrote one really stinging letter. Ed also told me about how to handle that. AP Europe was having a difficult time, because we relied on the parent company for process engineering—a fundamental process design. Not the mechanical execution, that was done locally. But the flow sheet, and how the flow sheet should be put together. How you balanced out various economic factors.

The price of electricity in Europe was two or three times the price of that in the USA, because Europe had very high-priced coal. We had low-cost natural gas and cheap coal. Their electricity was high and ours was low. The USA always balanced on minimizing capital, spending more on less-efficient motors and higher-pressure drops, and running the plants at a higher pressure. Well, when we tried to sell that, the British capital charges were about the same. If anything, they had longer depreciation schedules than we did. So their capital charges were relatively low. But their monthly annual operating costs were high, because the cost of energy was high. These designs that we were using were really optimized for the U.S. market, and not for the European market. I was having some difficulty getting our customers to buy into our concept, low-capital cost. The steel and chemical companies were used to optimizing on their consumption costs and not on their capital costs.

I complained bitterly. I wrote a long, stinging letter to Leonard. I said, "Look, when you sent me over here, you said you'd support me. You keep sending these rubbish designs that are noncompetitive. How do you expect me to sell this rubbish if we can't be competitive?" The letter went to Leonard. He was out. I got a call from the chief process engineer one day. [laughter] He said, "We're working on a design. How can we help you?" I said, "Look, you guys are not doing a good job. Go read my letter to Leonard." Bang.

A couple of hours later, Donley called me back. He said, "Look, you're absolutely right, but what you've got to do is motivate these people to help you. Don't put them on the defensive and make them feel angry at you, because they won't help you." That was a good lesson. You

can vent your spleen, but if you don't motivate the other guy to do what you want, you're not accomplishing your goal. We got that sorted out. But it was a lesson, because what it said is that you've got to design for the customer. You've got to understand what the customer's needs are. You've got to understand what the competition is doing in responding to those customers' needs. It was the presumption that what was right in the United States was also right for Europe. We had to displace that concept. That helped APCI because ultimately energy became more expensive in the United States, too.

AP Europe adjusted clearly and quickly and started putting in more capital, more heat-transfer surface, more efficient compressors—paid a little bit more in the capital, but significantly reduced our energy consumption per plant. Today our designs probably are much more optimized on what we would call a total return basis, recognizing that the customer has different ways of evaluating capital. Understanding those requirements up front is very critical to optimizing the design for that particular end use application.

In the chemical industry, for instance, they'll write the capital off over ten years. The steel industry will write it off over twenty years. Capital charges for the steel industry are low, but operating costs are high. Chemical industry, which had been my market, puts relatively high capital charges on their assets. They're looking at technological obsolescence being a much higher factor, and they don't want to take twenty years to recover their capital. In most cases, the chemical industry had access to low-cost hydrocarbons, natural gas, waste heat and so forth So their energy charges were normally pretty well optimized, whereas the steel industry would quite frequently buy their power and pay high grid rates for it.

BOHNING: I'm quoting here from *Out of Thin Air* (1). "The home office had not planned this expansion and, at times, put roadblocks in its way."

BAKER: Meaning?

BOHNING: You would have started to open up offices.

BAKER: Yes, right. We wanted to go simultaneously into Germany, Belgium, Holland, France, and Italy. We had won important contracts in those markets. Again, sending one good man to that territory to develop business, respond to some of these growth opportunities. The interesting thing was you think a monopoly is a tough thing to crack. But quite honestly, customers like to have choices. So we were relatively well received throughout Europe.

Some nationalistic companies didn't want to do business with America. They only wanted to do business with the French or the Germans. But those who were generally interested in having a competitive situation welcomed us, both in Britain and then on the continent. We were able to win key contracts that got us established in Belgium, in Germany, in the Netherlands, and then in France. We acquired a joint-venture relationship from Shell in France. We went after the French market.

I started all of these things going simultaneously. Some of these projects took up-front capital to start a new company, because we believed strongly in the concept of owning the plant and selling the gas. Keep the cow, sell the milk. There was a lot of front capital needed. We had no revenue coming in as we started separate companies. We couldn't consolidate one against the other. We couldn't match cash flows. Each company had a joint-venture partner that we had developed.

Ed simultaneously had the view, in the United States, that AP should apply our technology skills to the chemical industry. So he started the chemical business. First the ammonia plant, then the acquisition of Houdry, then the acquisition of Escambia Chemical, and then Air Reduction. He was trying to push the chemical business forward, and we made some good deals. I was over in Europe trying to make acquisitions to accelerate our growth in the gas business—and we just ran out of money.

I had a wonderful joint venture deal in Italy with the second-largest company in the north of Italy, which would have put us on the ground floor in Italy. I'd been selling oxygen plants in Italy from London, winning important orders there. Now what we wanted to do was become a gas company, not just a hardware company.

[END OF TAPE, SIDE 2]

BAKER: I had the deal all cut. It would take one million dollars to fund it, plus one million dollars as working capital to expand it. We had a handshake. I called Ed's office, all excited. They tell me, "We're going to have to build a big new chemical plant and can't spare the money." I was pissed off, to be honest with you. [laughter] I worked so hard in getting these deals. I went back to them and said, "We don't have any capital, but we'll put our technology in. You put the capital up. We'll put the technology in." They were kind of insulted. So that deal failed.

Many, many years later, almost forty years later, I did do a deal in Italy where we did acquire a major contract. But this time, we had to bring our own capital. In the meantime, Union Carbide picked up this other company. That's their company in Italy today.

BOHNING: When did the cartel start really paying attention to you?

BAKER: It took the British quite a while. I went through about ten managing directors while I was there. They thought the problem was their managing directors, not their marketing policies.

You know, it's like competing with a public utility company. A monopoly just doesn't know how to compete, because they're so used to taking orders. I was on the phone this morning with AT&T. The girls were very pleasant. I was telling them, "Look, I'm paying twenty cents a minute. I think that's too much. I'm making all these calls to this one area. Don't you have a wide-area network?" "Well, you're on our lowest rate. We don't have any other rates. Why don't you try the business department. Can I transfer you?" They're very pleasant, but they're not solving my problem—I think I'm paying too much for all these calls going back to Pennsylvania.

The same thing with British Oxygen. They had their rules and their regulations, and that's the way they did business. The fact that Air Products would come in the U.K. and would put the caps on the cylinders, would have a tailgate that didn't smash the concrete on the customer's deck when we put the cylinder down—just little things that were customer focused, customer oriented. We had built that philosophy very early on. We were small. We were competing then with these large giants. We knew that we just had to give <u>better service</u>. We did, and so we won our share of new customers.

There are just tremendous opportunities, when you're competing with a monopoly, to become customer focused, dig in, find out what the customers' needs are, respond to those needs, and develop engineering alternatives and different technical solutions. I believe that those companies that do that really will grow. Clearly, we have built today a four and one-half billion-dollar business—literally out of thin air. I mean, it's not just a catchy title, that's what we did. We had no raw material position. We had no technology position, going in. All we had was a group of entrepreneurial people with forward-looking ideas and a concept. If we could figure out ways of getting the price of the industrial gases <u>down</u> and focusing on new markets—not just competing to serve existing customers, where you had to battle to take them away, (although we weren't opposed to doing that either)—but offering cost advantages, we could make the market grow. That's what happened.

When we started out in the United States, we used to throw all the nitrogen away. Well, Air Products said, "Gee whiz, why do we want to do that? There's four times as much nitrogen as there is oxygen. Let's focus on markets for nitrogen." Carbide was so oriented to the metals industry and selling oxygen for processing steel. We said, "All right, let's go after nitrogen." So we looked at electronics and we looked at food. We looked at blanketing, shielding, purging.

Today, we sell three and one-half times as much nitrogen as we do oxygen. Now, stoichiometrically as four to one, we need a little bit of nitrogen for internal processing. The point is, if you focus on what we thought was the obvious—but others had just focused on one aspect—of course, the results of that are that our costs were lower. If we can take four and one-half parts of the gas we process and find markets for it, and the other company can only take one out of five parts, we're going to have much lower unit costs. It's like selling all the chlorine, all the caustic, and all the hydrogen out of the chlorine cell—when somebody else can only sell the chlorine and has to give the caustic away. So, we sold O_2 and N_2 and H.

BOHNING: As you were developing in Europe, were the bright young engineers you were hiring Americans, or were they local?

BAKER: Mostly locals. I don't believe that at any time we had more then ten Americans in residence there. First, they were expensive to send over. You had to provide housing, and schooling, and overseas compensation, and all those things. What we really wanted to do was, we wanted the brightest and best. Then, language is a problem on the continent. So we wanted people who knew the culture, knew the language. It took a while, and we made some mistakes. If you don't know the language and you don't know the nuances, you aren't always able to interpret what the person's saying—whether they really have what it takes to succeed.

The other thing that we concluded is that if we wanted to mold an organization to be really entrepreneurial, we really didn't want to hire people from our competitors. Then we would have to change <u>all</u> of the things that they had grown up with. I mean, it was nice to have some of their knowledge about specific customers, but what we really wanted was an entrepreneurial organization team who would work for long hours for low pay. [laughter] We couldn't afford big salaries, either.

As a consequence, we believe we really built the company around a lot of strong people. I mean, the vice president of engineering came out of Britain. The head of our sales for electronics came out of Britain. We have some of our top technologists from Germany and France today. Now we're bringing Oriental people in. So going for the brightest and the best, and then teaching them what they have to know about our business, turned out to be a much better strategy.

Now in a few key areas like finance, where we needed good solid experienced people who had a reputation and could breed confidence—controllers, tax people, lawyers—there we were buying experience, not just raw entrepreneurial spirit. So we had a blend of that. But in the main, the managers whom we hired in the beginning are the ones who are running the companies today. Ron Sullem, who runs all of Europe for us today, was a graduate from Leeds University. Al Bull was a young sales engineer with a German chemical company. Dave

Moran we hired out of Imperial College. The fellow whom we just sent to Hong Kong, Jeff Proctor, came from one of the Welsh universities. You can go right through the whole organization—finance, engineering, marketing, and so forth mostly hired right out of college.

It's a pattern that we followed in the United States, too. Hire the brightest and the best, do it every year—good years and bad. Build a cadre, build depth. Our competitors today are struggling. British Oxygen had to hire somebody who was a top executive in Air Products to try to bail them out. They just never had done their homework in building layer upon layer of bright, young, capable people who would then matriculate up to the top. People who wanted to start as a sales engineer and become chairman of the board.

It's an obvious strategy today, succession planning and development. Air Products focused on it almost from our beginning—which is, with all the other things you have to do, it's amazing how well it works. We believed in diversified experience. Sending me to Europe at age twenty-nine with a freshly minted MBA degree was a great thing for me, but it was a great thing for the company too. I developed experiences, knowledge, and diversified work practices that nobody else in the company had. I was able to add a dimension to the company. Of course, today international markets are one of our major thrusts, as it is a major thrust of the chemical industry today.

BOHNING: Those must have been heady times for you, being that young and having all this opportunity lying there for you to work with.

BAKER: At the time I didn't perceive it to be opportunity, but a whole bunch of problems.

BOHNING: Did you have any interactions with your counterparts in other American companies who were expanding in Europe at that time?

BAKER: A few, yes. That was helpful. It was a little easier to sell to DuPont or to Ford Motors or General Motors, because we had a bit of a reputation in the United States. We weren't a total stranger. With a British customer or a Belgian customer, you had to have this dialogue as to how you got here. "Are you going to stay? If we sign a fifteen-year contract, are you going to be here fifteen years from now?" The safe decision would be to go with the solid true-blue local guy. We didn't win every order. There were those who were more nationalistically inclined, or those who were somewhat risk averse. We did make a point that <u>they</u> had a stake in fostering competition. If they weren't prepared to back us, clearly we would not be here in the long term. But if they were prepared to back us, we'd have a long-term future.

It went well. We grew on the continent, developed businesses in Belgium, the Netherlands, France. We did a lot of exporting to Spain, Germany and Italy. We competed with our principal worldwide competitors in their home market. That's an important thing to do. If you want to test yourself against your toughest competition, compete with them at home. They're relatively weaker abroad. To beat up on them in the United States is not nearly as challenging—nor do you have to be as good—as competing with them in their own backyard, where they have much more strength, and capability, and relationships. So if you can win there, you can win anywhere. The song says, "If I can do it in New York, I can do it anywhere." Well, if you can do it in France or do it in Tokyo, you can do it anyplace.

That's what we did. We strengthened ourselves, because that's what it took to win at the highest level. We organized how to win at the highest level. We hired the right kind of people to succeed. If you needed better, more creative, more technically competent, more entrepreneurial people to win, those characteristics served you well in beating the competition.

The other thing about an international company is that every market is not the same. But the experiences that you gain in one market are translatable. It strengthens the company to participate in many markets around the world, then flow those experiences back, and then distribute them through your network. The companies that are in the world marketplaces competing for applications, different uses of products, different end market requirements—they develop that knowledge, and then they can introduce the concepts around the world. Those companies that only focus on the United States, I think, suffer. There's a big world out there, with a lot of things going on. If you're not interacting with those things, you're going to get left behind.

That is the lesson of the American steel industry—they never went abroad. They never knew what was happening in Japan, in Europe, in Australia, in Austria. Those technology developments—driven by different sets of economics that existed then in those markets, but that ultimately existed in the United States—were driving technological changes that just eroded American plants. I mean, the U.S. was building open-hearth furnaces when Europe was building LD steel plants. It was taking us five hours to do a heat that Europe was doing in thirty minutes. We weren't interacting. We weren't competing. We weren't there. We weren't on the ground floor. The United States was rather smart to get Werner von Braun , the scientist, to come over here, because we didn't know about rocketry and what it required.

That was one of the things that I was able to do—change the horizon and breadth of the company, create a cadre of people with different education and different culture experiences, and then help to blend that into our American experience. In the process of doing that, I think we became a stronger company with better visions. Union Carbide never did do it until real late. Then, of course, we were introducing new products and technologies that in the United States market, they knew nothing about. Then they started to scramble to try to play catch-up. They lost the momentum.

BOHNING: You came back from Europe in 1967.

BAKER: In 1967, yes. We were there ten years.

BOHNING: When you came back, did you feel you had accomplished the one-page list that you had composed when you first went overseas?

BAKER: Well, no. Not really. We hadn't gotten our full market share. But we certainly had put in place the things we needed. We had put in the people, the plants. We were on the continent. We were the only company who was operating in all of those different markets.

It's been said that the American companies did a better job of taking advantage of the common market of Europe than the Europeans did. We went across those borders, because we didn't have those cultural barriers that existed. We were strangers wherever we went. Being a stranger in Paris was no different than being a stranger in Germany. We just had to do the things necessary. It was difficult for the French to think in terms of competing in Britain, or competing in Germany. I mean, they just didn't do those things. We would build plants on the border of Belgium, and send one pipeline into Holland, and one into Belgium. We'd build a plant up on the border of France, and send products into Germany. The borders didn't mean anything to us. The distances were so much shorter than the distances in the United States that geography wasn't a barrier to thinking in global terms.

Now I presume there were some people who thought only on a countrywide basis. We didn't. We looked at the whole market and tried to build plants that were as large as possible, and thereby as low cost as possible, to serve the largest market that could be economically served from a single point.

BOHNING: Why did you come back? What precipitated that?

BAKER: I had felt that I had accomplished, primarily, the goals I wanted to do. Ed Donley was moving up in the organization as president. I thought now was the right time to get back and become the executive vice president.

BOHNING: That was a new position.

BAKER: Ed had enjoyed that position, too.

BOHNING: But it was relatively new.

BAKER: Yes. It was an opportunity to run all of our gas businesses worldwide. I was probably the first one to run all the gas businesses. Alternatively, one week I would report to Ed, another week report to Leonard, and then to George, depending upon what was hot at home.

So I came back and, really, turned Europe over to a British successor. Then we had some problems in Germany. I had to go back and fix those, and get new management in place. Then in the United States, we started to focus on a more market-oriented-type approach, by product and end markets. We created a medical division, and we created an international division.

BOHNING: Wasn't there also a welding division that you started?

BAKER: Yes, welding and medical. Ultimately, we made some initiatives, but we really never were able to get to a critical mass. It was partly done as a diversification effort. But the core businesses continued to grow so rapidly that we really didn't succeed very well in those other markets. We ultimately merged them back into gases. We continued to push on the international growth. We went to Canada. We went to Mexico, started in the Far East, went to Japan and, through a whole series of joint-venture acquisitions, throughout the Pacific. Today, we are in thirty different countries around the world.

I was able to use our experiences in Europe. There's always a fear about going abroad, "How are you ever going to penetrate Canada?" "Well look, we did it in Britain. We did it in Germany. Canada's on our doorstep. It's a lot easier to fly people up and down." Then you start looking at geography. Toronto was closer to Allentown than Washington. People just didn't think in those terms. In 1981, I just went right from Allentown to Montreal.

BOHNING: That sounds just like the description you gave of European companies and their attitudes.

BAKER: Canada is an hour away, but it just seems spread out and diversified. I started Canada and then ran all of our gas businesses. Then Ed was selected to succeed Leonard. Then I followed Ed as president, and I picked up the chemical business. We also had an engineering and construction business. There was a major national thrust into synthetic fuels. We didn't feel we had enough engineering capability. Ed made the decision to acquire and expand our capability by acquiring Stearns-Roger. That greatly increased our engineering capabilities. We went after some of these major synthetic fuel contracts with the U.S. government.

Looking to the government as a means of developing emerging new technologies for government use was a start for looking at technology that had a large potential commercial market application. That had been the story about our oxygen plants. That had been the story about our helium recovery program. That was the story about liquid hydrogen for the space program. It had been our involvement in providing liquid oxygen to the long-range rockets, when we were confronting Russia with the Minuteman program. In every case, those projects and programs that we had built for the federal government served us very well, in strengthening our relationships and developing key commercial markets.

Linde of Union Carbide took a different tack. They didn't like dealing with governments. They saw it as a burden. Government was too regulatory. They were administratively difficult. But we said, "Look, here's a way to get your research funded, get experience, and build manufacturing capabilities." We'd put up with all those burdensome mechanistic dealings, in order to expand our markets and to develop new technologies. We just took advantage of the needs of the government—provided those needs could be demonstrated to have potential applications to the commercial market. Then we could be the instrument for taking that technology into the marketplace. Just like Boeing developed the jetliner out of their tanker program for the government. We developed the liquid hydrogen business where we dominate that market today, because of our involvement in the space program.

BOHNING: I'm not sure how much time you have available.

BAKER: Well, what are some of the key questions that you want to make sure you get answered here?

BOHNING: There is one thing in particular. In 1986, Donley turned the company over to you.

BAKER: Yes.

BOHNING: You set out on your ten-year plan.

BAKER: Yes, right.

BOHNING: One aspect of that, that I wanted to focus on here, comes from this committee on innovation. I'm quite intrigued, because one of the things we're trying to do is look at innovation in chemical industry. First of all, what does innovation mean to you, in your experience with it?

BAKER: I have a view that wealth is created through the introduction of new products, processes, and technologies—which lower cost, reduce the consumption of materials, and improve the benefit to the customers. That as engineers—manufacturers, particularly—we are the wealth creators of the country. It's only through innovation that wealth is created. The steam engine to replace the horse-drawn, the 747 that replaces the 707, the PC that replaces the big blue box. The cellular telephone. The satellite. Every innovation that expands markets, reduces cost, makes things cheaper, and uses less materials, less energy—increases wealth.

The role of the manufacturer is to divide up, if you will, the benefits of that innovation between the consumer and the producer. My view is that innovation, and creativity, and technological advances are the fundamental driving forces that create economic well being for society. Those societies that focus on those things broadly are the ones that progress and develop—those companies that do it, or those divisions within companies. I think if you examine this concept you'll find that is a truism. The wealth of nations is no longer a function of raw materials, or of access, to natural resources. It's a function of their ability to innovate, to take advantage of those things. Raw materials and minerals are readily available to everybody. It was particularly important to Air Products, because we started with no advantages. Just air. Everybody had access to air.

[END OF TAPE, SIDE 3]

BAKER: Innovation was our absolute driving force. Now, you could have innovation in financing techniques, which we did. We developed some very unique on-site financing techniques, where we built plants using the customer's credit—a contract that he'd guarantee to buy gas from us for fifteen years. You can have innovation in marketing, in creating new uses and applications. We freeze all the McDonald's hamburgers. We put the space shuttle up, and so forth. You can have innovation in technology. We created processes for liquefying helium,

and hydrogen, and LNG [liquid natural gas], and taking oxygen out of air by absorption rather than by cryogenics.

If you can do all of those things, and do them simultaneously—innovation in marketing and manufacturing. We now have one hundred percent of the world's market for LNG exchangers. We have the world's finest manufacturing systems for building these huge two-hundred-ton heat exchangers, which we then ship all over the world to be the core process for liquefying natural gas.

That has been our driving force. We have created wealth. We have created wealth for the nations in which we've operated, because we've lowered their costs and improved their economic output. We have created wealth for the companies we serve. We supply customers all over the world. We have lowered their costs by introducing oxygen. Of course, we have created wealth for the shareholders of Air Products, and the employees of Air Products, and the communities in which we serve. You go back to Schumpeter economics. "Capitalism is the replacement of the old with the new." Out of that process of replacing the old way with the new way, you create wealth. That's what we think we do. We find better ways of processing air at lower costs, providing more benefits to our customers at lower costs—improving the quality of their products, the productivity of their operations.

Flat glass today is made in an atmosphere of hydrogen and nitrogen. There isn't an industrial process that doesn't use industrial gases, and use them in an expanding way. The same is true when you substitute water-based emulsions for solvent-based emulsions. You improve the quality of the environment. You keep our ozone from dissipating.

The reason the American chemical industry, as an industry, has been more successful than almost than any other industry—with the exception of maybe electronics—is the high rate of innovation that takes place. A high percentage of our sales is spent on research and development. The steel industry has not been an innovator. It has not been as innovative as the aluminum industry. That drive to cannibalize the existing processes with new ones, with much lower costs and improved benefits, is this thing that has made the chemical industry and the electronic industry world leader, and has made America a world leader. We started out with advantages, and raw materials, and agriculture, and so forth. But today we rely on the entrepreneurial and innovations capability of our people. That's why education, that's why opportunities, why delegation of responsibility to people, and why optimizing the performance of individuals as creators and innovators—that's why <u>that</u> is so important. If you get that right, everything else takes care of itself.

BOHNING: It's fairly obvious from what I've read that you've been very people-oriented, very employee-oriented.

BAKER: Yes, that's right.

BOHNING: You really were trying to encourage innovation and entrepreneurship, just as you had the freedom to do that in Europe.

BAKER: Right, yes.

BOHNING: How do you go about doing that? You're a bigger company now. Things are more complex than they were when you were starting out.

BAKER: I think you really want to divide things up into pieces, where people can see the whole. You take businesses and break them up into product lines, or geographic markets, or market applications, or industries. People can see the whole parameter of how your product fits in with a group of customer needs—then organizes in serving customers. We exist in business for one reason only—to serve customers. How well we do that, how well we understand our customers' needs, and what their real needs are, not always what they say they are—because sometimes they're different. You get close to the customer so that you can understand those, and then drive your processes to be responsive to those needs.

We got very close to the electronic industry through some of our nitrogen applications. We built pipelines to serve customers. The Silicon Valley today is totally connected to Air Products, and we to them. They couldn't function if one of our plants shut down. You don't have to have an earthquake—just cut our pipeline, and you'd put the electronics industry out of business. We sensed the need for ultra-high purity, that the microprocesses of the future were going to be submicron line widths. The purity of the gases had to be so high that you couldn't have dust particles or oxygen impurities, which would interfere with the submicron line widths. One four-hundredth of the width of a hair is etched on these silicon chips, to get sixty-four million pieces on a chip the size of your thumbnail. We started working with customers to perfect the purity of our products. Now we're the world leaders. The customers have become so dependent upon us that they've invited us to come in, set up shop in their factories, and control the processes that lead up to their diffusion furnaces—where they actually do the etching on their silicon chips. So we have formed partnerships with our customers.

The good Lord only gave us so many atmospheric gases. The challenge that we have to work on at APCI is how can we be innovative in taking those gases to more productive end uses? How can we process them at lower cost? How can we serve our customers more cost-effectively, building plants right next door or becoming part of their team? How can we

develop application machinery that facilitates the use of our products in our customers' factories? So you encourage people. They quickly recognize that if we only have a limited number of things to work on, then we've got to be very good at the end use, application, and processing techniques.

BOHNING: Do you have a reward system?

BAKER: Very much so, yes, in many forms. In the early days, the rewards were promotions, if you will. [laughter] But today, you're eliminating layers, so there aren't quite so many promotions. Personal recognition is the most important reward. To be recognized by one's peers means that you've done a good job.

We used to give people promotions. You can't always promote people. But to be recognized among their peers, among their families, and so forth—you can put monetary rewards on that, and we do. We have many, many events where we recognize the best driver of the year. The best safety record of the year. The best marketing man. The best manufacturing team. Increasingly, we're recognizing not one person, but teams. We recognize that many of the problems and challenges cannot be solved by one person, but by a group of people working together as an effective team. So there are team awards—for quality, for productivity.

We reward suppliers for their unique performance. We make them feel part of our team and, through us, the customer's team. We're not competing with each other. You're not motivating them to excel if all you're doing is pounding your suppliers on their price. You want to help them find ways to be more cost competitive. That may mean changing your specifications, and changing their manufacturing processes. If Motorola wins by selling more telephones, we win by selling more gas to make the chips that go in those phones. The recognition that there's no way that you can win if your customer doesn't win is a way of looking at it. The challenge is to get that through. You have to spend a lot more time in communicating—communicating where you're going, what the challenges are, what the customer needs are, surveying customers, "How are we doing"—all the time.

You have to operate at all levels. You have to operate at the technological discovery level. A group of scientists are looking for new technologies and new ways. You have to operate at the engineering application area. You have to work at that customer-applied R&D area. You have to have good communications across those lines. So that even the people working in the laboratory on discovering physical properties and new physics, chemistry, and biology—are knowledgeable about how that discovery could potentially impact on end market requirements. You really have to be market focused. Sometimes, you don't know what the potential markets are until you discover the phenomenon. Where could a new polymer go? Then you have to take it, and go out and try it, and see if it has a fit some place.

You have to operate on all concepts simultaneously. You have to make a commitment to it. You have to be patient. You have to sometimes protect R&D programs for which there are no immediate market applications, but where you potentially believe that work in that area will pay off. We've done a lot of work in molecular fibers in recent times, because they're good membrane systems and can effectively separate gases. We're constantly looking at new emulsion systems—particularly systems that will work in a water-based environment, rather than a solvent-based system.

BOHNING: You just made a very interesting comment about protecting areas, specifically R&D, for a period of time because there's no immediate output. It seems that today, that's not done very much anymore.

BAKER: Yes, there's a lot a pressure on performance. I think we're getting better, though. I think that maybe, we have spent a lot of money not wisely, not cost effectively in the past—and so we're becoming a little bit more market oriented and focused.

If you say, "Look, twenty percent of R&D ought to be on discovery, fifty percent ought to be on process, and fifty percent on products or applications or something," and you can do that, the problem that you have is that many times, R&D is a long-term process. But the managers in charge of running a business are going to be there only five years. Then they're going to get diversified experience doing something else. So clearly, there's a trade-off—between what the business manager running the business for five years is looking at, and what a R&D guy who may take ten years from concept to application is looking at.

But I think the good business leaders recognize that R&D is a process that's long in duration. The companies that have succeeded the best are those that have been the most innovative, have introduced the most new products. Every product has a life cycle. It will ultimately disappear. If it doesn't disappear physically, it'll disappear economically—that is, you just can't compete anymore. You have to renew your portfolio with a constant introduction of new products, new markets, new technologies. If that is understood as one of the driving forces to success, then you just do it.

We like to say that investment for the future consists of two things: it consists of hardware and technology. We have to be investing in the proper proportion of both things. If you just put a lot of money into hardware that processes things the same way for the same products, pretty soon you're going to have a lot of new hardware. But it's going to be dedicated to old products. That's the story of the open-hearth furnace, when somebody else was putting LD furnaces in. You've got to make sure that you've got a proper balance of new technology going into new investments.

The problem that we have is an accounting problem. The accounting systems require us to write off technology against current income today. We cannot say with certainty what the value of that technology is, over time. Hardware is equally uncertain. But because it's physical plant, we can amortize over ten or fifteen years. The charge for that investment is only one-fifteenth per year, whereas the charge for the technology investment is one hundred percent. I mean, it's just an accounting mechanism. We kid ourselves. But when you begin to think about it, you're investing in technology and hardware as a combined process—making sure your rate of investment and the balance between hardware and software is right. Air Products today has the highest ratio of total investment—R&D and hardware sales dollar—of any company in the chemical industry. We will be investing, this year, more than thirty percent of our current level of sales in R&D and in technology.

BOHNING: That's very high.

BAKER: But if you do that and do it successfully, you are creating a huge pump. You're priming the pump. The cash flows that will flow from such investments in the future, increasingly, will just give you the means to grow. We're spending over one billion dollars this year in a new plant and equipment. Ours is a company with four billion dollars in sales. We are also putting another hundred million dollars on top of that for R&D.

BOHNING: This means, then, that you have to be willing to take risks.

BAKER: Yes. But not foolish risks—measured risks. We try very hard to measure those risks, but there's nothing that's certain. When you're making a capital investment, and you do a DCF analysis—and calculate the present worth on something that's going out over fifteen years—the calculations are precise, but boy, the database is very imprecise. I mean, you're just making judgments about the future.

I believe that's also why some technological vision is needed. If there's a fallacy in business, it's that we probably don't spend enough time trying to synthesize the futures. Many times the facts are there, but we don't know how to weight them as to the probability. What will be the impact of digital communication? What will be the impact on the next series of microprocesses? IBM, as smart as they are, missed the trajectory curve of microprocesses. Those big blue boxes were replaced by a whole bunch of PCs. Now the big boxes are coming back. The American steel industry, as I said, got broadsided. The American automobile industry got broadsided by the small, efficient automobile from Japan. So you have to

constantly try to project forward the evolutionary innovative forces that are changing the world, the way we live in it.

BOHNING: That is what you tried to do in 1986 with your ten-year plan.

BAKER: Yes—to make a commitment to have a group of people studying technologies, trying to push the frontiers forward. You don't always get it right. You miss some things. You've got to also be very, very sensitive to the Not Made Here factor. Everybody is comfortable with what they know. They're uncomfortable with what they don't know. What they don't know is what kills you.

I believe people who are in the technology creation business are at least somewhat more sensitive to the fact that technology can have a major impact upon your business. You'd better be on top of the technological forces that are happening. But it doesn't have to be technology. It can be application technology. Look at the airline systems and their reservation systems. I mean, American Airlines makes more money on reservation services than they do on carting people. Having an information-based system is tremendous.

The Merrill-Lynch people grabbed a huge lion's share of the investment market by offering this computerized-base customer management account systems. That gave their customers—in one sheet of paper every month—a precise balance sheet of all of their securities, their interest, and so on. They just did it by computerizing their information and flows. So there are ways, from a commercial standpoint, to innovate. Air Products has introduced bar coding on cylinders. We can tell every customer precisely where each cylinder is. Wal-Mart, in its cash register system, ties back to its suppliers. The suppliers know overnight what the stock balance is in every Wal-Mart store.

DuPont has cut the cycle time for replacement of fashions. You'd order the fashion cloth in the fall for the spring, spring for the fall. They've gone through that, and they've optimized it. Today they can measure the consumption of The Limited stores' current fashions, the amount of cloth that that takes. They can change their mills. They can ship the material to China, have the Chinese process it overnight, put it on Federal Express, and deliver it to those stores. To the size, color, fashion they want—and they can do that in <u>fourteen</u> <u>days</u>. It used to take six months.

Chrysler, last winter in the Northeast, was able to change their manufacturing processes so that they could get more of their four-wheel drive vehicles out into the market place. They captured <u>billions</u> of dollars of market share. Look at their earnings this year. I mean, they made their systems agile to change and customers' needs. They were able to get that production line organized. Get all their suppliers—fifty thousand suppliers who participate—to change what

they were doing, the input. Get those cars out, get those trucks out. They captured the market. Fifteen snowstorms in the Northeast changed their relative market share position to that of General Motors. Just because they were able to organize themselves to respond to the storm needs. That's innovation—but innovation in agile manufacturing capability.

BOHNING: I know your time is short. What is important for the future of chemical innovation? We've been discussing some aspects of that, but do you have any thoughts on that concept specifically?

BAKER: If I look at the industry as a whole, I believe the thing that is now most important is we are now much more people focused than we have been in the past. Every employee is knowledgeable about what the industry is trying to do, what customers are trying to do, and so forth. We certainly have taken a strong responsibility, since Bhopal, for the environment. We're not resisting government. We're trying to be a leader in anticipating what is the right thing to do, organizing, and then measuring our performance. Publicizing our performance. Every chemical company will be sending a report out this year on what they're doing environmental wise. Showing the progress over the last five years. Showing what remains to be done. We're running television ads.

We have come to recognize that we exist at the behest of the public, and we'd better be responsive to the public's concerns, just as we're responsive to customers' needs. Then organize to do just that. It's not going to help us to say, "Well, we're misinterpreted. They don't understand us." It's our obligation to make sure that our customers <u>do</u> understand us, understand the risk in what we're doing and how we're taking care of them. We are responsible for their well being—our neighbors, our customers, our users. We are going to see that our products are disposed of properly. Our commitment to the environment is just as great as the commitment to the environment in your own backyard is.

The other industry focus today is the international market.

[END OF TAPE, SIDE 4]

BAKER: Two-thirds of the market for chemical products lies outside the United States. We have to access, and be a part of, and serve customers all throughout the world. There are a lot of bright people and customers who live outside the United States, and we need to access to them. The creation of wealth and economic progress for nations, for companies, and for individuals, is tied in to our ability to create new products that serve world markets more economically, more advantageously, more efficiently—with lower consumption of energy and materials. We have

to drive our businesses and invest around the globe. We must invest for the long term. You cannot optimize your business on three-year cycles. You're making chemical investments for fifteen years. You're making technology bets for fifteen years. You're not going to be right on every one. You've got to have to have lots of horses in the race. Some will win, some will fail, some will break even. You need lots of bets.

I believe the chemical industry is in relatively good shape on these philosophies. People, products, and processes, markets. We have a collective accountability to all of those stakeholders, to the communities in which we operate, to the employees in the companies, to the shareholders who invest, to the customers, and to the nation as a whole. So it's balancing those forces—and doing it in a responsible way that will cause, I believe, the American chemical industry to continue to be, one of the great industries in the world.

I believe that the attitude among the leaders of the chemical industry is that we do have collective accountability. We don't want to have happen to us what happened to the nuclear industry. They did <u>not</u> do a good job of communicating the risks, benefits, and the enormous investments they were making in safety. That industry lost its constituency, and they're out of business. It could happen to us if we did not adequately share that sense of responsibility to the publics we serve.

Bhopal was a lesson. You can point fingers to somebody else, but we are the stewards of a healthy environment, and the burden lies on us. We are finding that it's not a zero-sum cost. By being better stewards, we can find more efficient ways of doing things. Some of the paragons of environmental costs are really not so bad. We can put in environmental systems that save money. Air Products is making a good business out of its environmental systems business. We take trash, recycle it, and create electricity out of it—or we take sulfur out of the air and make gypsum for wallboards, for housing. So there are an infinite number of positive sides by being good stewards and being concerned about the environment. It's not just being goody-goody—it's good business as well.

I believe our people feel better about it. People are not asked to make a trade-off between safety, or environment, or the bottom line, or customer service. You've got to do all of those things. To hit a home run, you've got to touch all the bases. You just can't touch first base and third—you touch them all. We're doing that. We're doing it in our own company, and I believe I see the industry doing this also.

I'm very proud of the response. I've seen a real step change in attitude, from absolute resistance—"The government doesn't understand us; they don't know us"—to a recognition that we have a responsibility to communicate what we're doing and how we're doing it. If the customer doesn't understand it, it's not his fault; it's our fault. We haven't done a good enough job of communicating to that customer.

BOHNING: After *Silent Spring*, the industry stonewalled for some time (2).

BAKER: Yes, exactly. I was in some of those meetings. Air Products never really had a big environmental problem. We take air and clean it up, and make clean products from it.

BOHNING: On that note, then, I will close. I thank you very much for spending this time with me this morning.

BAKER: A pleasure, a pleasure. I believe what you are doing is good work. The chemical industry has a good story to tell. It does not have anything to be embarrassed about. It's progressive, it's forward looking. It's creating wealth for the world. Through the products, and medicine, and polymers, and environmental systems, we're making a difference. I'm proud to have been a part of that process.

BOHNING: Well, thank you again very much.

BAKER: Thanks for coming and seeing us.

[END OF TAPE, SIDE 5]

[END OF INTERVIEW]

NOTES

1. Andrew J. Butrica, *Out of Thin Air: A History of Air Products and Chemicals, Inc., 1940-1990* (New York: Praeger, 1990).

2. Rachel Carson, *Silent Spring* (Greenwich: Fawcett Publications, 1962).

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