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All of the energy industries are moving away from cross subsidies toward a profit center approach. They are attempting, to the extent allowed by regulation, to shed unprofitable assets and unprofitable markets. For example, natural gas pipelines are separating their roles as buyers and sellers (merchant) from their role as transporters and storers (service). Large electric utilities are beginning to unbundle generation from the remainder of their operations.

#### Implications for Electric Utilities

Electric utilities are in a transitional period of increasing competition coexisting with traditional regulation. Further deregulation will lead to increased industry restructuring, as described above. In generation a few large integrated companies could coexist with niche generators, much in the same fashion as the major oil companies use their own production as well as buy from smaller producers to meet their refinery needs.

There could also be many distributors who would be highly diversified in energy services. Transmission presents the largest unknown. Will it continue to be integrated with generation, owned by a quasi-government organization, or separately, owned by brokers?

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## MERGERS AND ACQUISITIONS IN THE PETROLEUM INDUSTRY

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#### Introduction

During the the four-year period from 1982 to 1985 there was an unprecedented wave of consolidation in the petroleum industry. In the space of a few months Gulf was acquired by Chevron, Superior by Mobil, and Getty by Texaco. The large publicized mergers were accompanied by a host of smaller acquisitions and a widescale restructuring of assets.

The consolidations were driven by the flight of equity capital from the industry. In the early 1980s oil-company executives commonly believed that oil prices would continue to rise. Many outside investors disagreed with this outlook, however. Oil-company stock prices were bid down, often below the book value of the company. Companies rich in crude-oil and gas reserves had a robust cash flow, but their outlays for in finding new resources met with limited success and thus were perceived by many as imprudent capital expenditures. In short, the billions of dollars being poured into oil and gas exploration had only a meager return compared to investments in microchips and communications media.

Declining oil stock values created an opportunity for T. Boone Pickens and other corporate raiders. If the takeover target could be purchased, its management fired, and its assets divested the break-up value of the company often exceeded its cumulative stock value. Even the threat of such action was sufficient to drive the targeted company's stock prices up, creating staggering profits for the raider.

The pressure placed on Gulf, Getty, Superior, and many smaller companies created an opportunity for other, financially stronger, oil companies to acquire their assets. Specifically, crude-oil and gas reserves could be purchased for one-half to one-third the cost of finding and developing new deposits. The outright purchase of a company the size of Gulf or Getty could not, however, be achieved without heavy borrowing.

The motives to acquire oil and gas reserves were more complex than the relative economics of finding and buying hydrocarbon reserves. The period of discontinuity in the oil market coincided with the termination of federal oil allocation and price controls and the the liberalization of anti-trust laws.

In 1971, President Nixon included the petroleum industry in his Price Stabilization Program, despite concerns about accelerating oil demand growth and diminishing domestic supplies. Regulation ramified under the Emergency Petroleum Allocation Act of 1973 (EPAA). The oil industry was the only industry to remain under price controls for a decade. While President Carter began dismantling this system in 1979, it was only under President Reagan in 1981 that price controls were fully eliminated.

During that interval it was practically inconceivable that the Justice Department, the Federal Trade Commission (FTC), the Congress, or indeed, the public would have tolerated mergers involving the Seven Sisters, or any other deliberate change in the industry structure initiated by major oil companies. It should not be surprising that an end to such regulation would be followed by a major restructuring of the ownership of petroleum assets, as the industry adjusted to new circumstances.

Federal policy in the early 1970s changed so abruptly and with such effectiveness that it dramatically reversed the fortunes of the major oil companies in the United States, and even curtailed their world-wide operations. Congress viewed the 1973 Allocation Act mainly as a response to the Arab oil embargo and the shortage of petroleum products, particularly heating oil in New England. The Act was preceded and followed by legislative and policy changes from a Congress that was consistently hostile to the oil industry, and an Administration that was uncomfortable if it appeared to be sensitive to industry concerns.

### Waning Oil and Gas Reserves

In the same decade in which the major U.S. oil companies saw their domestic political and economic influence wane, Saudi Arabia and other oil exporting countries discovered that they had extraordinary power over the pricing and availability of crude oil. The shift in power from the Majors with their world-wide interests in producing, manufacturing and marketing of petroleum products to the oil exporting countries, who had much narrower and more political concerns was not an easy transition.

Encouraged by the success of the Libyan price negotiations in 1971, the Arab oil embargo of 1973, and the preservation of the new OPEC-dominated price structure during the recession of 1975, Third World oil-exporting nations have taken control of crude-oil production from the companies that discovered and developed them, and lodged this control in their own national oil companies or ministries. Even Saudi Arabia has succumbed to the temptation, not only purchasing shares of ARAMCO, but establishing its own crude-oil trading company, NORBEC.

On the domestic front, in 1975, the eight companies with the largest holdings of crude-oil reserves controlled 55.6 percent of the U.S. total. By 1982, the top eight held only 44.5 percent.<sup>1</sup> Part of the reduction in the major oil companies' reserve base was due to a general decline in crude-oil reserves. During the period 1975 to 1982, U.S. reserves declined one-tenth, from 39 to 35 billion barrels. Only Mobil's history closely reflected the national trend. The remaining companies depleted their reserves and failed to find or acquire new crude oil at anything like the rate they were depleting it. Texaco's crude-oil reserves dropped more than any company, by 63 percent in just seven years. The company fell from the second to the sixth largest crude-oil producer during that period.

### Forces for Integration in the Oil Industry

When the regulatory environment relaxed abruptly in January 1981, most major oil companies had lost much of their crude-oil base. They were becoming refiners and distributors rather than integrated oil companies. As the trend had become apparent in the late 1970s, the Majors stepped up exploration and sought to acquire crude-oil reserves from smaller companies.

The major oil companies believe that a fully integrated structure, with crude-oil production capacity approximately matching refinery capacity and marketing outlets, is the most viable form of organization in the long-run. In the last decade, however, federal policy and exploration disappointments have not allowed the Majors to realign themselves in order to bring their raw materials, processing and marketing capabilities into balance.

Each of three big mergers in 1983 and 1984 followed the same pattern. A major oil company with a strong financial base has acquired another large company primarily for its oil and gas reserves. The FTC reviewed the merger and approval was made contingent on divestiture of assets which, if retained, could give the acquiring company excessive market power in a particular region.

It is important to note that since 1981 most petroleum companies have been making significant adjustments in their assets. Most of the changes have not been publicized, because they involve only items of local interest such as closing or selling refineries and service stations. Since the bulk of the federal regulatory programs have been terminated, there has been a major reshuffling of assets across a wide variety of petroleum companies.

The Texaco, Chevron and Mobil acquisitions gave these companies a chance to restructure and realign their firms in order to improve the efficiency of their operations. In the choice of companies purchased and in the scope of divestiture that followed, the pattern is the same. No one has sought to extend a horizontal monopoly or significantly increased concentration in one sector. For example, Chevron, which already accounted for 8.6 percent of domestic refinery runs, did not seek to buy a refiner or to keep all of Gulf's refinery capacity. Instead, it is retaining Gulf's crude-oil production and those other assets that do not duplicate its own. Chevron, Texaco and Mobil are seeking to obtain better balance between their crude-oil production, refining and marketing sectors. They are seeking to strengthen themselves as integrated companies.

The absence of price and allocation controls today, the crude-oil price collapse intensified competition between fuels, and lower gasoline prices have made it easy for people to forget federal energy policies of the 1970s and the political spirit that infused them. Few remember that, on October 8, 1975, an amendment to yet another endless progression of natural-gas deregulation bills found 45 Senators supporting a breakup of the eighteen largest oil companies.<sup>2</sup> Had the bill passed and been signed into law, large-scale integrated oil operations in the U.S. would have been effectively eliminated.

Vertical dis-integration, that is, the separation of companies into individual producing, refining and distribution entities, never again got as close as the 1975 Senate vote. Nonetheless, from the beginning of price controls in 1971 to the end of most petroleum regulation in 1981, federal policies achieved much of the effect of divestiture, intended or not.

#### Impact of Federal Regulations in 1970s

It was the conscious choice of public policy during the era of regulation to reduce the influence and importance of the major oil companies. In the international arena, the companies that had once dominated the political and economic fortunes of the oil-exporting countries lost their influence and ability to control events. In the United States, the Majors simply depleted their oil and gas reserves, increasing their reliance on OPEC's oil. The Majors behaved this way because price controls, allocation regulations, leasing policies and tax treatment made it unprofitable to act any other way. What was the point of investing billions of dollars to acquire crude-oil reserves if allocation regulations would force you to sell the oil to another refiner?

The regulation of this era was indescribably complex, and the intended and unintended effects of the regulatory package often conflicted violently. Even if there was not a consistency of specific intent there was one of general effect, however, and it is now possible to make a few generalizations about what happened, as one highlights the most significant federal decisions. A majority of Congress never supported divestiture, but a majority clearly were suspicious of the activities and power of the major oil companies and this suspicion was sufficient to tie the industry into a complicated array of regulations and impediments.

The petroleum industry was far more fragmented in 1981 than it was in 1971. Despite the fact that petroleum consumption had increased by 47 percent, the top eight oil companies' refinery capacity had slid from 58 percent of the total in 1970 to 49 percent in 1980, while their natural gas production had dropped from 39 percent of the U.S. total to 30 percent.<sup>3</sup> The share of domestic crude-oil production accounted for by the top eight fell only from 42 to 41 percent. This stability is short-lived, however as it reflects the dominance of the top three producers (Sohio, Exxon, and Arco) in the Prudhoe Bay field, where production will begin to decline steeply within three years. Without Prudhoe Bay, Sohio (now Standard) would not be in the top twenty producers, and the output of Arco and Exxon would have fallen almost as steeply as Texaco's. In 1981 there was not a single sector of the petroleum industry more concentrated than it had been in 1971, and in many sectors ownership had been significantly fragmented.

Congress threatened dismemberment, but did not carry through. The regulatory schemes and tax changes brought about by zealous legislators and administrators nevertheless produced much of the same impact. The regulations of the 1970s had two profound effects on the major oil companies. First, these measures were often designed to protect or subsidize the non-integrated, independent sectors.

The sudden elimination of the Mandatory Oil Import Program and its subsidy in 1972 hurt many small refiners; substitute programs had to be found. The substitute programs were, however, of unprecedented scope and effect, and favored some types of firms or particular companies over others, but with no consistent or rational pattern. Second, the allocation program by design and practice froze supply and distribution relationships. Depletion and geological chance might change crude-oil production and reserve ownership, but very little else could affect the destination of crude oil from established reserves. A quick resume of the key federal policies that diminished the importance of the major companies and limited their flexibility are the following:

- \* **"Special Rule No. 1"**, published by the Cost of Living Council under President Nixon in March 1973. This "technical adjustment", had more influence than any other administrative or legislative decision over the decade of regulation that followed. While even the Nixon-era price controls were "voluntary" for other industries, this rule imposed strict mandatory controls on 24 firms with annual sales of crude-oil and petroleum products of \$225 million or more. It left smaller firms free to bid up the price or take advantage of the regulatory situation.
- \* **The Emergency Petroleum Allocation Act (EPAA)** of November 1973. The initial push for an allocation law arose in early 1973 from small refiners and petroleum-product marketers in the Midwest suffering from spot shortages created, ironically, by the Special Rule No. 1 and changes in oil-import regulation. As passed by Congress in the Fall, however, the Act was intended largely as a stop-gap measure to deal with the Arab oil embargo; instead it was combined with the President's price control authority under the Price Stabilization Act of 1971 to construct the most Byzantine set of price and supply-allocation regulations ever developed for any industry in the United States. The Act was originally scheduled to expire in 1975, but instead was elaborated and extended with the Energy Policy and Conservation Act (EPCA) of December 1975.
- \* **The "entitlements" or crude-oil price-equalization scheme** under federal price controls. This scheme, implemented under authority of the EPAA, was intended to equalize crude-oil costs so that all refiners could compete on an equal basis, regardless of the mix of imported oil and price-controlled domestic oil in their feedstock supplies. As the program evolved, it was used to subsidize crude-oil and petroleum-product imports and the operation of small refiners who did not have to buy the same proportion of entitlements as large refiners and therefore had a cost advantage if they could acquire price-controlled crude oil. Many such refiners were able to take advantage of the program because allocation locked them into historic supply arrangements.
- \* **The "buy-sell" program under the EPAA.** This program allowed federal regulators to depart from historical sales patterns in the allocation of crude-oil, in order to meet other federal priorities and needs. When combined with the entitlements benefits described above, it granted some small refiners subsidies of several dollars per barrel.

\* **The elimination of the percentage depletion option for large oil companies.** In the 1970s, Congress first reduced the rate of percentage depletion, later eliminating it altogether for large oil companies and further reducing its benefits for independents. The allowance had been an effective subsidy for oil exploration and production by large and small oil companies alike. With percentage depletion, companies had an incentive to shift profits from downstream refining and marketing to crude-oil production and thus provided an incentive for refiners to integrate into crude-oil production. Following the allowance's elimination, refiners had a reduced incentive to acquire crude-oil reserves.

### Special Rule No. 1

Without developing an extensive analysis of the effect of a decade of regulation, it is worth taking a somewhat deeper look at Special Rule No. 1 and its effect on the federal allocation program, and at the Senate vote on divestiture that was to follow two years later. The Rule was a critical influence on subsequent events, although its significance was not recognized in 1973. It was critical both because it had substantial side-effects that were not understood and because it went much further than previous policies to single out favorable treatment for one group of companies at the expense of another. That unsavory aspect of federal policy was to haunt decision-making for a full decade.

According to its official history, the Cost of Living Council (CLC) devised Special Rule No. 1 because "the more flexible pricing standards of Phase III were not strict enough to control the hard-core inflation emerging in oil."<sup>4</sup> The CLC chose to control only the largest 24 companies, because in the council's view an environment of price predictability and certainty was required if the industry was to make the necessary investment in new crude-oil production and refining capacity.<sup>5</sup> Smaller oil companies were not closely controlled because the industry also needed price and supply flexibility to prevent product shortages. Special Rule No. 1 failed to control petroleum prices, but much worse, it created the need for allocation.

Because the 24 largest oil companies accounted for 95 percent of the industry's sales, the CLC believed that if those companies were controlled, inflation in oil prices could be contained. "The fallacy in the Phase III premise was the belief that the 24 largest companies actually controlled industry pricing."<sup>6</sup> The most immediate problem in trying to implement Special Rule No. 1 was crude-oil and product exchanges that interwove the largest and smallest oil firms. Price-controlled firms bought and sold extensively from uncontrolled firms. It did not take very long for arbitrage by companies free to buy and sell to drive all oil prices up. In attempting to comply with federal regulation and to prevent being taken advantage of, the major oil companies began adjusting their exchange and trading relationships.

The timing of this action could not have been worse. In 1972, crude-oil production in Texas and Louisiana finally reached 100 percent of capacity, after about three decades of excess producing capability. This development effectively brought to an end the era of "market-demand prorationing", by which regulators in the two states had guaranteed an adequate supply of crude oil to any refiner tendering a "nomination", at the same time they guaranteed every producer a share of the market.

Almost simultaneously, in the wake of the 1971 Teheran agreement between the major oil companies and OPEC, imported crude-oil prices for the first time began to exceed domestic prices. This shift eliminated the market value previously contained in import "tickets" (negotiable import licenses) distributed to all refiners under the Mandatory Oil Import Program (MOIP). The system not only subsidized small refiners, who received a greater than proportional share of tickets, but it provided the means by which landlocked independent refiners induced the Majors (who had both foreign supplies and tidewater refineries) to sell them domestic crude oil.

The confluence of events had radical and unanticipated impacts on the market. The middlemen and customers who found their historic supply relationships broken created the political base that demanded the EPAA. On May 25, 1973 the Senate Interior subcommittee had a one day hearing in Sioux Falls, South Dakota.<sup>7</sup> The complaints of independent oil dealers, farmers and the like outraged South Dakota's Senator Abourezk to the point he made a personal commitment to break up Big Oil. His early bills went nowhere until he was joined by freshman Senator Gary Hart, who declared himself a "radical free-enterpriser", proposing an end to price controls on oil and gas, coupled with limits on corporate acquisitions by oil companies, and their oil-divestiture of existing transportation, distribution, and retailing operations. The two sponsored the amendment in 1975 that would have dismembered the integrated companies. But it was really the unintended side-effects of President Nixon's price stabilization program that almost undid the American oil industry.

### Federal Anti-Trust Policy

In January 1981, President Reagan decontrolled oil prices and eliminated allocation --- a process begun by the Carter Administration in late 1979. It took three years, however, before any significant mergers were completed. There were at least four important reasons for this delay.

First, despite changes in the Administration and shifting concerns in Congress, any proposed merger may be challenged in a private anti-trust action by companies that assert it will result in anti-competitive behavior. The proposed Mobil/Marathon merger was successfully challenged in 1982. Second, the economic climate for the petroleum industry changed severely from on, as oil prices went down and many sectors of the industry slipped into red ink. The resulting reduction in stock prices made it financially more feasible to acquire a large company. Third, the FTC and Department of Justice still seemed willing until mid-1982 to challenge any large merger as they had done when Gulf tried to acquire Cities Service.

The Department of Justice issued new guidelines in June 1982, however, which were not really tested until the Texaco acquisition of Getty. Finally, in September 1982 the FTC published an extensive study, *Mergers in the Petroleum Industry*, which made federal policy clearer. The study made the new merger guideline operational for oil companies; it identified the relevant petroleum products and the degree of concentration in specific regional markets. This analysis made it possible to evaluate the degree of overlap between two companies considering a merger and the effect of the overlap on markets about which federal authorities were concerned.

In the Department of Justice's new merger guidelines, attention has tended to focus on the choice by the Department of the Herfindahl-Hirschman Index (HHI) for evaluating market concentration. Unlike the four-and eight-firm market-share ratios that had been the most fashionable indices of concentration for more than forty years, the HHI reflects both the market shares of the largest firms and the composition of the market outside the largest firms.<sup>8</sup> Even more important than the shift the use of HHI to measure market concentration was the operational guidance developed to identify relevant product and regional markets.

Once the concept is grasped the HHI is simple to use. The percentage market share of each firm is calculated and then squared. The resulting figures are summed. In the case of a market with a single firm, a monopoly, the result would be the square of 100, or 10,000 --- the highest possible HHI. In a market with eight firms of equal size the HHI would be 1,250 (12.5 squared times 8).

The use of the HHI, rather than four or eight firm concentration ratios, finds industries that contain four to eight firms of approximately equal size to be much less concentrated than industries dominated by one or two firms. For example, the HHI for the oil industry is quite low in contrast to the auto industry, where there are only three significant domestic firms and General Motors' market share hovers at around 50 percent. Thus, on the basis of the federal guidelines, the FTC approved (with some modification) mergers in the oil industry, but initially turned down the Republic/LTV steel industry merger. After considering the general condition of the steel industry as well as the high level of competition in the international steel market, the FTC concluded that strictly domestic measures of market share were not appropriate in the LTV/Republic case.

The new merger guidelines are quite explicit about the use of the HHI in determining the impact on competition of a proposed merger. If, following the merger, the HHI is below 1000 federal anti-trust authorities are unlikely to challenge it.<sup>9</sup> If the HHI falls between 1,000 and 1,800 the merger may be challenged and if it is more than 1,800 the government is almost certain to challenge it.<sup>10</sup> The federal policy also considers other things such as ease of entry, the dominance of one firm, the nature of the product, the availability of information about market transactions and the historic conduct and market performance of the industry.

Despite the pitfalls of relying exclusively on either the HHI or other measures of market concentration, the Department of Justice guidelines are an important advance in federal merger policy. Firms considering a merger or acquisition now have much more precise guidelines than in the past. The guidelines have reduced uncertainty, particularly for proposed mergers in which there are no significant market concentration.

In an industry that is relatively concentrated, such as the steel industry, the high HHI can be moderated by the more qualitative notions of conduct and performance when firms propose to merge. On the other hand, it is hard to make qualitative arguments to prevent a merger when market shares are low and the HHI is below 1,000. Those who have opposed the mergers in the petroleum industry have relied on qualitative and sometimes emotional arguments. These have not proved to be particularly convincing given the detailed and objective standards set by the new federal merger guidelines. As a result, there are likely to be further oil-company mergers if they make economic sense.

Despite the complexity of the quantitative measures of market concentration, the new guidelines are an advancement and helpful to all industries, not just the petroleum industry. Domestic market concentration, even when the international market is highly competitive, is relevant. The U.S. steel industry may feel pressure now, but that can change and the costs of divestiture in the future to meet the new circumstances could be high.

Officials from the FTC and Justice Department have said that the three oil industry mergers in 1984 could also have been approved under the old merger guidelines, which used four and eight firm market shares.<sup>11</sup> These traditional measures of market concentration will undoubtedly continue to carry weight with some courts and are therefore still relevant. Ultimately, the most important development in federal merger policy may lie rather with the expertise developed at the FTC and Justice Department, which allows them to deal with each merger selectively.

In general, those who opposed the acquisitions by Texaco, Chevron and Gulf did so because they argued that it would result in fewer firms, a less competitive industry and higher prices for the consumer. Fewer firms do not, however, necessarily result in higher prices or even in a reduction of competition. The relationship between the number and size of firms depends on economies of scale, the geographic scope of the market, and other aspects of industrial structure. All things equal, there are likely to be fewer oil companies in the near future for the simple reason that petroleum demand has shrunk one-fifth since its peak in 1978. In any declining industry there is bound to be consolidation and reorganization and, in general, competition tends to weed out the least efficient facilities and firms. Freezing corporate and market structures will not halt such a shrinkage (more likely, it will aggravate it), but just keeps the inevitable disinvestment from being translated into lower costs for consumers and other members of the public.

The oil industry, like any other, should be allowed to adjust to new circumstances. But, what about Texaco, Chevron and Mobil; did they make good choices? Will they be the surviving firms or will it be those that have stood on the sidelines and resisted the temptation to acquire other companies?

The first principle of rational trade is to buy cheap and sell dear. The companies who announced major merger plans thought they were acquiring crude-oil and natural-gas reserves at half the cost of acquiring similar reserves through exploration and development. But exploration is financed out of current income and these purchases were made on borrowed money. With interest rates up and oil prices down, the investments do not look so good. All three firms, in any scenario, will probably survive, but perhaps not profitably or fully intact. If crude-oil prices decline further these companies may be forced to divest themselves of the very assets they sought to acquire. They might have bought dear and have to sell cheap.

Mergers, divestitures and change in the petroleum industry will continue, as they should. Part of the natural process of a competitive industry is responding efficiently to changes in its economic environment.

#### Footnotes

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## ON THE VALUE OF INFORMATION FOR ACID RAIN POLICY MODELING

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### INTRODUCTION

Acidic deposition has been of considerable concern in recent times. A recent study by the National Research Council found that the eastern U.S. is subject to far greater rates of deposition of sulphates, nitrates and hydrogen ions than most of the western U.S. [10]. A study by Congress' Office of Technology Assessment estimates that 3000 lakes east of the Mississippi have suffered chemical or biological change because of acidic deposition [9]. While there has not been conclusive evidence on this controversial issue, much of the air pollution is supposed to be caused by coal-using power plants and industries in the Mid West [15].

Concern over environmental effects of acid precipitation has led to major research efforts in Sweden, Norway, U.S., and Canada. There has been considerable work in many institutions on analyzing the multiple problems caused by acid rain. For example, USEPA has invested in a 10-year multi-million dollar NAPAP program. The focus of all of these studies is to obtain better information on the impacts so that the "correct" policies can be formulated. It is not clear that better and more refined quantitative information on the changes in receptor characteristics due to acid rain would lead to different policies than the ones recommended at present. Thus the expenditure of vast amounts of resources to narrow the uncertainty of information may not be justified. This is the issue that we address in this paper: what is the value of additional information for acid rain policy implementation.

### ON THE VALUE OF INFORMATION

The basic principle adopted in this paper is that information has marginal value only if it changes policies recommended prior to obtaining this information. In order to estimate the value of information, we proceed as follows: First we establish preferences among selected acid rain policies for the different states in the U. S. We call this the "Base Case." Then we vary the input information, primarily results on the impact of acid rain on multiple receptors, from worst to best cases, and establish the new policy

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\* All empirical results reported in this paper are based on an earlier paper by Anandalingam [1], and on the B. S. thesis of Cardwell [3]. The reader is referred to these publications (which are available upon request) for details.