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Findings and Views Concerning the Exemption of Kerojet Fuels from the Mandatory Petroleum Allocation and Price Regulations

June 1978 (Statistically Updated to December 1978)

U.S. Department of Energy
Economic Regulatory Administration
Office of Regulations and Emergency Planning

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Office of Regulations and Emergency Planning
Washington, D.C. 20561

FOREWORD

This report represents the Economic Regulatory Administration's current Findings and Views regarding the exemption of kerosene-base jet fuel from ERA's Allocation and Price Regulations. In June 1978, we issued an earlier version of these Findings and Views for public comment. This updated version now contains statistical information available through January 15, 1979. The supply/demand forecast contained in Chapter IV now includes projections for 1980. Having evaluated the comments received and the more recent figures, we have changed neither our conclusions nor the substance of the analysis upon which they are based. Accordingly, the text of this document is quite similar to the June 1978 report.

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EXECUTIVE SUMMARY

- To exempt kerosene-base jet fuel (kerojet) from the Mandatory Petroleum Allocation Regulations, the Department of Energy (DOE) must find "... that such oil or refined product category is no longer in short supply and that exempting such oil or refined product category would not have an adverse impact on the supply of any other oil or refined product..." [Section 12(d)(1)(A) of the Emergency Petroleum Allocation Act of 1973 (EPAA), as amended]. Currently kerojet represents approximately 4.5 percent of the total demand for all petroleum products. DOE concludes that domestic refinery capacity together with available imports are sufficient to meet projected increases in demand through the year 1980. Exemption may, in fact, stimulate production and supply.
- To exempt kerojet from the Mandatory Petroleum Price Regulations, the DOE must also find "... that competition and market forces are adequate to protect consumers and that exempting such oil or refined product category will not result in inequitable prices for any class of users of such oil or product..." [Section 12(d)(1)(B) of the EPAA]. With current adequate supplies of kerojet, DOE finds that currently kerojet prices are experiencing only slight upward pressures. Competition and market forces are therefore currently adequate to protect consumers and supplies are estimated to be sufficient in

the future to prevent inequitable prices for any class of consumer as a result of exempting kerojet from regulation.

- The DOE further finds that the exemption of kerojet is consistent with the attainment of the objectives set forth in the EPAA.
- The DOE further finds that the exemption of kerojet from regulation will not significantly affect the rate of unemployment, Consumer Price Index, or the Gross National Product (GNP).
- Continuation of kerojet regulations designed for an embargo situation has not appeared to be necessary to achieve the objectives of the EPAA. The Economic Regulatory Administration (ERA) referred a proposed kerojet exemption to the Federal Energy Regulatory Commission (FERC) under Sections 402(c)(1) and 404 of the Department of Energy Organization Act, Pub. L. 95-91 (DOE Act). After receiving public comment, the FERC concurred with ERA's proposal. The DOE is now submitting to the Congress, in accordance with the requirements of Section 12 of the EPAA, Section 551 of the Energy Policy and Conservation Act (EPCA), and Section 102 of the Energy Conservation and Production Act (ECPA), the exemption of kerojet from the Mandatory Petroleum Allocation and Price Regulations.

CHAPTER I

INTRODUCTION

This report presents the DOE's findings and views with respect to the exemption of kerosene-base jet fuel (kerojet) from the Mandatory Petroleum Allocation and Price Regulations (10 CFR, Parts 210, 211, and 212) issued pursuant to the Emergency Petroleum Allocation Act of 1973 (EPAA), Public Law 93-159 (November 27, 1973), as amended. Section 455 of the Energy Policy and Conservation Act (EPCA), Public Law 94-163 (December 22, 1975), added Section 12 to the EPAA, which requires that any amendment submitted to the Congress for the purpose of exempting a petroleum product or refined product category from regulation be supported with certain findings and DOE views on a variety of matters related to the exemption. Section 102 of the Energy Conservation and Production Act (ECPA), Public Law 94-385, requires separate submissions to the Congress of energy actions exempting a refined product category from both price and allocation provisions of DOE regulations, but it does permit the DOE to submit concurrently separate energy actions proposing price and allocation exemptions.

Based on an analysis of historic and projected supply, demand, and price trends, the DOE has concluded that allocation and price controls are no longer necessary for kerojet fuel and that exemption of kerojet fuel will be consistent

with the attainment, to the maximum extent practicable, of the objectives specified in Section 4 (b)(1) of the EPAA. The DOE is submitting concurrently to the Congress, in accordance with the provisions of Section 12 of the EPAA, Section 551 of the EPCA, and Section 102 of the ECPA, two energy actions to exempt kerojet from allocation and price controls. The exemption will become effective upon the date specified in the amendment and the regulations will be converted to standby status. Inasmuch as DOE is submitting concurrent energy actions exempting kerojet from both price and allocation regulations, this report considers the impact of both exemptions.

The DOE's findings regarding the exemption of kerojet from regulation are as follows:

- o Kerojet is not in short supply.
- o Exemption of kerojet from the allocation and price regulations will not have an adverse impact on the supply of any other oil or refined petroleum product subject to the EPAA.
- o Competition and market forces are adequate to protect consumers following exemption of kerojet from regulation.

- o Exemption of kerojet from regulation will not result in inequitable prices for any class of user of kerojet or other products.

The DOE also believes that an exemption of kerojet from price and allocation regulations is consistent with the objectives set forth in Section 4(b)(1) of the EPAA. Since supplies of kerojet are adequate, and should continue to be sufficient, continued mandatory price and allocation controls for kerojet are unnecessary to:

- o protect public health, safety, welfare, and national defense [Section 4(b)(1)(A)];
- o maintain all public services [Section 4(b)(1)(B)] and agricultural operations [Section 4(b)(1)(C)];
- o maintain exploration for and production or extraction of fuels and minerals [Section 4(b)(1)(G)];
and
- o insure equitable distribution of crude oil, residual fuel oil, and refined petroleum products at equitable prices [Section 4(b)(1)(F)].

Because the regulations issued pursuant to the EPAA are designed to deal primarily with shortage conditions, an exemption is required to facilitate the attainment of the following EPAA objectives in the current period of adequate supplies:

- o preservation of an economically sound and competitive petroleum industry [Section 4(b)(1)(D)].
- o economic efficiency [Section 4(b)(1)(H)]; and
- o minimization of economic distortions, inflexibility, and interference with market mechanisms [Section 4(b)(1)(I)].

Further, an exemption should not have an adverse effect on allocating suitable crude oil to U.S. refineries [Section 4(b)(1)(E)], maintaining energy production, or providing for maximum use of refinery capacities.

DOE further finds that the exemption of kerojet from regulation will not have an adverse effect on:

- o any state or region of the country
- o availability of consumer goods and services
- o the Gross National Product (GNP)
- o competition
- o small business
- o the supply and availability of energy resources for use as fuel or feedstock for industry
- o the Consumer Price Index, consumer prices, or the implicit price deflator for the GNP, and
- o the rate of unemployment.

Chapter II provides background information on the use, production, and distribution of kerojet. Chapter III analyzes the historical interaction of supply, demand, and

price, and explores the market structure for kerojet during 1968-1978, prior to and during imposition of allocation and price controls. Chapter IV considers future demand, supply, price, and market structure conditions, examines the effect of exempting kerojet from controls, and indicates the benefits to be derived from such exemption. In Chapter V, the potential economic impacts of exemption are evaluated. Chapter VI provides a final summary of the DOE's findings and views in support of its judgment that kerojet should be exempted from the Mandatory Petroleum Allocation and Price Regulations.

CHAPTER II

BACKGROUND

This chapter provides background information regarding the characteristics, uses, production and distribution of kerojet fuel. Kerojet fuel has the technical properties of products in the middle distillates range. However, because of the distinctive nature of its usage, it has always been treated as a separate product under DOE price and allocation programs, and it therefore was not included among the products covered by the deregulation of the middle distillate category.

PRODUCT DESCRIPTION

Aviation turbine fuel (kerosene-type) is defined in 10 CFR 212.31 as "a relatively low freezing point distillate of the kerosene type and includes all kerosene products with an average gravity of 40.7^o API and 10 percent to 90 percent distillation temperatures of 390^o F. to 470^o F. covered by ASTM D-1655 and ASTM ES-2-74 specifications, and including JP-5 and other fuels meeting military specifications (MIL-T-5624G Amend. 1)," and in 10 CFR 211.142, "Aviation Turbine Fuel" (kerosene-base) means "all refined petroleum fuel designed to operate aircraft turbine engines. The basic specification is ASTM D-1655...."

Currently there are three civilian jet fuel designations: Jet A, Jet A-1, and Jet B. Jet A and Jet A-1 are kerosene base and employed primarily by domestic and international

airlines. JP-4, a naphtha-base fuel used primarily by the military, and its non-military equivalent, Jet B, were exempted from the Mandatory Petroleum Allocation and Price Regulations on October 1, 1976, and need not be considered in this report.

Of the eight different categories of jet propulsion fuels designated by the Department of Defense (DOD), JP-1 through JP-8, this report principally concerns JP-5, but also includes JP-6, JP-7, and JP-8, all kerosene-base fuels. JP-6 and JP-7 are largely experimental; JP-8, also experimental, may come into widespread use, but not before the end of 1980. Among the other fuels, JP-1 through JP-3 are obsolete.

Kerosene jet fuels have negligible Reid vapor pressures. Specifications call for flash points above 105 F. (41 C). In contrast, naphtha jet fuel freezes at a lower range of temperatures, is more volatile than kerosene jet fuel, and generates a potentially explosive vapor. Other minor differences among turbine engine fuels are attributable to additives which retard bacteriological growth (biocidal), lower the freezing point, or act as anti-corrosives.

PRODUCTION CHARACTERISTICS

Kerojet fuel has a kerosene base which is produced by simple distillation. However, several additional processes are required to produce an aviation quality jet fuel as

specified by ASTM D-1655 or ES-2. These include desulfurization to a maximum weight of 0.3 percent, reduction of the aromatics content to 20-25 percent, caustic washing to reduce lead sulphates, and final cleansing in water wash and clay towers.

These complex additional processes are a reason why kerojet fuel production is dominated by major refiners. Fourteen refiners which produce kerojet fuel are responsible for 97 percent of domestic production.

Kerojet fuel has the same distillation range as many middle distillate products, particularly kerosene, the lighter heating oils and diesel fuels. It is a relatively narrow cut in that only about 10 percent of the barrel may be used to produce kerojet fuels, as compared to some 20 percent for the entire middle distillate range, and 24 percent for naphtha jet fuel.

DEMAND

Kerojet fuel is used primarily (86 percent) by scheduled airlines in turbine engined (jet and turboprop) transport aircraft.

Military use of kerojet fuel amounts to 5.5 percent of the total. Most of this is JP-5 used by the Navy for carrier aircraft. Due to its lower volatility, the Navy prefers it to JP-4 for storage aboard ship.

General aviation use of kerojet fuel equals 5.5 percent of the total. 60 percent of total general aviation fuel consumption is kerojet fuel. The balance, 40 percent, is aviation gasoline. Kerojet use has grown rapidly since 1960 when turboprop and turbojet aircraft were first produced for use in such segments of general aviation as corporate aviation, commuter airlines (not listed in Civil Aeronautics Board (CAB) airline statistics) and public aviation (non-military government aviation). At the end of 1977, there were 6,000 such aircraft using kerojet fuel (1,900 jet, 2,500 turboprop, 1,600 jet helicopter: source Federal Aviation Administration (FAA)) as compared with 2,300 total in 1970. This rapid growth in the number of turbine aircraft has also created a demand for this fuel type at many airports where kerojet fuel was not formerly marketed during "base period" 1972 (as defined in 10 CFR 211.142).

The remaining 3.0 percent of demand for kerojet is from the manufacturers of aircraft and engines and from electric utilities as an alternate fuel. This alternate fuel use has been diminishing since 1972.

Aviation has become the primary means of long-haul and intercity commercial travel, and also of overseas travel. Revenue passenger miles grew from 105 billion in 1960 to 160 billion in 1973,^{1/} and to 223 billion for the twelve

1/ CAB Report to the Congress on "The Content and Feasibility of Proposed Programs for Additional Savings in Energy Consumption by the Air Carriers Regulated by the Board."

months ending July 31, 1978 (CAB data). Much of this growth followed the introduction of subsonic jet transport aircraft in 1958 when 25 billion passenger miles were flown. Revenue passenger miles remained at the same level in 1975 as 1974. In 1976 they increased 10.7 percent and in 1977, 7.4 percent. In the year ending July 31, 1978, airline revenue passenger miles increased 12.7 percent over the like period the previous year.

Thus, adequate air transportation has become not merely a convenience but a vital resource that cannot be given up without major changes in lifestyles, business procedures and productivity in government, industry and private affairs. However, civil air transportation, including general aviation as well as airlines, is energy-intensive, accounting for 4.7 percent of total petroleum energy consumption in 1977.

Kerojet consumption grew from 683 million gallons in 1960 to 12.6 billion in 1977 and increased at a 3.6 percent rate during the first six months of 1978 (BOM data). As another indicator of growth, airlines accounted for 83 percent of intercity passenger miles travelled by public conveyance in 1978, as compared with 75 percent in 1972.^{1/}

A corollary to explosive airline growth has been an atrophy of alternate passenger transportation modes, ground and sea, to the point where the application of all available resources could not equip them to assume a significant portion

^{1/} Air Transport Association (ATA)

of the role now performed by civil aviation without a three to five year lead time.^{1/} Thus, by 1980 very little strengthening of alternate transportation modes is anticipated.

SUPPLY AND PRICE

Throughout the period from 1975 to mid-1978 supplies were adequate to meet demand, except for localized situations caused by distribution deficiencies or by DOE regulations which limited the flexibility with which allocated volumes of fuel could be altered to keep pace with changing demand patterns.

As most active kerojet producers are maximizing yield of kerojet, there is limited flexibility in kerojet production to accommodate distributional deficiencies. As a national average, refineries can devote about 10 percent of their refinery runs to kerojet, but would only be required to produce at a 4.5 percent level to meet demand if all refineries produced kerojet. However, in some regions and for some refiners, kerojet production is at maximum capability.

Kerojet stocks have increased, paralleling slightly increasing demand. In June 1978, stocks were 31,427,000 barrels, a full month's supply.

In the first half of 1978, 8.0 percent of the domestic demand for kerojet was imported. This compares to 20.9 percent of the domestic demand for the full year 1973, 17.5 percent in 1974, 13.2 percent in 1975, 8.3 percent in 1976, and 6.4 percent in 1977.

^{1/} Department of Transportation

Prior to the 1973 oil embargo, kerojet fuel prices paid by airlines averaged 11 cents per gallon. The average October 1978 fuel price for CAB certificated domestic trunk airlines was 38.9 cents per gallon, a 5.8 percent increase over the October 1977 level. The rise to the June 1976 price level of 29.8 cents per gallon was filtered and delayed by fixed price, long-term contracts between airlines and their suppliers. As one or another of these contracts expired, temporary wide differences in prices paid for fuel occurred from one airline to another. Most of these contracts have now expired and have been replaced with a variety of agreements that have shorter durations and typically include price escalation clauses.

Military prices paid by the Defense Fuel Supply Center (DFSC) for JP-5 rose from 10 1/2 cents per gallon prior to the embargo to an average of 39.5 cents per gallon during the third quarter of 1978. This compares to 39.5 cents paid for JP-4 during the same period.

The retail pump prices paid by the various general aviation activities to fixed base operators (FBO) vary widely. For example, when an FEA survey of FBOs was conducted, retail prices in May 1977 varied from about 55 to about 83 cents per gallon. There are many reasons for such variations which have always characterized this market. They include volume of sales, transportation costs, presence or absence of competition, state taxes, local fees, and the amount of service given to fuel purchasers. For these reasons, it is difficult

to determine an average price. In December 1975, FEA granted to FBOs an additional markup of 3 cents per gallon, for a total of 4 cents, to reflect increased non-product costs. As a result of this action, accumulated cost pressures were relieved.

The subsonic jet transport aircraft was conceived and designed for a fuel cost of 9 cents per gallon (DFSC Report to FEA 1976). It took one gallon of fuel to move four tons of carrying capacity in the aircraft a distance of one mile. This compares with 3.3 tons for older, propellor aircraft and about 6 tons for the newer aircraft now in service (DC-9-50, 727-200 and "wide body jets") applying current fuel conservation procedures. Fuel amounted to 19.8 percent of airlines total cash operating expenses during first half of 1978. Labor costs, which represent 41.2 percent of total operating expenses, also rose significantly.

As costs have increased, domestic air fares have risen. During the 5 year period ending July 1977, domestic air fares rose 32.6 percent. The resulting reduction in Revenue Ton Mile (RTM) demand contributed in 1974 to a drop in demand for kerojet fuel below the 1973 level. Fuel demand was also reduced by energy saving procedures. 1975 and 1976 fuel demands were on a level slightly above 1974, but still below 1973. Thus, rising ticket prices during this period did not constrain RTM demand. During the past two years a major

program of promotional and reduced ticket prices has been the primary cause of RTM demand increase estimated by ATA at nearly 30 percent.

When jet aircraft were introduced into airline service in October 1958, little use was made of kerojet fuel by the military, which had switched to naphtha-base JP-4 in 1952, and there was insufficient demand for alternate use products such as diesel fuel, fuel oil, and kerosene to deplete the supply. Therefore, kerojet was priced to the airlines on an incremental barrel basis, as surplus product. By 1965 demand had increased to the point where efforts were made to price it more nearly on an alternate product value basis. Full impact was delayed by the existence of long-term contracts between refiners and airlines. However, between 1967 and 1972, the airline kerojet fuel price increased 13.4 percent (source ATA). In 1973, prior to the embargo, airline kerojet prices went up another 8 percent (source DFSC), but were still 12 percent below the price of kerosene (source National Petroleum News Factbook). Thus, kerojet fuel was not priced at its alternate product value and was under pressure for price increases at the time of the Arab Oil Embargo. These price increases had not been realized due to long-term contracts between suppliers and airlines.

Effective January 15, 1974, FEA mandatory price regulations froze prices at the May 15, 1973, level, a time when kerojet prices were below alternate product value.

In addition to pricing, the availability of supply is also affected by the fact that kerojet fuel is a "narrow cut" of the crude oil barrel and by the limited number of suppliers.

Some refiners having access to the most appropriate quality of crude oil can refine as much as 14 percent of the barrel into kerojet fuel. A higher level can be maintained for short periods using sophisticated and costly secondary operations that would result in the loss of more than one gallon of some other product (gasoline in summer, heating and residual oil in winter) for each additional gallon of kerojet fuel. This level of 13-14 percent yield involves hydroforming which adds to cost.

For all producers of kerojet fuel, the maximum sustained level of kerojet production without hydroforming and without catalytic reforming is in the vicinity of 10 percent of the barrel of crude oil. However, since many refiners produce no kerojet, and some are presently turning more than 10 percent of their crude barrel into kerojet, there is limited flexibility, particularly in some geographic areas, to increase supply quickly to meet any rapid change in demand. Over an extended period, increases in demand could be accommodated either by the entry of additional refiners into the kerojet market or by an increase in overall refinery capacity by the current kerojet suppliers, or both.

As a result of the foregoing, temporary spot shortages of kerojet have been experienced during the past two years.

and can probably be anticipated during the short-term future. The existence of controls creates rigid relationships which aggravate this condition whereas an unimpeded market would allow the industry supply flexibility to cope with such spot shortages. However, there is no overall shortage of supply.

DISTRIBUTION

Eighty-six percent of kerojet fuel is marketed to commercial airlines by refiners, principally large integrated refiners, and its marketing is characterized by multiple point contracts involving deliveries by one supplier to several airports. Distribution is accomplished mainly by transport trucks and by pipelines (which go directly into major airports).

All of the fuel used by the U.S. Armed Forces is procured by the Defense Fuel Supply Center. Many of the military procurement contracts call for fuel to be delivered directly from the refinery to specific military installations. The remaining military contracts are "single point" (or point of origin) contracts requiring little or no activity by the refiner beyond the refinery gate. The contracts allow for delivery of the product at the refinery with DFSC arranging transportation to the point of use. The major portion of

DFSC distribution is accomplished by transport trucks. The rest is delivered by railroad tank cars, river barges, coastal tankers, and ocean-going barges.

With respect to general aviation, kerojet fuel is delivered to FBOs by refiners, usually in trucks. FBOs are aviation fuel retailers. Thus, delivery is made to a large number of airports, most of which sell relatively small volumes. Nearly all FBOs are branded and independent. They store fuel in tanks that may be owned by them, or the refiner, or a combination. Although they sometimes use fixed pumps to deliver fuel to the consumer, trucks are usually used. In either case, these may be owned by the FBO, or the refiner, or a combination.

In January 1978, large integrated refiners supplied 91 percent of kerojet fuel, large independents supplied 6 percent, and small refiners provided 3 percent. At the same time, four refiners produced two-thirds of all kerojet, while twelve refiners produced 91 percent. Independent distributors, resellers, and retailers play a very minor role in kerojet marketing.

CHAPTER III

HISTORICAL CONDITIONS (1968-1978)

INTRODUCTION

The historical interaction of supply, demand, and price of kerojet fuel, and the market structure of the petroleum industry are examined in this chapter in order to address the findings required by the EPAA. The following questions will be resolved:

- o Is kerojet fuel in adequate supply?
- o Will exemption of kerojet fuel from regulation result in shortages of other refined products?
- o Are competition and market forces adequate to protect consumers following an exemption of kerojet fuel?
- o Will exemption result in inequitable prices for any class of user?
- o Is the exemption of kerojet fuel consistent with attainment of the objectives of the EPAA?

This chapter provides an overview of the period 1968 through 1978 and a perspective for assessing the effects of exempting kerojet fuel from the Mandatory Petroleum Allocation and Price Regulations.

Chronology of Allocation and Price Controls

Allocation and price controls on petroleum products (including kerojet fuel) have been imposed at various times over the past several years beginning with the series of price controls established under the Economic Stabilization Program. The principal allocation and price controls involved, for purposes of this report, are as follows:

<u>Program</u>	<u>Effective Date</u>	<u>Description and Responsible Office</u>
Phase I	August 15, 1971	Original Price Freeze Office of Emergency Preparedness
Phase II	November 13, 1971	Mandatory Price Controls Price Commission
Phase III	January 11, 1973	Voluntary Price Standards Cost of Living Council
Special Rule No. 1	March 6, 1973	Mandatory Price Controls on Petroleum Industry Cost of Living Council
Price Freeze II	June 13, 1973	Price Freeze II Cost of Living Council
Phase IV	August 19, 1973	Mandatory Price Controls on Petroleum Products Cost of Living Council
Mandatory Middle Distillates Allocation Program	November 1, 1973	Office of Oil and Gas Department of Interior Energy Policy
Emergency Petroleum Allocation Act of 1973 (EPAA) as extended and amended by the EPCA (12-22-75) and the ECPA (8-14-76)	November 27, 1973	Mandatory Allocation & Price Regs. issued Jan. 14, 1974, Federal Energy Office Federal Energy Administration and Department of Energy

Major Provisions of the Controls

The Phase I Controls consisted of a general price freeze imposed on all sectors of the U.S. economy for a period of 90 days under which prices were frozen at their August 15, 1971 level.

The Phase II Mandatory Price Controls established ceiling prices for all industries based on Phase I prices with limited adjustments allowed to reflect increased costs.

The Phase III Voluntary Price Standards, applied generally to all industries and permitted price increases above those lawfully in effect on January 11, 1973, to reflect increased costs without regard to profit margin limitations. Phase III had the effect of permitting large increases in petroleum product prices. As a result, Phase III was amended by Special Rule No. 1 on March 6, 1973, the first time price controls were established expressly for the petroleum industry. Special Rule No. 1 limited price increases to a weighted average price of one percent above the January 11, 1973, base price levels. However, Special Rule No. 1 applied only to sales of crude oil and refined products by the 23 largest oil companies, and petroleum prices continued to rise because of price increases by the uncontrolled portion of the petroleum industry.

Partly because of continuing increases in petroleum prices, Price Freeze II was placed in effect on June 13, 1973.

This 60-day price freeze was imposed on virtually all consumer prices.

The Phase IV Controls for Petroleum Products, developed during the 60-day price freeze, went into effect on August 19, 1973, and provided for a comprehensive system for controlling petroleum prices at the producer, refiner, and distributor levels. Controls regarding retailers were implemented on September 7, 1973.

The Phase IV price controls were incorporated into the Mandatory Petroleum Price Regulations now in effect under the EPAA.

The Mandatory Middle Distillates Allocation Program, which went into effect on November 1, 1973, required suppliers to allocate to wholesale purchasers supplies equal to volumes purchased in the corresponding month of 1972, or, if these quantities were not available, then a pro rata share of the supplier's supplies. Any supplies available in excess of 1972 levels could be distributed at the supplier's discretion under this program.

The programs established under the Emergency Petroleum Allocation Act of 1973, and under the Mandatory Petroleum Allocation and Price Regulations issued January 14, 1974, provided for a comprehensive set of controls covering both the allocation and pricing of petroleum products at all levels of the petroleum industry. These regulatory programs were established to deal with the problems

created by the reduction in supplies of petroleum products aggravated by the October 1973 oil embargo, and to preserve to the maximum extent possible during a shortage situation, an economically sound and competitive petroleum industry. They also contain provisions to assure equitable distribution of refined petroleum products at equitable prices. Included among these provisions is the Domestic Crude Oil Entitlements Program, which was created for the purpose of allowing all refiners to share in the benefits of price controlled domestic crude oil production. Under this program, refiners with greater than average access to low-cost domestic crude oil are required to make payments to refiners who use greater than average amounts of more costly domestic and imported crude oil, so that all domestic refiners, in effect, have an equitable share of the limited quantities of low-priced domestic crude oil. Under allocation controls a priority allocation system was established for the distribution of petroleum products.

The allocation and price regulations achieved a substantial measure of success in easing the impact of the October 1973 embargo. Whether the present regulations are needed to ensure equitable prices or adequacy of supply to

all users is the subject of the next section, which addresses kerojet fuel supply, demand, and price patterns before and during controls.

Current Conditions

During the shortage that occurred as a result of the embargo imposed in October 1973, the allocation and price regulations achieved a substantial measure of success in easing the impact of the shortage. However, there are clear indications at this time--and have been for more than four years--that adequate supplies are available and controls are no longer needed. During 1976, the Federal Energy Administration was able to make the necessary findings to support the exemption from regulation for several categories of petroleum products including residual fuel oil (effective June 1), middle distillates (effective July 1), naphthas, gas oils, and other specialty products (effective September 1), and naphtha base jet fuel (effective October 1). Most recently, the DOE and the Federal Energy Regulatory Commission have held hearings on Findings to exempt motor gasoline from controls. Furthermore, the Energy Conservation and Production Act, P.L. 94-385, enacted on August 14, 1976, exempted stripper well crude oil production from the price regulations.

DEMAND

The demand for kerojet fuel (see Figure III-1) increased between 1968 to 1973 at an average annual rate of about 7 percent. The oil embargo interrupted this trend, reducing

total 1974 demand by 8 percent from 1973. However, demand in 1975 increased by 3 percent over 1974 and recovered to a level almost comparable to 1972. It held this level throughout 1976, but increased by 5.3 percent during 1977, and 3.6 percent during the first six months of 1978. The greatest demand occurred in Petroleum Administration for Defense (PAD) District I. Next, in order of declining demand, were PAD Districts V, II, III, and IV (see Figures III-1 and III-2). Demand by use is demonstrated in Figure III-3 and Table III-5.

Effective January 1, 1975, the allocation level for domestic, supplemental, scheduled cargo, international and intra-state air carriers was raised from 95 percent to 100 percent of base period use (as reduced by application of an allocation fraction). Local service and "other" air carriers had already been at that level.

Tying allocations to the 1972 "base period" however, has not been and is not a limiting factor. DOE allocation regulations Section 211.145(b) provide that the base period allocations for airlines may be adjusted on the basis of changed circumstances. Such adjustments have, in general, updated allocation entitlements to the point where they are in phase with demand.

As to other kinds of wholesale purchasers, amendments to the Mandatory Petroleum Allocation Regulations (41 F.R. 49627, November 10, 1976) conformed allocation levels to changing supply patterns for fixed base operators and certain

FIGURE III-1
DEMAND FOR KEROJET FUEL, 1968-1977*

FIGURE III-2

PETROLEUM ADMINISTRATION FOR DEFENSE (PAD) DISTRICTS

MB/D

FIGURE III-3
DEMAND BY USE FOR KEROJET FUEL²

consumers. The amended rule provides that such operators are entitled to 100 percent of current requirements (subject to an allocation fraction) for use in the conduct of an ongoing business of selling aviation fuels to consumers. Certain traditional customers of fixed base operators and others that use aviation fuel for business flying, public aviation, personal flying, instructional flying and air travel club flying are also eligible for allocation levels of 100 percent of current requirements.

A number of conservation steps were taken to reduce demand for fuel. Air traffic procedures were amended to reduce delays both in the air and with engines idling on the airport. More direct routings have been developed and holding patterns have been moved to the more fuel-efficient higher altitudes. Airlines agreed to schedule reductions that increased aircraft load factors. Cruising speeds were reduced for maximum economy. As a result, the FAA estimates that revenue ton miles per gallon increased 19 percent between 1973 and 1976 for both airlines and general aviation. FAA estimates that it is possible, although problematical, that a small additional improvement can be achieved in the next four years.

Airline Demand

As a result of these savings, airline demand for kerojet fuel was at approximately the same level at the beginning of 1977 as it was at the beginning of 1973 while RTM increased 68.3 percent during the same period. Thus RTM demand has

remained strong despite a 32.6 percent airline ticket price increase during the same four year period. Toward the latter half of 1977 and throughout the first half of 1978, a large number of varied promotional discount fares were offered to the public by the airline industry. As a result, RTM demand was up 7.4 percent in 1977 and 11-1/2 percent in the first half of 1978. (Source CAB, ATA.) This trend will undoubtedly continue, as fares have become increasingly competitive in recent months.

The airlines have also adjusted schedules for purposes of increasing passenger load factors. They have discontinued service to a number of low-yield markets. This development is part of a trend that began in 1960. As shown in Figure III-4, fewer than 400 points were served in the coterminous 48 states. This trend continues today.

Probably the greatest reduction in airline demand for kerojet fuel was caused by a virtual elimination of competitive scheduling caused by "share of the market" conflicts among competing airlines. The airlines believed that a prospective passenger would select for his proposed trip the airline that operated the greatest number of flights between him and his destination. When one airline desired to increase its share of a market, it would thus increase the number of flights between those points, thereby increasing the number of empty seats, decreasing the passenger load factor, and increasing the cost and amount of fuel consumed per passenger. Competing airlines felt compelled to follow

FIGURE III-4

Points Receiving Passenger Service by Certificated Air Carriers

Source: Civil Aeronautics Board

suit. Beginning December 24, 1974, with the Civil Aeronautics Board acting as moderator and observer, competing airlines met and agreed to proportionate schedule reductions that would retain the market share of each airline. These meetings are no longer held due to objections from the U.S. Department of Justice. In the event of kerojet fuel decontrol, it is anticipated that the present cost of the fuel would prevent a return to wasteful scheduling, and that maximum effort would be made to accomodate traffic demand increase by increasing aircraft capacity and load factors.

The efficiencies and economies that, in the past, enabled kerojet fuel demand to remain stable while traffic increased should be somewhat less effective in restraining total kerojet demand in the future. The substantially increased competition in the airline industry that is resulting from recent amendment to the Federal Aviation Act and changes in CAB regulatory policy will result in increased traffic demand and cause a commensurate increase in kerojet fuel demand. This increase will likely be offset only partially by the continuation of fuel economics resulting from the gradual modernization of the airline fleet from the less fuel-efficient older aircraft (such as B-707, DC-8) to the newer aircraft (such as B-747, DC-10) with a better RTM per gallon ration, as will be explained in more detail in Chapter IV.

Military Demand

Military demand has not been constrained by allocation regulations because allocations are made to the Department of Defense on the basis of 100 percent of current requirements, not subject to an allocation fraction.

General Aviation Demand

Agricultural allocations are at the same level as DOD. The many other segments of general aviation were raised to an allocation level of 100 percent of current requirements, reduced by an allocation fraction. These segments had previously been set at different levels ranging from 100 to 75 percent of base period use. In general, the present allocation levels meet the demand.

The overall effect of these situations caused by DOE regulations is that most Fixed Base Operators have been able to gain sufficient adjustments to their allocations to accommodate demand. General aviation activity has been at a stable level, except at the top end, which includes business and corporate aviation activity, where a steady growth has been maintained. These top end segments of general aviation have been less affected by fuel price increases and strong inflation in aircraft and equipment prices. Business and corporate aviation operate nearly all of the non-airline turbine-engined aircraft in civil aviation. As a result, general aviation demand for kerojet fuel has been steadily increasing both in absolute terms (up 18.4 percent in 1977 over 1976) and also

as a percentage of total general aviation fuel consumption (up to 60 percent in 1977 from 53 percent in 1976).

The primary cause of changed general aviation demand patterns has been the introduction of turbine-engined aircraft into areas where little or no kerojet fuel was consumed during the base period.

Non-Aviation Demand

Demand for kerojet fuel from non-aviation uses comes primarily from electric utilities which use it for peaking. Under DOE regulations, such use is limited to base period volumes. Under 10 CFR 211.146(e), it is further limited to preclude use if the utility continues service to interruptible non-priority industrial users or to any customer who can use a fuel other than aviation fuel. In the event of kerojet deregulation, it is not anticipated that non-aviation uses would expand to a significant percentage of overall kerojet consumption.

SUPPLY

Domestic production of kerojet fuel has more than kept pace with the growth in consumption during the 1968 to 1977 period. Domestic production increased from 530,099 barrels per day in 1968 to 730,530 barrels per day in 1976 and 788,142 barrels per day in 1977. Table III-1 compares the domestic production of kerojet with historic domestic production trends of all refined products.

During the same period, end-of-year stocks increased at an average annual rate of about 8 percent (see Table III-2),

TABLE III-1

DOMESTIC PRODUCTION OF REFINED PRODUCTS
AT REFINERIES FOR 1968-1978
(Thousands of barrels/day)

	<u>Motor Gasoline</u>	<u>Distillate Fuel Oil*</u>	<u>Residual Fuel Oil</u>	<u>Naphtha Jet</u>	<u>Kero Jet</u>	<u>Other** Products</u>	<u>Total All Products</u>
1968	5,212	2,300	756	333	530	2,001	11,132
1969	5,468	2,340	729	287	594	2,062	11,480
1970	5,699	2,454	705	230	597	2,222	11,907
1971	5,971	2,495	752	233	601	2,245	12,297
1972	6,281	2,630	799	210	636	2,149	12,706
1973	6,527	2,820	971	181	679	2,463	13,641
1974	6,358	2,668	1,071	195	641	2,362	13,294
1975	6,518	2,653	1,235	180	691	2,174	13,452
1976							
I Qtr	6,470	2,826	1,373	166	745	2,176	13,756
II Qtr	6,880	2,759	1,260	194	707	2,403	14,204
III Qtr	7,067	2,963	1,306	198	757	2,136	14,427
IV Qtr	6,931	3,144	1,568	190	712	2,357	14,903
Average	6,838	2,924	1,377	187	731	2,268	14,323
1977							
I Qtr	6,872	3,419	1,852	948	] includes both Kerojet and Naphtha Jet Fuels		
II Qtr	7,021	3,108	1,691	989			
III Qtr	7,167	3,259	1,702	994			
IV Qtr	7,067	3,315	1,744	967			
Average	7,033	3,272	1,746	974	] includes both Kerojet and Naphtha Jet Fuels		
1978							
I Qtr	6,771	2,997	1,810	963			
II Qtr	6,980	3,085	1,594	986			
III Qtr	7,360	3,194	1,629	963			
October	7,057	3,353	1,606	937			
Average	7,042	3,120	1,670	967			
(Year to date)							

* Excludes Kerosene

** Includes Kerosene

Source: Department of Energy, Monthly Energy Review, December 1978.

TABLE III-2

AVERAGE DAILY KEROJET DEMAND AND STOCKS AT END OF YEAR

	<u>Demand</u> <u>(000 BBL/Day)</u>	<u>Stocks</u> <u>(000 BBLs)</u>	<u>Number of Days</u> <u>of Supply</u>
1968	609	15,373	25.2
1969	694	19,517	28.1
1970	718	20,989	29.2
1971	751	20,747	27.6
1972	803	19,346	24.1
1973	842	22,945	27.3
1974	771	23,906	31.0
1975	791	25,158	31.8
1976	788	25,590	32.4
1977	832	28,283	34.7
1978 (first half)	838	31,427	37.5*

SOURCE: BOM

* Stocks are normally lower in December than September. Therefore a forecast for the end of 1978 is 34.0 days' supply.

increasing the number of days supply of kerojet fuel from 25.2 days at the end of 1968 to 37.5 days in July 1978.

Despite the increase in stock levels over this period, post-embargo stock levels are probably not required to be as high as earlier levels since utilization of increased refinery capacity provides a larger refining capability margin than existed in 1970 and 1971. This larger margin would be useful in accommodating any demand surges, with stocks

meeting the initial part of the surge while refinery runs are being increased. Nonetheless, largely due to the small number of kerojet refiners and the complex distribution network, there may continue to be occasional temporary local shortages.

In addition to production and the change in stocks, the third component of domestic supply is imports (Figure III-5). In the first half of 1978, imports accounted for 8.0 percent of domestic kerojet fuel needs (which is an increase from 6.4 percent in 1977 and 7.8 in 1976) excluding kerojet fuel imported from offshore U.S. territories. The difference between the two curves shown in Figure III-5 represents the amount of kerojet fuel imported.

Historically, U.S. flag and foreign airlines operating international routes used bonded fuel because it was cheaper. Following the 1973 embargo, bonded fuel prices rose to as much as 11 cents per gallon higher than price controlled non-bonded kerojet fuel that was domestically available.

The U.S. and foreign international airlines petitioned the Federal Energy Office (FEO), the predecessor to the FEA, to amend its regulations to permit them an allocation of the lower priced domestic fuel. Under U.S. bilateral agreements foreign carriers have the legal right to purchase U.S. domestic fuel, but did not receive a guaranteed allocation as did the U.S. carriers under the FEO mandatory allocation program. Second, FEO regulations issued January 14, 1974, exempted from price controls nonbonded fuel uplifted

FIGURE III-5
KEROJET FUEL SUPPLY, 1968-1977*

for foreign destinations. Therefore, granting the petition would provide the international carriers with two important benefits: (1) a mandatory allocation of fuel, and (2) at FEO controlled prices. Domestic airlines argued that those domestic refiners which produced kerojet fuel had adequate capacity to meet domestic demand, but would have to continue to meet the demands of the international airlines by importation of kerojet fuel. These imports would be at uncontrolled world prices. As the imported volumes were added to the mix of domestically-refined fuels, there would be a proportionate increase in the price of the resultant mix of domestic and foreign kerojet. The domestic airlines further argued that they would be required to pay this higher price, which would amount to subsidizing the international airlines. The international airlines responded that no subsidy was involved as they were only receiving that product at those prices to which they were entitled.

The airline petition was granted by amendment to Part 211 of FEA regulations on April 8, 1974. As a result, international airlines phased out their purchases of bonded kerojet fuel and began purchasing price-controlled kerojet fuel. Whereas non-bonded imports increased and bonded imports decreased, total imports decreased (Figure III-6).

Some foreign airlines continued to use bonded kerojet fuel, but this use has dwindled from over 90 percent of total kerojet fuel imports from 1968 to 1973, to 67 percent

FIGURE III-6
IMPORTS OF KEROJET FUEL

in 1974, and 4 percent in 1977, as international airlines were given access to lower cost domestic kerojet fuel. Currently, the only bonded fuel uplifted in the U.S. on a regular basis is that used by four Eastern Block nations serving JFK airport: Russia, Poland, Czechoslovakia, and Romania. One reason for the continued use of the bonded Jet A-1 fuel by these nations is due to a mechanical difference in many of their aircraft engines which requires the lower freezing point of Jet-A-1 fuel (-58 degrees) rather than the -40 degrees freezing point of domestic Jet A fuel. The deregulation of kerojet fuel should not have any appreciable effect on this situation. Under the various bilateral agreements between the United States and other countries, international airlines are required to be given fair and equal opportunity to compete with domestic airlines. The international airlines are expected to continue purchasing domestic kerojet fuel as long as it is cheaper than bonded fuel.

During the Embargo, in the fall of 1973, the airlines were receiving as little as 70 to 75 percent of current needs. The airlines' primary supply problem was caused not as much by the low allocation level as by the wide fluctuations in the allocation fractions maintained from month-to-month by the various suppliers. One of the factors causing these fluctuations was the refiners' reaction to public concern over the image of long lines at automotive gasoline stations, which resulted in sporadic efforts to maximize gasoline production.

The airlines claimed that they could adjust to nearly any allocation level if they had to, but they characteristically needed to plan many months in advance and needed an assured stability of supply at some level. As a result, the FEO issued "two orders for an increase in the refinery yield of kerosene base jet fuel on February 20 and April 10, 1974. This was unpopular with certain of the refiners who were regular suppliers of kerojet fuel. They claimed that they were already approaching the maximum yield of kerojet fuel of 13 or 14 percent and were already into the area where expensive and wasteful secondary refinery operations were required.

On March 25, 1974, FEO ordered all kerojet refiners to maintain an allocation fraction of 1.0. Although this lacked the force of formal rulemaking, it has been generally observed by the industry. Its advantage was that it met the airline need for a predictable supply, but allowed the refiners flexibility as to whether to meet this supply obligation through increased refinery yield, exchanges with other refiners, imports, or other means.

The result has been that those refiners which produce kerojet fuel have been regularly meeting demand without major problems outside of occasional local shortages. These refiners, however, have maintained kerojet production near a peak refinery yield percentage and have resorted to imports for about 7 percent of supply. Any increase in demand in the future would be met either by increased imports or by

the entry into the kerojet market of domestic refiners who are not presently in that market. The supply situation is thus in close balance with demand, which has caused occasional local shortages as demand or supply patterns change.

Primarily at the urging of the other NATO nations, the Department of Defense is studying the feasibility of using kerosene-base JP-8 fuel in place of naphtha-base JP-4. NATO's primary interest is in use of a common fuel by all NATO aircraft. DOD's additional interest is based on the lesser volatility of JP-8 as compared to JP-4. If this switch were made, there would be a 22 percent increase in demand for kerosene-base jet fuel with a corresponding decrease in demand for naphtha jet fuel. A sudden increase in demand of this magnitude could cause severe competition for that narrow cut of the barrel of crude oil from which kerojet fuel is refined, with a potential for supply disruption. However, the increase in demand, if it does occur, will be gradual rather than sudden. If DOD does elect to switch there would be no significant impact before the end of 1980 because present tactical military aircraft would require modification before being able to use JP-8. New military aircraft designed to use JP-8 would phase in slowly. Moreover, DOD's first conversion efforts would be concentrated in the NATO nations using local kerojet supplies. Conversion efforts in the USA would not begin until about two years thereafter. This gradual increase should allow

the refining industry ample opportunity to make the necessary modifications and expansions that would increase supply accordingly.

PRICE TRENDS

This section traces kerojet fuel price trends for the period 1968-1978. Prices remained relatively stable during Phases I through III of controls. Phase IV controls (beginning on August 19, 1973), however, were ineffective in counteracting the "cost-push" forces that were causing prices to spiral. The controls were limited in their impact on price because they permitted product cost pass-through as required by law at a time when imported crude oil was increasing as a proportion of all crude used, and at a time when its price was rising rapidly.

As indicated in Table III-3, kerojet fuel prices for both the airlines and the military averaged approximately 11 cents per gallon over the six year period 1968-1973. However, beginning in 1974 and continuing through 1975, a disparity occurred between airline and military kerojet fuel prices. This disparity occurred because airlines purchased up to 85 percent of their kerojet fuel under pre-embargo long-term contracts while the military purchased on a 6-month cycle. However, these airline contracts have now expired, and airline and military prices again average within 1/2 cent of each other.

Until 1973, the Defense Fuel Supply Center was able to procure adequate supplies of kerojet fuel for domestic requirements through formal advertising. After early 1973, however, the DFSC was unable to procure sufficient supplies of kerojet fuel from its traditional suppliers because of fuel shortages,

TABLE III-3

KEROJET AVERAGE WEIGHTED DOMESTIC PRICE
(CENTS PER GALLON)

<u>YEAR</u>	<u>AIRLINES</u>	<u>DFSC</u>	<u>REFINER COST OF</u> <u>CRUDE OIL</u>
1968	10.1	10.5	7.5
1969	10.7	11.3	7.8
1970	11.1	11.2	8.1
1971	11.6	10.7	8.6
1972	11.6	10.6	8.5
1973	12.6	10.9	9.9
1974	21.9	26.1	21.6
1975	27.6	29.7	24.7
1976	32.7	33.1	25.9
1977	37.4	37.2	28.4
1978(first half)	38.6	39.0	29.2

SOURCE: CAB, DFSC, DOE

uncertainties in the crude oil market, and government price controls.

As a result, the Defense Production Act of 1950 (DPA) as amended, was invoked in late 1973 to require oil companies to supply petroleum products, including kerojet fuel, for the Government's needs. The DPA authorizes the President to require acceptance and performance of defense contracts or orders, in preference to others, by any person he finds capable of their performance in order to maintain national security.

Under the EPAA, FEA designated the firms that would supply fuel to the Department of Defense, generally on the basis of 1972 supplier-purchaser relationships. The allocation system, by further discouraging competitive procurements, had an additional impact on the prices paid by the Department of Defense for kerojet fuel. Despite price controls, the average cost for a gallon of fuel almost tripled as the cost of crude oil feedstocks to domestic refineries rose (see Table III-3).

Retail kerojet prices paid by the various general aviation segments of civil aviation vary widely, as was evidenced by a May 1977 FEA survey which showed retail prices to this segment ranging from a low of 55 cents per gallon to 83 cents per gallon. Historical average retail prices for this aviation segment are difficult to determine because of varying transportation costs and sales volumes, the presence or absence of competition, differing state taxes, local

fees, and the amount of service given to purchasers. The results of studies conducted by Aviation Data Service, National Air Transportation Associations, and the DOE are shown in Table III-4.

The retail price of kerojet fuel sold through retail outlets (Fixed Base Operators) averaged 69.67 cents per gallon in May 1977. This was an increase of 2.6 cents per gallon, or 3.9 percent, from the preceding two years. The average price, including applicable State and Federal taxes varied regionally as follows:

Northeast	73.5 cents	Southeast	71.0 cents
North Central	67.5 "	South Central	67.0 "
Northwest	72.0 "	Southwest	67.0 "

SOURCE: DOE and National Air Transportation Associations

The more than 200 percent increase in airline kerojet price with essentially constant demand from 1973 to 1977 demonstrates that kerojet is an essential product, particularly for commercial airlines, and demand for which has been largely price-inelastic.

The difference between international and domestic kerojet prices paid by airlines narrowed from about 12 cents per gallon at the end of 1974 to about 4 cents per gallon in mid-1978.

In very general terms, it can be concluded that the international price is uncontrolled and therefore represents a free market price. It should be realized, however, that the international price includes a number of remote

TABLE III-4
HISTORICAL RETAIL KEROJET FUEL PRICE*

Annual Average (cents per gallon) 1959 - 1975			
1959	36.5	1968	37.9
1960	36.9	1969	38.5
1961	37.5	1970	39.0
1962	37.1	1971	41.2
1963	36.7	1972	42.1
1964	35.0	1973	50.0
1965	36.2	1974	61.7
1966	37.6	1975	66.0
1967	38.6		

Source: Aviation Data Service, Inc.

* Study contract ended in 1975 and was not renewed by FAA.

and/or monopolistic foreign airports where the price is very high, raising the average price above the level at which kerojet would sell in an unregulated market in the United States. It should also be remembered that the international price represents absence of control both on the crude oil and on the kerojet product.

MARKET STRUCTURE

Kerojet fuel is used primarily by commercial airlines. In 1977, the airlines accounted for 86 percent of kerojet fuel demand as evidenced in the following table:

TABLE III-5
USERS OF KEROJET 1977

	<u>Thousands of Barrels</u>	<u>Thousands of Barrels Per Day</u>	<u>Percent of Total</u>
Airlines	256,948	679.3	86.0
General Aviation	16,424	45.0	5.5
Aviation Factories	2,113	3.1	.7
Military	16,632	45.0	5.5
Non-Aviation Use	<u>7,324</u>	<u>20.1</u>	<u>2.3</u>
Total	299,441	793.1	100.0

Source: DOE

Large integrated refiners are the major suppliers of kerojet fuel. The capital demands for specialized refining and marketing equipment have tended to restrict entrance to the kerojet market.

During the period 1972 to 1975, large integrated refiners dominated the kerojet market. As shown in Table III-6, in 1975 large integrated refiners accounted for about 92.5 percent of kerojet fuel sales, large independent refiners for about 3.5 percent, and small refiners for 4 percent of the market.

Over the 1972 to 1975 period, Federal regulations and practices appear to have had the effect of permitting small refiners to increase their market share at the expense of the majors and large independents.

Table III-6

REFINER GROUP SHARES OF KEROJET FUEL SALES

<u>Year</u>	<u>Sales (000 bbls)*</u>	<u>Large Integrated Refiners</u>	<u>Large Independent Refiners</u>	<u>Small Refiners</u>
1972	228,619	93.5	4.5	2.0
1973	236,929	93.5	4.0	2.6
1974	241,429	92.5	3.5	4.0
1975 (est)**	250,571	92.5	3.5	4.0

* Excludes bonded fuel imports and direct imports by the DOD and/or other independent marketers.

** Since 1975, refiners reporting to DOE have been instructed to consolidate reports of sales of naphtha jet and kerojet. 1975 estimates of sales are based on DOE kerojet production reports.

Source: DOE

CHAPTER IV

IMPACT OF DECONTROL ON SUPPLY/DEMAND, PRICE, AND MARKET STRUCTURE

This chapter considers future demand, supply, price, and market structure conditions, and assesses the impact of exempting kerojet fuel from the Mandatory Petroleum Allocation and Price Regulations. It further addresses the questions raised by the EPCA as set forth at the beginning of Chapter III of this report.

To answer these questions, the following analytical approach has been taken:

- o Demand forecast -- A demand forecast for kerojet fuel and all refined products was developed through 1980.
- o Supply forecast -- The availability of refining capacity and crude supply on both a domestic and worldwide basis to meet forecast demand has been evaluated.
- o Pricing forecast -- The price movement pressures arising from foreign market prices, alternate product prices, and the competitive structure of the industry have been assessed.
- o Market structure and competition -- Trends that may affect future competition of the major industry segments have been examined.

DEMAND FORECAST

As described in Chapter III, and charted on Table IV-1, domestic demand for kerojet fuel increased from 609,000 B/D in 1968 to 832,000 B/D in 1977 and is estimated at 853,00 B/D in 1978 (extrapolated from six months data).

The airlines will continue to be the dominant users of kerojet. Other uses of kerojet are not expected to have a significant impact on the demand for kerojet fuel.

Demand for air transportation as measured by Revenue Ton Miles* (RTM) increased 9.9 percent in 1976 over 1975, and 7.3% in 1977 over 1976 and is holding at a 12 percent increase into the first seven months of 1978. RTM is forecast to grow at a 6% rate in 1979 and 1980 because the general level of economic activity is not expected to grow as rapidly as it did during the 1975 to 1976 period. However, recent partial deregulation of the airlines could have a stimulating effect on airline traffic at least over the short term through 1980. Some relaxation of current regulations had already been effected by 1977 and appears to be a cause of the increased airline activity during the last quarter of 1977 and the first quarter of 1978. These RTM increases have been reflected in increased kerojet demands.

Legislation to further deregulate airlines became effective on October 24, 1978. It could further accelerate kerojet fuel demand, as new routes are activated. However,

* Revenue Ton Miles are the tons of paid cargo and passengers multiplied by the miles traveled.

TABLE IV-1

DEMAND FOR KEROJET FUEL
(MB/D)

1968	609
1979	694
1970	718
1971	751
1972	803
1973	842
1974	771
1975	791
1976	789
1977	832
1978*	853
1979**	883
1980**	918

Source: 1968 to 1977 data from BOM

* 1978 is based on preliminary BOM Data

** Forecast kerojet demand increases are based on the average of forecasts by Federal Aviation Administration and Air Transport Association of America i.e., 3.5% in 1978, 3.5% in 1979, 4.0% in 1980. These projections are greater than those derived from DOE's Demand Model which extrapolates the historical relationship between Kerojet fuel demand, revenue ton miles, and real national income over the period 1970-1976.

FIGURE IV-1

DOMESTIC DEMAND FOR KEROJET FUEL

some routes may also be abandoned. Thus, as this new competitive and economic climate for the airlines is emerging, a degree of uncertainty will exist with respect to kerojet forecast until a new pattern of airline service is established.

Aircraft orders indicate the airlines expect increases in demand for air transportation. They ordered 102 aircraft in 1976 and 116 in 1977, as compared with 29 during 1975. Scheduled aircraft deliveries were 76 in 1978, and are 126 and 140 in 1979 and 1980 respectively. Most of these new aircraft will represent new capacity. Proposed noise regulations that would have caused some older aircraft to be retired did not emerge from the 95th Congress.

Not all of the growth in RTM demand will be transmitted into demand for kerojet fuel, which increased 3.7 percent in the first six months of 1978 and is projected to increase at a rate of 3.5 percent in 1979 and 4 percent in 1980.* Between mid 1977 and mid 1978 the average load factor for trunk airlines increased from 57 to nearly 63 percent. Airlines have been adding to the number of seats in existing aircraft. Aircraft utilization has been improved. Thus, much of the RTM increase has been absorbed without causing the type of increase in kerojet fuel demand that would occur from handling this traffic with new flights. RTM demand, however, is forecast to remain so strong that many

* Air Transport Ass'n., Airline Fuel Forecast
Federal Aviation Admin. Aviation Forecast 1979-1980.

of the older aircraft retired by major airlines will be put in operation by new or expanding local service airlines, cargo airlines, or charter airlines. The Federal Aviation Administration has stated that the future capacity of the airline industry to absorb fuel price increases by means of efficiencies and load factor increases will not nearly match the 1974 - 1977 period.^{1/} It thus appears that for the period through 1980 there will be a more direct relationship between traffic demand and fuel demand.

There are practical limits to the maximum sustainable load factors on a system-wide basis for any airline. A local service airline flight with five stops, having heavy reservations between stops four and five, may have to fly the first four legs with light loads. One airline aircraft, carrying a 100 percent load factor at 8 A.M. from New York to Chicago, may have to fly lighter loads the rest of the day before it is in a position for another 100 percent load factor between the same two points at 5 P.M. The practical maximum load factor is higher for trunk air carriers than it is for local service airlines. The CAB load factor "standard" is presently 55 percent.^{2/} CAB is presently reviewing this standard to determine whether a higher one should be established. FAA forecasts that the average airline load factor will

^{1/} FAA Report to the Congress on Aviation Energy Savings.

^{2/} CAB Report to the Congress on Savings in Energy Consumption by Air Carriers.

gradually rise from 55 to 60 percent by the 1980s with a peak at 63 percent during 1978. Presently, there is very little margin between the break-even load factor and the maximum practicable load factor. However, the leverage is immense, and the profitability to be gained from small increments of load factor above the break even point are large. For this reason, airline profitability has been excellent for the past two years and is forecast to remain good through 1980.

As noted above, demand for kerojet fuel will increase at an annual growth rate between 3.5 and 4 percent through 1980. Such moderate and evenly phased increases in kerojet fuel demand are within the overall capacity of the domestic petroleum industry and should result in no supply shortages or increases of imports beyond current levels. It is possible, however, that such increases could cause refiners who do not produce kerojet to enter that market, because many current kerojet producers could not increase their present volume of kerojet production. Alternatively, more sophisticated and costly refining by present refiners would be required to meet forecast kerojet demand increases. One major refiner not currently marketing kerojet testified at the ERA hearing it would enter into kerojet production if kerojet were decontrolled. Kerojet fuel demand in relationship to overall petroleum product demand is shown in Table IV - 2.

SUPPLY FORECAST

To assess the adequacy of petroleum product supplies relative to forecast demand, the key supply determinants

TABLE IV-2

PROJECTED DOMESTIC PETROLEUM
PRODUCT DEMAND
(Thousands of barrels per day)

	<u>1977</u>	<u>1978*</u>	<u>1979*</u>	<u>1980*</u>
Kerojet Fuel	835	853	883	918
Other Products	17,583	17,800	19,000	20,000
Total Domestic Demand	18,418	18,700	19,900	20,900
Exports & Crude				
Oil Losses	259	200	200	200
Total Demand	18,677	18,900	20,100	21,100

* Projections are rounded to the nearest 100,000.

NOTE: Numbers may not sum to totals because of rounding.

SOURCE: Data for 1977 is actual demand as reported in the Monthly Energy Review and 1978 is preliminary actual data. Demand projections for 1979 and 1980 are derived from EIA's Analysis Memorandum DOE/EIA-012/20 based on macroeconomic forecasts by Data Resources, Inc. (DRI's CONTROL0727 macroeconomic simulation). Kerojet demand projections are prepared by the Economic Regulatory Administration, based on forecasts by the Federal Aviation Administration and the Air Transport Association of America. Since ERA forecasts for aviation turbine fuel demand differs slightly from those produced from EIA's Short Term Petroleum Demand Forecasting Model, the difference is reconciled by modifying the EIA forecast for "Other Products" to stay consistent with the Total Demand derived from the STPDFM.

of refinery capacity, refinery yields and crude oil supply, were analyzed (Table IV-3). It was determined that the supply of kerojet fuel is expected to be adequate to meet the overall industry demand for kerojet fuel. However, spot shortages resulting from distribution problems could occur in the future as they have in the past.

Refinery Capacity

An analysis of petroleum supplies in Table IV-3 shows that total average annual petroleum product demand for 1980 cannot be met without increased domestic refining capacity or increased capacity utilization, and will cause increases in product imports. Domestic refinery capacity is projected to increase by over 1,700 MB/D from 1977 to 1980, while the increase in total petroleum demand is projected to be about 2,400 MB/D. The supply balance presented in Table IV-3 assumes a refiner capacity utilization in 1979 and 1980 of 90.0 percent (based on crude oil inputs only). At this utilization rate imports will have to increase by about 900 MB/D in 1980 above the 1977 level. The assumed 1979 and 1980 capacity utilization rates are comparable to those achieved in recent years (Table IV-4).

Continued operation of domestic capacity at the assumed rate of 90.0 percent for 1979 and 1980 with no change in the kerojet yield would satisfy almost all of the projected kerojet demand, with the balance satisfied by imports (Table IV-5). Thus, no significant increases in imports of kerojet fuel from current levels need to be expected.

TABLE IV-3

ANALYSIS OF U.S. PETROLEUM SUPPLY
(MB/D)

	<u>1977</u>	<u>1978****</u>	<u>1979</u>	<u>1980</u>
Refinery Capacity*	16,388	17,200	17,700	18,100
Percent Utilization**	89.1%	88.0%	90.0%	90.0%
Anticipated Utilization	14,608	15,100	15,900	16,300
Product Imports	2,176	2,000	2,500	3,100
Natural Gas Liquids	1,618	1,600	1,500	1,500
Other***	<u>275</u>	<u>200</u>	<u>200</u>	<u>200</u>
Total Supply	18,677	18,900	20,100	21,100

*DOE's "Trends and Refinery Capacity and Utilization," September 1978. Estimates do not include Puerto Rico and Virgin Islands, which contribute approximately 1 million barrels per day additional capacity but whose product shipments to the U.S. are considered as imports.

**Based on crude inputs only.

***Includes processing gain, other hydrocarbon inputs, stock change and unaccounted-for crude oil.

****Preliminary actual.

NOTE: Numbers may not sum to totals because of rounding.
Percentages based on unrounded numbers.

TABLE IV-4

DOMESTIC REFINERY CAPACITY UTILIZATION

<u>Year</u>	<u>Crude Oil Input as a Percent of Capacity</u>
1968	90.6
1969	90.6
1970	88.6
1971	87.2
1972	88.4
1973	89.8
1974	83.9
1975	84.2
1976	87.0
1977	89.1
1978	88.0 preliminary
1979	90.0 projected
1980	90.0 projected

SOURCE: U.S. Bureau of Mines, 1968-1973. DOE 1974-1980.

TABLE IV-5

PROJECTED KEROJET PRODUCTION AND SUPPLY, 1977-1980
(MB/D)

	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Projected U.S. Refinery Capacity	16,755	17,200	17,700	18,100
<u>Projected Utilization</u>	<u>89.1%</u>	<u>88.0%</u>	<u>90.0%</u>	<u>90.0%</u>
Estimated Domestic Refinery Production	14,608	15,100	15,900	16,300
<u>Kerojet Fuel Yield</u>	<u>5.4%</u>	<u>5.4%</u>	<u>5.4%</u>	<u>5.4%</u>
Estimated Domestic Kerojet Fuel Production	782*	815	859	880
Kerojet Fuel Imports	<u>+ 50*</u>	<u>+ 38</u>	<u>+ 24</u>	<u>+ 38</u>
Total Supply	832	853	883	918

NOTE: Total may not add due to rounding. Percentages based on unrounded numbers.

* Excludes production used to build up stock. Total 1977 production was 792 MB/D.

In general, percentage yields of kerojet fuel could increase slightly to meet domestic demand, or decrease slightly without a major change in imports, since the projected expansion of domestic refining capacity is sufficient to offset the rise in kerojet demand. Some slight shifts in product yields are likely, depending on specific demand developments conditioned by weather characteristics and other factors. These shifts in production have been demonstrated historically and are clearly within the range of industry capability. In fact, new technology in refining allows more flexibility in the yield mixes of new refineries than was possible in the past. No refinery yield problems are foreseen for the forecast period.

Availability of Crude Oil

Supply projections based on high domestic supply and high conservation assumptions indicate that increasing amounts of imported crude oil will be refined domestically. Crude oil imports have been and are projected to be at the following levels (in MB/D).

1975	4,105
1976	5,287
1977	6,548
1978	6,000
1979	6,700
1980	7,600

If there were no major supply interruptions worldwide, sufficient production capacity would be available in foreign countries to meet an increased demand for crude oil imports. The September 1978 crude oil shut-in production in the major exporting countries amounted to 14.6 percent of total production capacity (Table IV-6). While 13 OPEC countries, Canada, and Mexico together had a total theoretical production capacity in excess of 40.4 MMB/D in September 1978, they produced only 34.5 MMB/D. These countries are thus theoretically capable of producing an additional 5.9 MMB/D, provided that such a level of demand exists and that incentives exist for expanding production. Up to 3.5 MMB/D of this excess production capacity has been utilized to offset most of the recent termination of exports from Iran. The remainder is being met by the drawdown of currently abundant stocks. A return of Iranian exports to even half of their previous level, which is the minimum that is expected, should eliminate any need to draw down inventories below normal levels.

Thus, with or without controls, the crude oil supply is expected to be adequate to meet demand for kerojet fuel through 1980. If Iranian imports should remain at zero for a prolonged period, which is not expected, there could develop some tightness of supply for all refined products on a worldwide basis. It is not expected that such tightness would require the reimposition of controls on any exempted product, however, although the possibility of activating DOE's Standby Petroleum Allocation and Price Regulations (which were issued 44 FR __, January 18, 1979), is always available.

TABLE IV-6

CRUDE OIL PRODUCTION FOR MAJOR PETROLEUM EXPORTING COUNTRIES
(Thousands of barrels per day)

Country	Production							Production Capacity	Production Shut in
	1972 Year	1973 Year	1974 Year	1975 Year	1976 Year	1977 Year	1978 Sept.**	1978 Sept.	1978 Sept.
	Thousands of barrels per day								Percent
Algeria	1,040	1,070	960	960	990	1,040	1,220	1,300	6.2
Iraq	1,465	2,020	1,970	2,260	2,415	2,330	2,900	3,000	3.3
Kuwait*	3,283	3,020	2,545	2,085	2,145	1,970	2,685	3,300	18.6
Libya	2,239	2,175	1,520	1,480	1,935	2,080	2,020	2,300	12.2
Qatar	482	570	520	440	495	430	510	600	15.0
Saudi Arabia*	6,016	7,595	8,480	7,075	8,575	9,200	8,385	10,700	21.6
United Arab Emirates	1,202	1,535	1,680	1,665	1,935	2,010	1,840	2,375	22.5
Subtotal: Arab OPEC	15,727	17,985	17,675	15,965	18,490	19,060	19,560	23,575	17.0
Ecuador	78	210	175	160	185	180	210	225	6.7
Gabon	125	150	200	225	225	230	225	225	—
Indonesia	1,080	1,340	1,375	1,305	1,505	1,030	1,540	1,700	6.5
Iran	5,023	5,860	6,020	5,350	5,885	5,660	6,050	6,500	6.9
Nigeria	1,815	2,055	2,255	1,785	2,070	2,100	2,120	2,300	7.8
Venezuela	3,219	3,365	2,975	2,345	2,295	2,240	2,250	2,600	13.5
Subtotal: Non-Arab OPEC	11,340	12,980	13,000	11,170	12,165	12,240	12,445	13,550	8.2
TOTAL OPEC	27,067	30,965	30,675	27,135	30,655	31,160	32,005	37,125	13.8
Canada	1,540	1,800	1,695	1,460	1,300	1,320	1,260	1,800	30.0
Mexico	440	465	580	720	850	980	1,270	1,500	15.3
TOTAL OPEC, Canada, Mexico	29,047	33,230	32,950	29,315	32,805	33,460	34,535	40,425	14.6
TOTAL WORLD	50,550	55,755	55,875	52,990	57,340	59,520	62,660		

*Includes about one-half of the former Kuwait-Saudi Arabia Neutral Zone. Production in September 1978 amounted to approximately 570,000 barrels per day.

**Estimated.

Sources: Central Intelligence Agency, National Foreign Assessment Center, *International Energy Statistical Review*, 1 November 1978, National Energy Board of Canada, and U.S. Department of Energy.

OPEC Countries Crude Oil Production

Foreign Excess Refining Capacity

Worldwide refinery capacity has grown from 36.5 MMB/D in 1973 to 45.8 MMB/D in 1977. Free-world refinery capacity utilization, excluding the U.S., decreased from 74 percent in 1973 to 63 percent in 1976.

Including the refinery construction projects that were underway, foreign refining capacity in the free-world is estimated at 46 MMB/D for mid-1977. Assuming reasonable rates of refinery utilization (77 percent excluding the U.S), there would be enough refining capacity to accommodate a free-world petroleum demand growth rate of about 16 percent per year in the 1975-1980 period (Table IV-7). DOE believes that worldwide consumption will not grow at this rate but will continue to grow at a rate closer to the historic three percent rate, so that there would be an excess foreign refining capacity available to meet any anticipated increase in U.S. kerojet import demand.

Price Forecast

Kerojet prices will rise as crude oil costs and refiner nonproduct costs rise whether or not kerojet is exempted from controls. Domestic crude oil costs will rise in accordance with the provisions of EPCA and ECPA.

It is difficult to project the rate of increase in foreign crude oil costs over a number of years, but it is expected that these costs will not decline and will probably continue to rise in the future. Cost increases

TABLE IV-7
FOREIGN REFINING CAPACITY

	1975		1976		1977	1977-1980
	Refining Capacity	Consumption	Refining Capacity	Consumption	Refining Capacity	Refining Additions Planned**
North America (Ex. U.S.A)	2638	2440	2748	N.A.	3035	623
Central America & Caribbean	1781	580	1916	N.A.	1894	288
South America	5120	2220	5014	N.A.	5088	1186
Western Europe	18718	12603	19972	N.A.	20859	3490
Middle East	3281	1607	3285	N.A.	3348	1342
Africa	1083	1027	1328	N.A.	1479	1536
Asiatic Area	9397	7300	9868	N.A.	10076	2055
Grand total (Ex. Sino-Soviet Area)	42018	27777	44132	N.A.	45779	10520

* As of January 1.

** Estimated from the Oil and Gas Journal, April 25, 1977; "Worldwide Construction."
Pages 125-142.

SOURCE: Bureau of Mines, International Petroleum Annuals for 1975-1977 data.

from the rise in OPEC price increases can be reasonably established for 1979, and assumption must be made as to the possibility of further increases in 1980. As the volume and percentage of imported crude oil increases through 1980, the average cost of crude oil to U.S. refiners is assumed to rise at a higher rate than the rate of inflation.

As the volume of higher-priced imported crude oil used in domestic refinery operations increases relative to the volume of domestic price controlled crude oil, the average cost of crude oil to U.S. refiners will rise at a higher rate than the rate of inflation. Projected increases in crude oil costs are shown in Table IV-8. Because the EPAA permits dollar-for-dollar passthrough of increased crude oil costs, continued controls would have no influence on price increases generated by crude oil cost increases.

Under current DOE regulations, refiners can pass through certain nonproduct costs. These costs are projected to increase about one cent per gallon per year.

Assuming that these rising crude oil and nonproduct costs are allocated to all refined products on a percentage of production basis, controlled kerojet price increases will closely follow those of crude oil and refiner nonproduct cost increases since the amount of kerojet imported is relatively small. Projected cumulative increases in crude oil and refiner non-product costs with controls are shown in Table IV-8. From the

TABLE IV-8

PROJECTED COMPOSITE CRUDE COST AND
NONPRODUCT COST INCREASES WITH CONTROLS
(cents per gallon)

<u>Year and Qtr.</u>	<u>Cumulative Crude Oil Cost Increase Over 3rd Qtr. 1978 Cost</u>	<u>Cumulative Increase in Refiner Nonproduct Costs</u>	<u>Total Cumulative Increase</u>
<u>1978</u>			
4th	.2	.2	.4
<u>1979</u>			
1st	1.0	.5	1.5
2nd	2.3	.7	3.0
3rd	3.0	1.0	4.0
4th	3.8	1.3	5.1
<u>1980</u>			
1st	5.4	1.5	6.9
2nd	6.1	1.8	7.9
3rd	6.3	2.1	8.4
4th	6.6	2.4	9.0

NOTE:

Nonproduct cost increases are derived by inflating historical refiners' gross margins by the projected GNP implicit price deflator from the Data Resources, Inc. PESSIMO0524 macroeconomic simulation. Costs of increased refining capacity is not included. Crude Oil costs include the 14.5 percent 1979 OPEC increase and a 7 percent 1980 OPEC increase, equivalent to the projected U.S. inflation rate.

SOURCE: EIA Short-term Petroleum Cost Distribution Model (11-3-78)

fourth quarter 1978 to the fourth quarter 1980, total refiner costs are projected to rise about 9.0 cents.

Five factors have been evaluated in assessing the effect on price movement of kerojet deregulation:

1. Banked Costs
2. Supply/Demand
3. Nature of the Market
4. Alternate Product Value
5. World Price

In this section, the implications for prices due to these factors are assessed, with a focus on how controls exert influence on these factors.

1. Banked Costs

Under current DOE regulations a refiner is permitted to pass through the increases in product costs and non-product costs of products that are under controls, subject to certain constraints. Increased costs not recouped during the month after they are incurred can be carried forward, (i.e., banked) for future use with certain limitations.

Jet fuels have had their own bank only since February 1, 1976, when they became a "special product" in DOE regulations. Previously they had been included in the "general refinery products" category. Both naphtha jet fuel and kerojet fuel were included in the same bank until October 1, 1976, when naphtha jet fuel was decontrolled. Since then historic data on kerojet fuels alone has been available.

Table IV-9 examines the relationship between the aviation jet fuels bank (including kerojet and naphtha jet fuel), and the total bank for the top 30 refiners. In October 1977, the bank for kerojet fuel was \$248 million and in October 1978, the bank was \$118 million for these 30 refiners, a decrease of \$130 million from October 1977 and \$33 million from the October 1976 level of \$151 million. Banks, or unrecouped costs, are drawn down as costs are recouped in subsequent months. Present pricing regulations permit (but do not require) the allocation of unrecouped kerojet costs to motor gasoline prices. DOE's available information does not reflect the proportion of unrecouped kerojet costs which was passed through to the market in kerojet prices between October 1976 and October 1978, and the proportion of these kerojet costs which was reflected in motor gasoline prices during that period.

In October 1978, two major refiners and four large independents were out of banks. This, and the decreasing size of the aviation jet fuel bank, indicates that there could be a slight upward pressure on price as the result of deregulation. The total average price for all firms selling kerojet would rise less than a half of a cent if these firms with zero or negative banks were to raise their prices to the average price of their competitors.

TABLE IV-9

UNRECOUPED AVIATION JET FUELS COSTS FOR THE TOP 30 REFINERS
(millions of dollars)

	<u>Oct. 1976</u>	<u>Oct. 1977</u>	<u>Oct. 1978**</u>
Total Bank	1,471	1,651	1,397
Aviation Fuels Bank*	151	248	118

SOURCE: Energy Information Administration, Form P-110-M-1.
Monthly Energy Review, December 1978, page 74.

* As of October 1, 1976, the entire bank relates to kerojet fuel.

** Preliminary

2. Supply/Demand

As described in the Supply Forecast, no overall shortages exist or are expected under current demand projections. There exists adequate domestic refinery capacity to meet present and projected demand for kerojet fuel without significantly increasing the level of kerojet imports. Distributional problems, in part attributed to the requirement for refiners to pass through average transportation costs in product prices in all regions, have created occasional local shortages as demand or supply patterns have changed. These temporary imbalances have recently manifested themselves primarily in certain north central and western areas. There has been little competition in that, when DFSC or the airlines solicit bids, it is very rare that response is received from other than the current supplier. There have been virtually no declarations of surplus kerojet by suppliers. Airlines, as well as their suppliers, have experienced problems in obtaining fuel for airline routes authorized by new CAB route awards. This kind of problem is most acute in the PAD IV area. Much of this situation could be attributable to supply inflexibility caused by DOE regulations, which would be removed in the event of deregulation. Some could be due to the temporary diversion of kerojet production capacity to alternate products. However, the problem of imbalance is mainly a

distribution problem which is also an indication that there are pressures for a price increase. An average price increase of one half cent per gallon should provide adequate incentive for refiners to alleviate any local shortages which could occur.

3. Nature of the Market

In January 1978, the large integrated refiners (175,000 B/D and up and who own or control 30 percent or more of their refinery feedstocks) manufactured and sold 91 percent of kerojet, the large independent refiners sold an estimated 6 percent and the small refiners sold 3 percent. Because of the current and anticipated growth characteristics in this market, it is not expected that competition for the kerojet market will show major changes. Deregulation of kerojet is not expected to affect the market structure of kerojet nor have any supply/demand impacts. The present domination of this market by major refiners is expected to continue. These market conditions should not cause prices to rise.

4. Alternate Product Value

Alternate product value has been set forth as a factor affecting kerojet prices following deregulation. The argument is that, in the absence of controls, a refiner would produce the most profitable product, so prices of less profitable products would tend to rise to the point where they were equally profitable. In evaluating this

argument, we must consider the profitability of producing kerojet as compared to the profitability of diverting kerosene to alternate uses, such as to middle distillate production.

Although kerojet fuel represents a narrow cut of the crude oil barrel, there are several products, including gasoline, naphtha jet fuel, kerosene and heating oils that are either totally or partially produced from the same portion of the barrel. All of these are, to a degree, alternates to kerojet fuel production.

Gasoline is more costly to refine than kerojet fuel. The production requires additional refining processes, including extremely costly catalytic cracking, hydrocracking, and catalytic reforming to increase octane quality.

The kerosene used in producing kerojet fuel could be poured into tanks storing distillates. It would directly increase the gallonage in those tanks and would require no change in refinery procedures or equipment. In October 1978, at the start of the most recent heating season, the average wholesale price of #2 heating oil was 38.1 cents per gallon. The average price of kerojet fuel at that time was 39.3 cents per gallon. (See Tables IV-10 and IV-11) A short-term direct predictive relationship between kerojet fuel prices and other middle distillate fuels is not immediately discernable, partly because of the different marketing and distribution systems between kerojet and its alternate products.

TABLE IV-10
HISTORIC DOMESTIC PRICE COMPARISON
(cents/gallon)

	<u>Wholesale Regular Motor Gasoline</u>	<u>(JP-4) Naphtha Jet Fuel</u>	<u>Kerosene Jet Fuel</u>
1968	11.6	10.5	10.1
1969	11.8	10.8	10.7
1979	12.3	10.6	11.1
1971	12.7	10.5	11.6
1973	12.7	10.5	11.6
1974	14.7	11.1	12.6
1975	25.5	27.2	21.9
1976	33.8	31.5	31.2
1977	38.1	35.0	35.8
1978 (October)	42.2	38.5	39.3

SOURCE: 1968-1975 motor gasoline prices from Independent Petroleum Association of America, kerojet prices from Civil Aeronautics Board and Air Transport Association, naphtha prices from Defense Fuel Supply Center. 1976-1978, DOE Form P-302-M-1

In a market where the prices of some products are controlled and others are not, if cost increases are not recoverable in controlled products, they tend to be passed to the uncontrolled products. Particularly in view of the fact that middle distillate prices have been decontrolled, a refiner could recover kerojet costs in middle distillate products. In addition, the incentive of a refiner to produce

kerojet, a product that may not provide sufficient profitability, could be reduced and refiners could have the incentive to produce alternative decontrolled products when such products have greater profitability. Thus the deregulation of middle distillates, together with the retention of controls on kerojet, has had the potential to impose a slight upward pressure on middle distillate prices and to reduce the production of kerojet and, in general, to distort relationships that would pertain in a totally free market.

Due to the close balance of supply with demand for kerojet fuel and the potential for diversion of kerosene to production of alternate products such as middle distillates, following deregulation there is a potential for upward pressure on kerojet prices which would tend to be most severe during periods of peak demand for an alternate product.

However, in light of recent price relationships, it does not appear that an imbalance exists between the price of kerojet fuel and the price of its alternate products (see Table IV-11).

5. World Price

Some studies of petroleum product deregulation argue that prices of uncontrolled domestic products could rise to the level of the "world price." The "world price" is the price of foreign product refined from foreign crude

TABLE IV-11

ALTERNATIVE VALUES OF OTHER PRODUCTS AFFECTING KEROJET PRICING

	<u>Regular Gasoline Wholesale</u>	<u>Kerosene Wholesale</u>	<u>Kerojet Sale to Airline & DOD</u>	<u>Naphtha Jet Fuel Sale to Airline & DOD</u>	<u>#2 Heating Oil Whole- Sale</u>
<u>1975</u>					
Average	34.5	31.6	29.9	28.7	30.3
<u>1976</u>					
Average	34.9	32.4	31.2	31.5	31.2
<u>1977</u>					
Jan	35.8	36.0	33.2	33.4	34.8
Feb	36.6	36.9	34.1	34.0	35.8
Mar	37.3	37.1	34.6	34.5	36.1
Apr	38.1	36.5	34.9	34.3	35.9
May	38.7	36.6	35.1	34.3	35.8
June	39.1	36.3	35.7	35.1	35.7
July	39.1	36.1	35.8	35.6	35.7
Aug	38.8	37.9	36.0	35.5	35.7
Sept	38.4	36.5	37.0	35.6	35.6
Oct	38.3	38.0	37.3	35.7	35.9
Nov	38.2	37.7	37.5	35.8	36.7
Dec	38.2	38.6	37.8	36.2	37.6
<u>1978</u>					
Jan	37.8	39.1	38.5	36.9	37.0
Feb	37.5	38.8	38.2	36.5	36.5
Mar	37.6	38.6	38.4	36.9	36.4
Apr	38.1	38.2	38.5	36.8	36.2
May	39.0	38.2	38.6	37.3	36.0
June	39.9	38.7	38.9	37.2	35.8
July	40.8	37.7	38.9	37.6	35.8
Aug	41.8	38.2	39.3	37.5	36.0
Sept	42.4	39.4	39.3	37.7	36.9
Oct	42.2	40.1	39.3	38.5	38.1

SOURCE: DOE Forms P-302-M-1 and P-112-M-1.

oil. The argument is that this product is under no price controls and therefore reflects the level that would be reached in the absence of controls.

Table IV-12 compares kerojet imports at world prices to total U.S. kerojet production. The first column shows the total volume of imports. In 1973, world priced imports (including bonded product) were approximately 26.0 percent of total U.S. supply. This percentage decreased to 8.4 percent in 1976 and 6.8 percent during the first six months of 1978, and is projected to remain less than 10 percent of the total U.S. production through 1980.

It is difficult to determine any one specific world price because prices vary widely from one foreign airport to another and because of the variety of factors affecting world prices. Nonetheless, it is possible to identify a price range. In September 1978 the difference between foreign and domestic kerojet fuel prices was about 4 cents per gallon. This approximately represents the difference between crude oil costs for domestic and foreign refiners which would exist regardless of kerojet deregulation. Therefore, world prices would appear to have to rise significantly to have an effect on unregulated kerojet prices.

SUMMARY AND CONCLUSIONS

In this section the analyses of demand, supply, prices factors, and market structure are consolidated along with

TABLE IV-12

IMPORTS OF KEROJET FUEL
(Thousands of barrels/day)

	<u>Total Imports</u>	<u>Total U.S. Production</u>	<u>World Priced Imports as Percent of Total U.S. Production</u>
1968	86	530	16.2%
1979	111	594	18.7
1970	125	597	20.9
1971	150	601	25.0
1972	162	640	25.3
1973	176	679	25.9
1974	135	641	21.1
1975	105	691	15.2
1976	62	733	8.4
1977*	50	782	6.4
1978	38	815	6.8***
1979**	24	859	2.8
1980**	38	880	4.3

* Excludes production used to build up stocks.

** Projected

*** First six months data only.

SOURCE: BOM 1968-1977 Bureau of Mines
1978-1980 FAA and ATA

DOE's findings to address the issues specified by the EPAA to support the exemption of a product from the price and allocation regulations.

Will exemption of kerojet fuel from regulation have an adverse impact on the supply of kerojet fuel or any other refined product?

DOE finds that the supply of kerojet fuel over the 1978-1980 period will be adequate and that exemption will not result in general shortages of kerojet fuel or other products. Domestic and foreign refining capacity is projected to be adequate to meet any national increases in kerojet demand. An analysis of the yields of other products, when refineries run at rates sufficient to meet kerojet fuel demand, will not impact adversely on the supply of other refined products. Furthermore, DOE finds that each sector of the industry--refiners and distributors--will continue to have access to adequate supplies of kerojet at equitable prices because of market forces created by supply/demand balances, competition, and in the case of refiners, by the DOE Domestic Crude Oil Entitlements and Buy/Sell Programs.

Will exemption result in inequitable prices for any class of user of kerojet fuel or any other refined products, and

Will competition and market forces be adequate to protect consumers following an exemption of kerojet fuel from regulations?

Changing refining costs of crude oil is one of the primary causes of price changes in kerojet fuel. Total crude oil and refiners' non-product costs are projected to increase by as much as 9.0 cents per gallon by 1980 under price control provisions. This crude oil cost increase to domestic refiners will create direct pressure for price increases among all products including kerojet, even if price controls on kerojet fuel continue, because current regulations permit refiners to recover increased crude oil costs.

The factors discussed demonstrate that only minor kerojet fuel price increases are projected as a direct result of exempting this product from controls. DOE's views as to the effects of each of these factors on prices can be summarized as follows:

Banked Costs. In October 1978, two major refiners and four large independents were out of banks. This indicates there could be some upward pressure on price as a result of deregulation. If firms with zero banks increased kerojet prices after deregulation to the level of their competitors, this could result in a slight average national price increase.

Supply/Demand. Supply of crude oil is adequate, considering the current drawdown of large crude inventories to deal with the current loss of Iranian supplies, which loss is expected to be temporary. Kerojet refining capacity, together with a normal/historic level of imports, is adequate to meet present national demand. Industry also has the

capacity to supply the modest increase in kerojet demand which DOE projects for the future.

Temporary local shortages are primarily indications of refining and marketing inflexibility but they also indicate a slight upward pressure on kerojet fuel prices. A price increase of one half cent per gallon should provide adequate incentives for refiners to alleviate local shortages.

Nature of the Market. Exemption of kerojet from regulations will not adversely affect the competitive viability of refiners and marketers. The present structure of the kerojet market is not expected to change as a result of deregulation; therefore, market structure will not generate kerojet price increases.

Alternate Product Value. The pricing of alternate products is not expected to generate significant increases in kerojet prices.

World Price. World prices are expected to have no effect on kerojet fuel prices in the event of deregulation due to the ability of domestic refiners to meet projected demands while maintaining kerojet imports as a minor portion of overall supply.

Summary and Conclusion.

Deregulation of kerojet is expected to improve the flexibility and balance of supply/demand and the market structure. It is expected that deregulation may cause a slight price increase.

CHAPTER V

IMPACT OF EXEMPTION OF KEROJET FUEL ON THE ECONOMY

Section 12 of the Emergency Petroleum Allocation Act (EPAA), as amended by the Energy Policy and Conservation Act (EPCA), requires that DOE state its views about the potential economic impacts, if any, of exempting kerojet fuel from allocation and price controls. Where practicable, these views should include:

- o State and regional impacts, including effects on governmental units;
- o Effects on the availability of consumer goods and services and the Gross National Product (GNP);
- o Effects on employment and consumer prices, specifically, the rate of unemployment, the Consumer Price Index, and the implicit price deflator for GNP.

Three major factors link the energy sector to the rest of the economy: energy prices, energy supply conditions, and energy demand conditions. Changes in these factors as a result of a change in energy regulations, are likely to produce complex impacts on the economy which are not easy to trace without the aid of econometric models of the economy.

A change in energy regulations results in both direct and indirect impacts. Direct impacts encompass the primary impacts on prices, employment, and output in the energy sector, which in turn produce impacts on GNP, total employment and the CPI through changes in aggregate demand for energy products. The indirect impacts include the secondary impacts on the prices and production of non-energy goods and services which in turn produce impacts on aggregate economic variables.

In order to capture the direct and indirect impacts of a change in energy regulations, DOE uses simulations of a number of econometric models. An assessment of these aggregate impacts starts by comparing the results of a simulation of a macroeconomic model under a "base case" to the results of a simulation incorporating the change in regulations. A change in energy regulations is injected into the model by altering the energy sector of the model. This alteration is achieved first by computing a new value for the component known as WPIO5 which is the Wholesale Price Index for fuels and related products and power using DOE's short term petroleum forecasting model. The new level of WPIO5 in turn is fed into a macroeconomic model of the U.S. via the Wholesale Price Index of which it is a component, yielding new values for such variables as the GNP price deflator, the unemployment rate, etc.

The inputs of the macroeconomic model provide inputs for other econometric models, namely, a regional income model, an industry input-output model and a household expenditure model. These models estimate, respectively, the regional, industrial, and socioeconomic impacts of changes in the energy sector.

As was concluded in earlier chapters, the deregulation of kerojet fuel is expected to have virtually no impact on the price or availability of any other petroleum product, and the impact on the price of kerojet will be a slight increase. Consequently, the value of WPI05 in the event of decontrol would be unchanged from the "base case" and there would, therefore, be no economic impact.

The aggregate economic impact of a small change in the price of kerojet fuel as a result of decontrol, would be negligible. This can be easily seen by noting that kerosene-base, commercial jet fuel has a weight of .330 in the entire Wholesale Price Index, while the WPI05 (for all fuels) has a weight of 10.707 in the entire Wholesale Price Index. In other words, kerojet fuel comprises 3.1 percent of the WPI05 and only 0.3 percent of the Wholesale Price Index. For example, a price change of one cent per gallon of kerojet fuel would have an extremely

small effect on the WPIO5 and an even smaller effect on the Wholesale Price Index. A price change of this magnitude would have an impact on the national economy which is virtually zero according to the criteria specified in Section 12 of the EPAA.

CHAPTER VI
FINDINGS AND CONCLUSIONS

This chapter states DOE's findings and views concerning the possible exemption of kerojet from the Mandatory Petroleum Allocation and Price Regulations. Section 12 of the Emergency Petroleum Allocation Act of 1973 (EPAA), which was added by the Energy Policy and Conservation Act (EPCA), requires that DOE make certain findings and express its views on a variety of matters in submitting an exemption to Congress. As indicated in Chapter I, since DOE is submitting to Congress concurrent Energy Actions exempting kerojet from both pricing and allocation regulations, the findings and views contained herein address both of the exemptions.

DOE's findings and views expressed in this chapter are drawn from the combined analyses presented in Chapters III, IV, and V. These findings and views are grouped under five general headings: (1) findings related to supply and demand, required for exemption from allocation regulations; (2) findings related to price, required for exemption of kerojet from price regulations; (3) DOE's findings that exempting kerojet from regulation will be consistent with the objectives of the EPAA; (4) DOE's views on a variety of potential impacts that must accompany

any exemption submitted to Congress, including state and regional impacts; and (5) DOE views related to the effects of exempting kerojet from regulation upon employment, the Consumer Price Index, the availability of consumer goods and services and the Gross National Product.

(1) Findings Related to Supply and Demand

In the exemption of any oil or refined product from the allocation regulations, the (DOE) must determine "...that such oil or refined product category is no longer in short supply..." [Section 12(d)(1)(A) of the EPAA]. Chapters III and IV present the DOE's examination of the supply/demand situation of kerojet. In this report, the DOE finds that kerojet is not in short supply and that anticipated supplies will be sufficient to meet the demand over the near term. Similiarly, stocks of kerojet are sufficient to meet demand surges.

The total supply of kerojet will be adequate over the 1979-1980 period, and exemption will not result in overall shortages of kerojet. With projected expansions, domestic refinery capacity, together with small volumes of imports, is expected to be adequate to meet demand. Sufficient supplies of foreign crude oil should be available, and the entitlements program will ensure the availability of equitably priced crude to all domestic refiners. An analysis of the refinery yields required to meet demand for kerojet demonstrates that refineries have the flexibility to satisfy most of the expected kerojet demand.

Any exemption must also be accompanied by a finding "...that exempting such oil or refined product category will not have an adverse impact on the supply of any other oil or refined petroleum product subject to the Act..." [Section 12(d)(1)(A) of the EPAA]. The DOE finds that exempting kerojet will not have any adverse impact on the supply of other products.

The analysis of historical supply and demand in Chapter III, and the supply and demand forecast through 1980 in Chapter IV, fully support the DOE's findings that kerojet is now, and will continue to be, in adequate supply to meet current and projected demand.

(2) Findings Related to Price

In the exemption from price regulations, the DOE must determine "...that competition and market forces are adequate to protect consumers..." [Section 12(d)(1)(B) of the EPAA]. Kerojet prices will increase as crude costs and other costs increase. Supply and demand are in balance generally and for most individual refiners and are expected to remain in balance. The industry in general is expected to maintain adequate levels of profitability, and competition is expected to remain at its current levels. The removal of controls (under which cost increases are presently being passed through to consumers or will be passed through under anticipated rule changes) will have no significant effect on prices of most refiners, although it will reduce price

pressures on some refiners that have exhausted their kerojet banks, and overall price increases resulting from exemption are not likely to exceed one cent per gallon. It is the DOE's finding, therefore, that competition and market forces are adequate to protect consumers if kerojet is exempted from regulations.

The DOE must also accompany any exemption from price regulations by a finding "...that exempting such oil or refined product category will not result in inequitable prices for any class of users of such oil or product..." [Section 12(d)(1)(B) of the EPAA]. Since only a small price increase is projected to occur as a result of exemption, and since the market structure analysis in Chapter IV indicates little change in market structure from historical patterns as a result of exemption, the DOE finds that exemption would not result in inequitable prices for any class of end-user. The market for this product has traditionally been competitive. With supply presently adequate, price increases for kerojet, solely as a result of exemption, are not expected to be significant. Competition appears to be sufficient to protect both the independent sector of the petroleum industry and consumers.

(3) Consistency with the Objectives of the EPAA

The DOE, in presenting any exemption for Congressional review, is required to support such an exemption with a finding that it is "consistent with the attainment of the objectives specified in Section 4(b)(1)" of the EPAA.

It is DOE's finding that the exemption of kerojet from the price and allocation regulations is consistent with the attainment of the objectives set forth in Section 4(b)(1) of the EPAA. Since an adequate supply is anticipated, the continued allocation and pricing of kerojet are not necessary to protect the public health, safety and welfare and the national defense [Section 4(b)(1)(A)]; the maintenance of all public services [Section 4(b)(1)(B)]; the maintenance of agricultural operations [Section 4(b)(1)(C)]; of the maintenance of exploration for the production or extraction of fuels and minerals (Section 4(b)(1)(G)]. Adequate supply and the positive effects of increased competition should insure that an exemption is consistent with the preservation of an economically sound and competitive petroleum industry [Section 4(b)(1)(D)]; the equitable distribution of crude oil, residual fuel oil and refined petroleum products at equitable prices [Section 4(b)(1)(F)]; economic efficiency [Section 4(b)(1)(H)]; and the minimization of economic distortions, inflexibility, and interference with market mechanisms [Section 4(b)(1)(I)]. An exemption should have no adverse effect on the allocation of suitable crude oil to U.S. refineries [Section 4(b)(1)(E)].

(4) DOE's Views Related to Potential Economic Impacts

Any exemption from either price or allocation regulations must be accompanied by "...a statement of the President's views as to the potential impacts (if any) of

such (exemption) amendment..." [Section 12(d)(2)(A) of the EPAA]. This section of the EPAA further specifies a number of particular views which should be included, if practicable. In this section of the report, the DOE presents views of such potential impacts, presented in the order in which they are cited in the Act.

Views on the state and regional impacts (including impacts on governmental units). Because neither supply nor demand nor price impacts are anticipated as a result of an exemption, no significant state or regional impacts are anticipated. In particular, no impact is expected on any governmental units.

Views on the effects on the availability of consumer goods and services. Assessing the potential impacts on the availability of consumer goods and services as a result of exempting kerojet involves consideration of the major uses of this product. Airlines, military aviation and general aviation are dependent on this product and account for 86 percent, 5.5 percent, and 5.5 percent, respectively, of all kerojet consumed. Since supplies of kerojet have been determined in Chapter III and IV to be adequate to meet both present demand and demand over the 1977-1980 period, it is the DOE's view that exemption will have no adverse impact on the availability of consumer goods and services.

Views on the effects on the Gross National Product.

The effect of an exemption on the Gross National Product (GNP), as determined in Chapter V, will be insignificant.

Views on the effects on competition. In Chapters III and IV, the DOE examined the market structure for kerojet and concludes that exemption of kerojet from regulation will not adversely affect the competitive viability of independent refiners and marketers.

Views on the effects on small business. Marketing of kerojet is not expected to change from present patterns as determined in Chapter IV. Only gradual increases are projected in supply or demand and only slight price increases are anticipated as a result of exemption. An exemption, therefore, would not adversely affect small business. Small refiners increased their market share of kerojet sales from 2.0 percent in 1972 to approximately 3.0 percent in 1977. These trends indicate the continued viability of the independent marketer.

Views on the effect on the supply and availability of energy resources for use as fuel or as feedstock for industry. Chapters III and IV examine the supply availability of kerojet and demonstrate that supplies are adequate to meet present demand and anticipated demand for the period 1979-1980. This supply situation is not likely to change as a result of exemption, and, therefore, the fuel and feedstock needs of industry will continue to be met following exemption.

(5) Views on Unemployment, Consumer Price Index, and
Gross National Product.

In the case of an exemption from price regulations, the DOE must analyze the effects of such exemption on "...the rate of unemployment for the United States, the Consumer Price Index (CPI) for the United State, and the implicit price deflator for the Gross National Product..." [Section 12(d)(2)(B) of the EPAA].

As explained in Chapter V, the potential impact of exemption of kerojet on the rate of unemployment, the CPI and the implicit GNP price deflator will be negligible.

SUMMARY OF FINDINGS AND CONCLUSIONS

The DOE has presented the conclusions of this report and related them to the specific provisions of Section 12 of the EPAA, which details the findings and views which must be made to exempt a refined petroleum product from DOE allocation and price regulations. On the basis of the conclusions reached in this report, the DOE believes exemption of kerojet from regulations at this time is fully consistent both with the data supporting the adequacy of supply of kerojet and with the DOE's responsibilities as specified in the EPAA, the EPCA, and the ECPA.

The DOE believes there are substantial benefits to be derived from exempting kerojet from controls. Because the regulations would no longer control conditions in the marketing and distribution of kerojet, deregulation would eliminate the inefficiencies associated with complying with the regulations and the unnecessary interference with market mechanisms. By eliminating uncertainties about the DOE's future regulatory policy, deregulation will also contribute to the likelihood of adequate future supplies of kerojet, because refiners will be more likely to make the necessary capital investment in production capacity when they are able to have more confidence in their economic forecasts regarding return on investment.

Following are further specific beneficial aspects associated with an exemption of kerojet from regulatory controls:

- o Decontrol will allow suppliers and marketers of kerojet to better serve the requirements of small businessman and the market place will be more responsive to the needs of all individuals and companies, especially with respect to servicing the needs of consumers in marginal marketing areas.
- o The substantial administrative burdens and personnel administrative costs associated with compliance with the regulations will be abolished. Reporting requirements of the current control program will be reduced with deregulation, thus moderating the attendant burdens on both the public and private sectors.