



Petroleum Refining Audit Technique Guide

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The taxpayer names and addresses shown in this publication are hypothetical.

Audit Technique Guide Revision Date: 6/1/2022

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Overview

A. Background

- (1) This section provides instructions for dealing with the many facets of the petroleum refining industry and the many processes that it employs.
- (2) Miscellaneous subjects and situations common to this industry will be considered in this section. These topics were selected because they involve transactions or situations that are not common in other industries.
- (3) Exhibits and useful examination aids have been included at the end of this section. This material was included to provide inexperienced agents with tools that can be used in the examination of a petroleum refiner. The suggested examination procedures are not mandatory but recommended for consideration. Like most industries, this one has its own “lingo”, so a useful glossary is provided in Exhibit 13.
- (4) A variety of non-IRS material can help an examiner better understand refinery operations. They include –
 - Online information of the U.S. Environmental Protection Agency (EPA), the U.S. Energy Information Administration and the U.S. Occupational Safety and Health Administration’s (OSHA) Technical Manual, Section IV: Chapter 2.
 - Books on petroleum refining written in non-technical language or for non-technical persons.
- (5) Refining (as well as petrochemical) operations are basically manufacturing operations and, as such, involve additional aspects beyond the drilling and production technology discussed in the ATG for Oil and Gas.
- (6) Refining operations may involve a relatively simple separation of components as in a topping plant or, as found in a modern large refinery, a separation of components plus the breaking down, restructuring, and recombining of hydrocarbon molecules.
- (7) In past years, domestic topping plants or skimming plants were sometimes used (*i.e.*, Farmer’s Cooperatives) to distill off light components with the sale of possibly only gasoline or diesel fuel. The residue was then subsequently processed at a major refinery to produce a full range of products. Domestic simple topping plants are a rarity today. In some foreign operations, topping plants are used to segregate rough cuts of the local crude. These cuts and virgin crude oil are then blended to produce a blend of crude suitable for sale/transportation to a particular refinery/market area depending upon the design of the refinery and/or the desired mix of finished products.
- (8) Modern large-scale refineries not only produce the normal refinery products (*e.g.*, kerosene, jet fuels, gasolines, heavy oils, etc.), but also are a source of feedstocks for the petrochemical industry.

- (9) Refiners make substantial investments to meet Environmental Protection Agency (EPA) requirements pertaining to emissions from their operations and fuel quality standards. Beginning in 1989, EPA required gasoline to meet volatility standards (in two phases) to decrease evaporative emissions of gasoline in the summer months. Upon passage of the 1990 Clean Air Act amendments, EPA began monitoring the winter oxygenated fuels program implemented by the states to help control emissions of carbon monoxide. It also established the reformulated gasoline (RFG) program which is designed to reduce emissions of smog-forming and toxic pollutants. EPA also set requirements for gasoline to be treated with detergents and deposit control additives. More recently, EPA has set standards for low sulfur gasoline and low sulfur diesel which will help ensure the effectiveness of low emission- control technologies in vehicles and reduce harmful air pollution. See [Gasoline Sulfur](#) and [Diesel Fuel Standards and Rulemakings](#). The American Jobs Creation Act of 2004 created Code Section 179B and Code Section 45H that provided tax incentives for small business refiners in complying with EPA sulfur regulations.
- (10) [Exhibit 1: Hydrocarbon Series in Petroleum](#) provides an analysis of hydrocarbon series found in crude petroleum or in intermediate/finished product streams after refinery processing.

A.1. Refinery Processes

- (1) Originally petroleum refining was a rather simple process of separating crude oil into its component parts by distillation. The fractional distillation of an average crude oil yields a relatively small gasoline fraction, with larger amounts of kerosene and gas oil. [Exhibit 2: Distillation Fractions - Typical Crude Oil](#) illustrates distillation fractions of a typical crude oil. While the temperature range for indicated fractions remains relatively constant, the percentage distilled will vary based on the specific type of crude involved.
- (2) Conversion of the higher-boiling materials into more valuable products (gasoline or petrochemical feedstocks) is essential. Conversion is partially accomplished in the cracking process by which the large paraffins are broken down to yield a mixture of smaller paraffins, olefins, etc. Such conversion enables the refiner to convert as much as 80 percent of some crude oils into gasoline (if desired) whereas, only about 20 percent could be attained by fractional distillation. In addition, the cracking and other processes not only increase the quantity of gasoline, but also the quality.
- (3) While the cracking process conversion of the heavier hydrocarbons to gasoline range hydrocarbons increases the quantity of gasoline products, the process also reflects an overall volumetric gain or increased yield. The total products produced, as a percent of feed to the unit, will reflect a 15-25 percent gain in volume (115-125 percent yield) due to the changes in gravities after cracking or hydrocracking. If refinery measurements were by weight, the yield would be approximately 100 percent.

- (4) The cracking process produces both saturated and unsaturated hydrocarbons. The distinction is based on the type of bond between the carbon atoms within the hydrocarbon molecule. Other processes are used for recombining the resulting hydrocarbons to produce finished refinery products or for separating individual products as specialty feedstocks for the petrochemical industry. Separation of component streams is accomplished by additional fractionation, absorption, or solvent extraction. Precise separation/extraction of a particular product by fractionation is not always possible due to the small difference in boiling points. While some refineries may have a “super fractionation” area producing finely defined cuts, particular product extraction is often accomplished by absorption or solvent extraction.
- (5) In addition to the cracking and recombining of the hydrocarbons, other processes are available for the rearrangement of straight-chain hydrocarbons into ring or cyclic structures, the conversion of straight-chain hydrocarbons to branched-chain hydrocarbons, the removal of hydrogen to produce highly reactive hydrocarbons with double or triple bonds and/or aromatics, and the production of complex branched molecules of the paraffinic series. Some of these processes involve shrinkage (due to changes in gravities) with volumetric yields of 75-90 percent. See [Exhibit 1: Hydrocarbon Series in Petroleum](#) for illustrations of the various hydrocarbon arrangements. The relationship or arrangement of the hydrogen and carbon can be altered in many ways, and the resulting products have distinct characteristics.
- (6) [Exhibit 3: Petroleum Refining Process Diagram](#) provides a chart depicting the petroleum refining process. A specific refinery may or may not have all of the indicated processing units, or it may have additional units (isomerization, coking, asphalt, etc.). However, the chart is illustrative of possible product flows between some processing units.
- (7) The engineering design of a refinery is based on the type(s) of crude to be processed and optimum production of products. Actual production of the amounts of specific products will fluctuate, within limited parameters, based on seasonal demands or economic market conditions (*i.e.*, a refinery designed to produce up to 60 percent gasoline may at times produce a lesser amount of gasoline with increased fuel oil production to satisfy seasonal demands, etc.).
- (8) Refinery operational flexibility is controlled by changes in individual processing unit operating conditions or by diversion of streams between units.
- Changes in operating conditions could involve an adjustment to the severity on the reformers to increase/decrease yields versus decreased/increased quality (octane number) or an increase in the temperature in the catalytic cracker to generate more olefins and ultimately more alkylate.
 - Diversion of streams could involve sending the catalytic-cracked light gas oils to be blended to furnace oil (for seasonal demands) rather than hydrocracking the total available stream, blending butylenes directly into

gasoline instead of alkylating, or diverting the higher boiling components of straight-run naphtha (reformer feed) making more kerosene/turbine fuel.

- Operational flexibility may also involve the coordination of shutting down of a single unit for repairs (turnaround), based on seasonal production demands. While a hydrocracker improves the quantity and quality of both gasoline and distillate blending stocks, its most important advantage is its ability to swing refinery production from high gasoline yields to high distillate yields. With seasonal peak production of distillates, the hydrocracker may be shut down for repairs.
 - The simplified flow diagram shows the entire hydrocrackate stream going to the catalytic reformer. In actual operations, fractionation of the hydrocrackate can produce a heavy hydrocrackate, a light hydrocrackate, and a kerosene range stream. These streams are suitable for distillate blending stocks or for upgrading to gasoline blending stocks.
- (9) In addition to the above design and operational flexibility in producing normal refinery products, the feasibility of producing petrochemical feedstocks creates other variables. The light gases from a catalytic cracker contain hydrogen, ethylene, propylene, and butylene. Separation of these components provides a design/operational stream for either alkylation or petrochemical feedstock. Catalytic reforming is a source of aromatic hydrocarbons (benzene, toluene, and xylene). Solvent extraction of aromatics from the reformate can provide a valuable petrochemical feedstock.

A.2. Petrochemical Industry

- (1) The importance/interaction of the petrochemical industry cannot be ignored when considering refining operations. The interrelationship in research, licensing/royalty fees, disposition of intermediate products, and many other items must be analyzed through contractual arrangements, joint ownerships, and trade-offs, among others.
- (2) The potential utilization of petroleum based (hydrocarbon) building blocks is tremendous. Available byproducts of cracking (ethylene and propylene) provide the principal building blocks of the petrochemical industry. Methane can be converted to ammonia and ammonia to nitric acid. Anhydrous ammonia can be commercially sold in the liquid form as a fertilizer, or the ammonia and nitric acid can be combined to provide a solid fertilizer of high nitrogen content. Another example involves the production of synthetic rubbers. Successive dehydrogenation of n-butane produces 1,3-butadiene (plus hydrogen to be used in other processes). Polymerization or copolymerization of this product provides Buna rubbers for many products including automobile tires.

A.3. Refining and Petrochemical Operations

- (1) The integrated oil and gas operator may have its own petrochemical plants and/or may be involved in petrochemicals through arrangements with third parties.

- (2) Fully integrated oil and gas operators with in-house divisions/companies for production, shipping, refining, petrochemicals, marketing, research and development, etc., provide a challenge in determining proper accounting for cross division/company operations. Research and development operations provide benefits and services to the other divisions/companies as well as development of patents, etc., available for lease or sale to third parties. Intermediate streams or product streams from one plant provide feedstock for another plant.
- (3) Refining/petrochemical arrangements with third parties may involve actual partnerships or be joint ventures with individual variable percentage ownership in the feed preparation plant(s) and the petrochemical plant(s) involved. In such integrated joint ventures, frequently an operating committee is responsible for daily operations, but has no ownership.
- (4) Particular problems encountered in such joint operations are further discussed in Section H, Joint Operations.

A.4. Catalysts

- (1) In refining/petrochemical plant processes, catalysts are frequently employed. By definition, a catalyst is a substance that hastens or retards a chemical reaction without undergoing a chemical change itself during the process. Such processes involve many substances as catalysts. Examples are acids, minerals, metals, mixed metals, metallic oxides, or halides. Metallic catalysts may be utilized in the free state (*i.e.*, gauze or sponge form) or bonded to a base material to facilitate handling or usage.
- (2) While the catalyst does not undergo any chemical change in the process, it may become inactive or ineffective after a time, due to physical abuse or buildup of impurities. Some processes include ongoing provisions for regeneration (*i.e.*, burning off of carbon buildup) of physically stable catalysts. Where precious metals are involved (platinum, gold, silver, rhenium, etc.), reclamation of any physically deteriorated catalyst is standard operating procedure. Such reclamation usually involves returning the material to the manufacturer for reprocessing with credit for the precious metal (normally, practically no operational or reclamation loss of the precious metal is experienced).
- (3) The cost of catalysts is handled in different ways according to the types of catalyst involved and the taxpayer's accounting method(s). Some taxpayers may charge the catalyst to expense when it is placed in use. Others may capitalize the initial cost and claim depreciation. In some cases, the catalyst may be rented or leased under a standard supply contract. The correct tax accounting method for handling catalysts depends on the contractual arrangements, the type of catalyst involved, and operational factors, among them operational life, recoverability, and reclamation. See Section H.2, Types of Catalysts, for further discussion of catalysts.

A.5. Inventory - LIFO

- (1) Refiners have historically used the Last-In, First-Out (LIFO) method for inventory accounting that is covered in IRC § 472 and the regulations thereunder. The “dollar value” method of pricing LIFO inventories is specifically covered in Treas. Reg. § 1.472-8.
- (2) It is beyond the scope of this manual to explain how LIFO inventory prices are calculated. However, examiners should be aware that some refiners have elected to use the Inventory Price Index Computation (IPIC) method that is addressed in Treas. Reg. § 1.472-8(e)(3). IPIC relies primarily on consumer or producer price indices published by the U.S. Bureau of Labor Statistics (BLS). The election to use IPIC may constitute a change in method of accounting under IRC § 446. See Treas. Reg. § 1.472-8(e)(3) and Rev. Proc. 2019-43, IRB 2019-48 1107 (or its successor).
- (3) LIFO inventory adjustments can affect the Adjusted Current Earnings (ACE) component in the Alternative Minimum Tax (AMT) income calculation. See IRC § 56(g)(4)(D)(iii). It should be noted that IRC § 56(g)(4)(D)(iii) was repealed by Pub.L. 115-97, Title I, § 12002(b)(8)(A), Dec. 22, 2017. 131 State. 2093.

A.6. LIFO - Definition of Items

- (1) Oil and gas taxpayers may define items in their calculation of LIFO inventory pools too broadly. Combining numerous types of crude oil or refined products into fewer items within pools for LIFO may not clearly reflect income.

Example: It was determined that a Petroleum Refiner defined LIFO items too broadly in a 2008 Field Attorney Advice, [20080401F](#).

- The Petroleum Refiner had 2 LIFO pools, one for crude oil and one for refined products.
- For the crude oil LIFO pool, the taxpayer maintained 3 items of inventory. However, the taxpayer’s books and records defined approximately 140 different stock-keeping units (SKUs) within the 3 items.
- For the refined products LIFO pool, the taxpayer maintained 12 items of inventory. However, these items were comprised of SKUs ranging from 4 to approximately 108 per item.
- Based on the facts and circumstances, it was concluded that the taxpayer’s definition of an item did not clearly reflect income because the overly broad definition could result in compensating the taxpayer for effects of artificial inflation resulting from changes in quality and/or product mix.

Crude Oil and Other Feedstock Pools

- The physical characteristics of crude oil depend on varying scales of heavy versus light crude (measured by American Petroleum Institute (API)

specific gravity) and sweet versus sour crude (measured by sulfur content).

- The price of crude oil varies with specific gravity. Lighter gravity crude oils tend to be more expensive because they tend to yield higher portions of more valuable refined products. Another factor in price is sulfur concentration. Generally, lower sulfur concentration is more desirable since refineries vary on the extent they are equipped to remove it.

A.7. Accounting Practices

- (1) There is no standard system of accounting employed by oil refineries, nor are there any prescribed examination guidelines within the industry.
- (2) In some situations, the refinery may operate as a self-contained entity preparing its own tax return or, in the case of a multinational conglomerate, feed its operational results back to corporate headquarters for consolidation.
- (3) Since refinery managers need various types of data to evaluate and control their operations, numerous types of reports and analysis are prepared using complex cost accounting techniques.
- (4) The examining agent should obtain a complete working knowledge of the accounting system prior to beginning his examination and should be cautious not to devote time to internal allocations having no tax significance.
- (5) An example of an information document request which could be used in a review of the accounting system is shown in [Exhibit 4: Illustrative Information Document Request - Accounting System](#). This exhibit also provides a list of some terms which might be of use when reviewing the cost accounting system.
- (6) A prime area of examination concern should be the proper treatment of various types of overhead/indirect expenses.
- (7) Consideration should also be given to the form of business entity under which the refinery operates. See Section H, Joint Operations, for a discussion of Joint Operations.

B. Referral and Coordination

- (1) During the course of an examination, the agent may discover items that are highly complex and unique which require the experience and expertise of a specialist examiner and/or a specialist within the industry itself. The Petroleum Industry Specialist is a good resource in such situations.

B.1. Foreign Crude Pricing

- (1) A major element in the cost of production at a refinery, and a significant source of examination potential, is the use of foreign crude oil.
- (2) Delegation Order 4-17 on Foreign Produced Crude Oil providing for service wide coordination was rescinded effective 12/01/2011. Agents should refer to

IRM 4.61.3, *International Program Audit Guidelines, Development of IRC 482 Cases.*

B.2. Cross-Border Activities (CBA)

- (1) In addition to the examination potential to be found in crude oil pricing, International assistance from a CBA examiner may be required if issues are present.

B.3. Computer Audit Specialists (CAS)

- (1) It is essential that the CAS be requested as early in the examination as possible. Consultations should also be held during the course of the examination concerning updating existing record retention agreements in view of current experiences.
- (2) Examples of possible applications which may be helpful are to be found in [Exhibit 6: Examples - Computer Application Programs](#).

B.4. Engineers

- (1) In addition to the skills of a petroleum engineer, the assistance of a general/industrial engineer may be required in the event the refinery has been involved in a major expansion or repair program. See Sections C.3, Construction Costs, D, Crude Oil Inventory, D.4, Line Fill Inventory Issue, G, Indirect Expenses – Depreciation and/or Amortization, G.6, Repairs, H.4, Depreciation, and H.7, Single Identifiable Property (SIP), for examples of other potential examination areas where engineering assistance may be needed.

B.5. Excise Taxes

- (1) Generally, an excise tax examination may be conducted as a separate examination, as part of the “package audit” requirements for an Industry case. However, excise tax consideration and examination is mandatory for the Large Corporate Compliance Program (LCC) within Large Business & International.
- (2) A review of the taxpayer’s retained copies of *Quarterly Federal Excise Tax Return*, Form 720 (Form 720), in conjunction with a “transcript” of taxpayer’s account (and in light of the examination of the taxpayer’s income and deductions per books and the income tax returns under examination) may indicate that an excise tax examination is warranted. This decision should be made as early as possible in each case so the examination work can be coordinated to the maximum extent desirable.
- (3) Review of the Form 720(s) with attachments is an important part of the examination of a taxpayer that owns or operates a refinery. The operator of the refinery may be liable for certain excise taxes.
- (4) IRC § 4081(a)(1) imposes an excise tax on certain removals, entries, and sales of “taxable fuel” defined as gasoline, diesel fuel, and kerosene. See *also* IRC § 4083(a)(1) for the definition of taxable fuel. IRC § 4041(a)(1) imposes an excise tax on any liquid other than gasoline used or sold for use in a diesel-powered

highway vehicle or diesel-powered train unless these fuels were previously taxed as taxable fuels. IRC § 4041(a)(1)(A)-(B); see also IRC § 4083(a)(2) for the definition of gasoline. IRC § 4041(a)(2) imposes an excise tax on any liquid (excluding gas oil, fuel oil, and taxable fuel), referred to as alternative fuels, used or sold for use in a motor vehicle or motorboat. See also IRC § 6426(d)(2) for the definition of alternative fuels. IRC 4042 imposes a tax on any liquid used by any person as a fuel in commercial waterway transportation known as an Inland Waterway tax.

- (5) The oil spill liability tax is an environmental tax. This per barrel tax generally applies to crude oil received at a U.S. refinery and to petroleum products entered into the U.S. for consumption, use, or warehousing. (The rate of tax per barrel varies depending on date.) The tax also applies to certain uses and the exportation of domestic crude oil. See IRC. § 4611.
- (6) The tax imposed on ozone-depleting chemicals (ODCs) is also an environmental tax. This tax is imposed on an ODC when it is first used or sold by its manufacturer, producer, or importer. The manufacturer or importer is liable for the tax. See IRC § 4681. The instructions for *Environmental Taxes*, Form 6627 (Form 6627), lists the taxable ODCs and tax rates. See also IRC §4682; Treas. Reg. § 52.4682-1.
- (7) Verification of the environmental taxes reported on the Form 6627, which is attached to the Form 720, may include review of the following items for ODCs or imported products (See IRC § 4681):
 - Identification of the source documents, chart of accounts, flowcharts, operations manual, and responsible parties involved;
 - Records of all Ozone Depleting Chemicals produced, and records of all Ozone Depleting Products imported;
 - Records of the sale, export, or use of Ozone Depleting Chemicals or Products;
 - Records to substantiate that the appropriate tax has been paid previously, including floor stocks, if applicable.
- (8) The environmental taxes deduction ledger account(s) should be analyzed and traced to source documents for a representative period. The examiner should determine that the taxable chemicals were properly classified for the appropriate tax rate, and that none of the taxable chemicals and none of the petroleum liquids were omitted from the amounts reported on Form 6627.
- (9) IRS Publication 510, *Excise Taxes*, is an excellent resource for examiners.

C. Capital Expenditures

- (1) A major area of interest in the examination of refineries and petrochemical plants is the cost basis of property. The cost basis of tangible expenditures and intangible assets is involved in the determination of amortization, depreciation,

and gain or loss on the disposition of all or part of such property.

C.1. Allocation of Acquisition Costs

- (1) In any transaction where different properties or assets are acquired, there may be the problem of allocation of the basis to the various properties or assets. In some contracts, the amount relating to each separate property or asset is stated. When stated at realistic values, the allocation problem is eliminated. However, where not stated or stated with realistic values, the acquisition of a refinery, refinery facilities, patents, processes, and know-how involves complex allocations of the purchase price to properties.
- (2) Transaction costs related to the acquisition of a capital asset should be capitalized as an additional cost of the asset and added to the basis of the asset. Transaction costs to be capitalized include facilitative costs such as commissions, consulting fees, feasibility studies, environmental impact studies, legal fees, salaries, travel, and similar costs paid or incurred in the process of investigating or otherwise pursuing the acquisition of property. For additional guidance, see Treas. Reg. § 1.263(a)-2(f) for transaction costs related to acquisitions of tangible property; § 1.263(a)-4(e) for transaction costs related to acquisition or creation of intangible property; and § 1.263(a)-5 for costs that facilitate the acquisition of a trade or business.
- (3) These transaction costs may include expenditures involved in forming a joint venture or a partnership. See section H, Joint Operations. It is noted that the cost of environmental impact studies should be distinguished from expenditures deductible under the provisions of IRC § 174. Rev. Rul. 80-245, 1980-2 CB 72 and the potential problems involving environmental impact studies are discussed in section C.4, Environmental Impact Studies.
- (4) Examiners should be aware that under MACRS the General Depreciation System (GDS) recovery period for refineries and petrochemical plants is 10 and 5 years respectively. See Asset Classes 13.3 and 28.0 in [Exhibit 12: MACRS Asset Classes Commonly Used in the Petroleum Industry](#).
- (5) Some taxpayers have asserted that certain assets located at their refineries should be depreciated using Asset Class 28.0. See [Exhibit 13: Guidance on MACRS Asset Categories for Refinery Assets](#) for guidance to examiners on this issue.

C.2. Examining Acquisition Costs

- (1) When examining acquisition costs, the examiner should verify the purchase price (or the adjusted cost basis of any property given in a like-kind exchange) of all properties acquired and consider whether taxpayer properly included additional costs that facilitated the acquisition of such property.
- (2) Verify that the allocation of the total acquisition cost to the respective assets acquired comports with current tax law. Refer to *Asset Acquisition Statement*

Under Section 1060, Form 8594 (Form 8594), if the assets appear to constitute a trade or business.

- (3) Depending on the circumstances the total acquisition costs may be allocated among property such as:
- Inventories (including pipeline “fill”), intermediate stream and finished products, warehouse equipment and parts;
 - Patents, licenses, processes, and know-how assets;
 - Equipment and plant facilities;
 - Pipeline and storage facilities;
 - Land, right-of-way, and land improvements;
 - Intangible property such as patents or “going concern value”; and
 - Environmental impact studies.
- (4) Some of the documents that should be examined for verification of acquisition costs include:
- Authorization for expenditure (AFE) records;
 - Letters of intent, offer, and counteroffer documents;
 - Minutes of executive committee meetings and directors’ meetings;
 - Settlement sheets, transaction closing documents, papers transferring the consideration and conveying title;
 - Purchase price/fair market value analysis and allocation workpapers used as the basis for recording the cost basis of the individual assets on the books,
 - Analysis of the history and the projected performance of the tangible and the intangible assets including evaluation reports, Insurance coverage, and an itemized list of assets before and after the acquisition,
 - Details for the vouchers of the original entries in the journals and ledger of accounts,
 - Chart of accounts before and after the acquisition,
 - Organizational chart before and after the acquisition;
 - General information available such as employee newsletters, reports to stockholders, reports to SEC, or news releases.

C.3. Construction Costs

- (1) Construction costs, in general, fall into three categories: initial refinery construction, expansion of refining capacity, and other improvements. In each

category construction costs may include work done by outside contractors, self-construction, or a combination of both.

- (2) Contracts with outside contractors should be reviewed to ensure that all costs itemized in the contract have been properly considered as capital expense. The agent should also verify that the items included in the construction contract are properly classified or allocated for depreciation. Engineering assistance may be required where a lump sum construction contract calls for items to be constructed which will fall into more than one category for depreciation.
- (3) The agent should verify that appropriate self-construction costs have been properly capitalized. A good examination technique, when reviewing outside contractor costs, is to inquire if the taxpayer was furnishing personnel or equipment to supervise or assist in the construction process.
- (4) When self-construction costs are encountered, the agent should ensure that the capitalized costs include the direct costs, as well as the indirect costs such as insurance, benefits, and overhead.

C.4. Environmental Impact Studies

- (1) In the oil and gas business, as with other industries, construction activities such as building pipelines, roads, canals, refineries, and industrial plants may have an adverse effect on the natural environment. Sometimes the company will spend a great deal of money conducting studies to examine the effect the construction will have on the environment. Should these costs be deductible as ordinary operating expenses, or should they be capital expenses? Any cost incurred for the acquisition, production, or improvement of property must be capitalized. In addition, any costs that facilitate the acquisition or production of property, such as environmental impact studies, should be capitalized as part of the cost of the asset acquired or produced. See Section C.1, Allocation of Acquisition Costs. However, if the study results in the abandonment of the project, the cost of the impact study may be deducted as a loss under IRC § 165 in the taxable year the taxpayer abandons the project.
- (2) In the examination of taxpayers that have had large expansions or have constructed plants that might have an environmental impact, the agent should look for costs that might not have been capitalized.
- (3) Expenditures to conduct environmental impact studies to support a company's application to expand its facilities are not research and experimental expenditures within the meaning of IRC § 174. Whether such expenses are capital expenditures will depend upon the facts of the particular case. The expenses, if not chargeable to a capital account, are ordinary and necessary business expenses deductible under IRC § 162(a). Rev. Rul. 80-245, 1980-2 CB 72 holds that the costs of environmental impact studies paid by a public utility company in connection with its application to expand its generating facilities are not research and experimental expenditures within the meaning of IRC § 174.

C.5. Patents, Processes, and Know-How

- (1) The operation of refineries and petrochemical plants often involves the utilization of numerous patents, exclusive processes, and trade secrets. During the examination of these operations, the agent should look costs of acquiring or creating these types of assets. These items are capital expenditures and, depending on the asset, may be amortized either as an amortizable section 197 intangible ratably over the 15-year period beginning with the month in which the intangible was acquired, or under Treas. Reg. § 1.167(a)-3(a) over the asset's useful life.
- (2) The purchase of these types of assets frequently will occur when other items of plant, property, or equipment are being purchased. When other items are purchased, the agent should inquire if the purchase includes any patents, exclusive processes, or know-how.
- (3) Know-how may be defined as an aggregation of data or information that is employed in a business endeavor and has the effect of providing the user with a competitive advantage over others who do not have access to, or use of, such data or information.
 - Royalty payments for the purchase or license of know-how that are contingent upon the use of (and reasonable in terms of the benefits actually derived from) licensed know-how during the year for which the payment is paid or incurred can be deducted as necessary and ordinary business expenses.
 - All other expenditures for know-how, with a few exceptions, must be capitalized. See Treas. Reg. § 1.263(a)-4(c) for examples of intangible property costs that are generally capitalized as acquisition costs.

D. Crude Oil Inventory

- (1) The inventory of refiners may include both domestic and foreign crude. See Section F.1, Foreign Crude. The domestic and foreign crude inventory may include both produced and purchased crude oil.
- (2) The acquisition of crude oil for manufacture into finished products by refiners will be either through long-term contracts of supply by domestic and foreign producers or by spot purchases of crude oil on an as needed basis. The agent should look to per unit (barrel) variances in purchase price of purchased crude, especially if acquired from related entities.
- (3) In the examination of refinery and petrochemical operations, the agent should obtain the assistance of engineers if problems are encountered in the determination of the correct value of produced crude oil that is included in the inventory of a refiner.
- (4) Crude Oil Inventory must observe all the rules of Sections 471, 472 and 263A. In the examination, the agent should obtain all required documentation to examine the refiner's calculations of Sections 471, 472 and 263A.

D.1. Blending Stocks

- (1) Finished or saleable refinery products are a blend of various refinery streams and sometimes include purchased blending stocks. The prime example is gasoline.
 - With reference to the Simplified Flow Diagram in [Exhibit 3: Petroleum Refining Process Diagram](#), finished gasoline would be variable blends of the straight-run gasoline, reformate, catalytic-cracked gasoline, thermal-cracked gasoline, alkylate, and n-butane. These individual product streams (stocks) are normally segregated in storage tanks prior to actual blending operations.
 - For a refiner without the modern processing units to produce high quality gasoline components, or one faced with the temporary shutdown of such a unit, blending stocks are frequently purchased on the open market. Blending operations and blending stocks are further discussed in Section F.3, Blended Stock and Additives.
- (2) The refiner's unfinished products inventory will normally include all produced or purchased basic stocks available for further processing or blending into finished products. The unfinished products inventory may be subcategorized to include:
 - Liquefied Petroleum Gas (LPG) Stocks
 - Gasoline Stocks
 - Kerosene and Gas Oil Stocks
 - Residual Stocks
 - Lube and Wax Distillate (Unfinished)
 - Industrial Chemicals
 - Additives
 - Catalysts

D.2. Finished Products

- (1) The refiner's finished products inventory will include all saleable products resulting from further processing and blending of unfinished stocks. Individual refineries produce different products and taxpayer's categorization and subcategorization will vary. See [Exhibit 7: Illustrative Finished Products Inventory](#) for a list of the types of goods found in product inventories.

D.3. Spare Parts and Equipment

- (1) To avoid unplanned shutdowns and to assist in performing routine maintenance, refineries normally maintain an inventory of spare parts and equipment.

- (2) The agent should examine those spare parts and equipment items that should be or are being inventoried. Items not held for resale are not inventory, and LIFO is not a permitted accounting method for such items. See IRC 1221(a)(1) (defining inventory and distinguishing inventory from capital assets.) See *also* Treas. Reg. § 1.472-1 (permitting an election to use the LIFO method of accounting when dealing specifically with inventories). Depending on the facts, expendable, rotatable, or standby emergency spare parts that are not inventory may be parts that are not inventory may be treated as incidental or non-incidental materials and supplies under Treas. Reg. § 1.162-3.
- (3) With respect to equipment, the agent should determine that proper consideration is given to investment credit and recapture of investment credit for items being placed in service or removed from service.

D.4. Line Fill Inventory Issue

- (1) As explained in more detail in Section A.1, Refinery Processes, refineries convert crude oil and intermediate feedstock into finished petroleum products by a variety of physical, thermal, and chemical separation processes. Products that have been partially refined within the refinery are commonly called intermediate products. These intermediate products also must be included in inventory. See Treas. Reg. § 1.471-1.
- (2) Examination coined the term “line fill” to describe, in one name, intermediate product volumes within the refinery. However, line fill refers to all product volumes located within piping, processing units, surge tanks, vessels, drums, boilers, cylinders, reactors, vats, kettles, hoses, and other containers used within a refinery in the process of refining crude oil and intermediate feedstock into finished products and feedstock for sale. Line fill volumes are distinct and separate amounts from the tank volumes found in the taxpayer’s storage tank farms, for both crude oil and finished products. The term “line fill” should also not be confused with the term “line pack” or “cushion gas”. Line pack refers to the volume of gas in a pipeline necessary to provide sufficient pressure to distribute gas over a large geographic area, and it is generally of uniform composition.
- (3) Examiners have observed that some taxpayers incorrectly account for line fill by:
 - Not treating any line fill as inventory.
 - Not treating the proper amount of line fill as inventory (*i.e.*, physical line fill volumes at year-end exceeds the volumes recorded for tax).
 - Treating line fill costs as deductible or depreciable.
- (4) Some taxpayers may attempt to capitalize the cost of line fill as part of the refining assets and depreciate it over the life of the refining equipment. Some taxpayers may not capture any line fill at all for tax accounting purposes, as either a separate capital asset or separate inventory item, and presumably

deduct the cost as incurred. Typical arguments from taxpayers are that line fill is necessary for the equipment to operate, or that depreciation is appropriate because of molecular changes to the petroleum product within the refinery.

- (5) Line fill represents petroleum products that are in the process of being manufactured and therefore the changes that are brought about are intentional. Depreciation allowance applies only to that part subject to, among other things, decay or decline from natural causes. See Treas. Reg. § 1.167(a)-2. The molecular changes in the crude oil and feedstocks are not brought about from natural causes, but from intentional manufacturing actions. In contrast, line fill is a direct, income-producing factor because taxpayers are in the process of manufacturing a substantially transformed product, which is being held for sale. Thus, line fill is analogous to work in process and must be included in inventory. See Treas. Reg. § 1.471-1.
- (6) Line fill represents a vast array of manufactured and work-in-process inventory items. Suggested steps by examiners include:
 - Determine if line fill volumes are captured within the existing tax inventory amounts. The refinery's tank farm inventory and line fill inventory may be held in different reporting entities so the agent should reconcile the inventory amounts down to the tank-detail level and/or reporting entity.
 - The total amount of line fill volume that actually exists within a refinery may not be properly captured in the taxpayer's inventory records. Examiners may need the assistance of a petroleum engineer to determine the types of petroleum hydrocarbons and the location and amounts of feedstocks within the refinery, as well as to identify the correct price for determining year-end inventory dollar amount.
 - The examination team should consider reviewing the taxpayer's regulatory agency filings with respect to refinery volumes. See [Exhibit 11: Regulatory Agency Filings with Respect to Refinery Volumes](#).
 - If the examiner finds discrepancies in the taxpayer's dollar or volume amount of line fill inventory, a change in accounting method adjustment under IRC § 446 with an IRC § 481(a) adjustment may be required. Examiners are encouraged to contact an Inventory Subject Matter Expert or Local Counsel in the examination of line fill inventory issues.

E. Sales and Transfers

- (1) Transactions involving disposition of raw materials, or the products of the refinery, may be reported as exchanges, transfers, or sales. Crude oil exchanges must be reported in crude oil costs using the basis of the item given up plus or minus any "boot" and related expenses of the particular exchange. Accordingly, it is necessary to distinguish an exchange agreement, a buy/sell agreement, and a true sale agreement.
- (2) Exchange agreements may exist when:

- Both sides of the agreement are stated in a single document.
 - The two agreements are negotiated simultaneously.
 - The two agreements refer to each other.
 - One side of the transaction involves a financial disadvantage sufficient that a prudent businessman would not enter into that part without the financial benefit of the other part of the agreement or agreements.
- (3) Intercompany transfers of products may be recorded at cost basis and reported in the cost of sales of the respective divisions or recorded at “arm’s-length” value and reported as a sale of products transaction. When refinery products are transferred to an intracompany division or to a related domestic company at cost, or at a stated value, the impact on the taxable income should be considered.
 - (4) Transfer of products to or from a foreign related company should be examined. The product pricing should be evaluated against the “arm’s-length” value so as to ensure that taxable income is not distorted and to ensure that the foreign tax credits are correctly determined. See IRM 4.61.3, International Program Audit Guidelines, Development of IRC 482 Cases for discussion of international issues.
 - (5) Buy/sell agreements are accounted for as “normal” purchase/sale transactions. They may involve transporting, handling, or warehousing petrochemical products. These agreements should be examined to verify what was done. Special consideration should be given to transactions near the end of the year when such agreements may be made to cover a LIFO inventory layer without physical delivery of the product. The examiner should look for identical “contra” agreements after the end of the year to offset the prior agreement. LIFO inventory issues are discussed in Section A.5, Inventory – LIFO.
 - (6) True sale agreements and buy/sell agreements involve dispositions which are not exchanges or transfers reported in the cost of sales such as crude oil or other product transactions. The area of interest for the examination of the sales accounts, in addition to the gross receipt’s reconciliation, includes the special agreements with related parties (both domestic and foreign entities) and joint venture arrangements. Potential issues may involve “arm’s-length” pricing, timing, and/or the character of the sales reported. Joint operations are discussed in Section H, Joint Operations.

E.1. Refinery Products

- (1) The refining/petrochemical products are ready for marketing at various points of the manufacturing process, including distillation, cracking, and treating. The various “split off” points in the manufacturing process are noted, in general terms, in the discussion in Section A.1, Refinery Processes.
- (2) Finished refinery products such as fuel and lubricating oil are the principal products sold. The accounting for amounts reported in gross sales of these

products should be reconciled to the sales journal or ledger. Potential issues include transfers, exchanges, or sales at less than “arm’s-length” value. The main line of petroleum finished products are illustrated in [Exhibit 7: Illustrative Finished Products Inventory](#).

- (3) Unfinished products in the manufacturing process are sometimes saleable for various uses, such as raw material for further refinery processing, blending, or as feedstock for many different manufacturing processes. The best-known market for these “intermediate stream products” is their use in the manufacture of fertilizers, synthetic rubber, and plastics.
- (4) The petrochemical manufacturing plant may be nearby or contiguous to the refinery to take advantage of the convenient source of raw material. The plant may be an intracompany or related company-owned facility. The list of divisions and/or related companies and their business operations should be ascertained from the annual report to stockholders or [SEC](#) reports. The areas of interest for examination include “arm’s-length” pricing and “timing” of the transactions reported on the return.

E.2. Miscellaneous Revenue

- (1) The operator of the refinery may realize revenue from miscellaneous sources such as:
 - Sale of steam to contiguous or nearby facilities.
 - Sale of electricity in circumstances similar to above.
 - Sale of scrap materials, equipment.
 - Sale of containers, deposit recoveries.
 - Royalties, fees, and rents from patents, know-how, catalysts, and/or facilities. This revenue should be reported as gross receipts, but some items may be included in the cost of sales or netted to an expense account.

E.3. Know-How, Patents, and Royalties

- (1) Research and development have created technology that is a vital commodity for the refining and petrochemical industries. The demand for proven processes and the utilization of patent rights is an important source of revenue. Investments in these intangible assets and a listing of the in-house developed know-how, patents, and processes should be analyzed:

- To verify the royalties and fees received from books to the return.
 - To account for additions and removals.
 - To verify the income reported from the disposition of all or an undivided interest in these intangible assets.
 - To verify that the sale/transfer to a controlled foreign corporation or other related party was correctly reported.
- (2) Rent or royalty income received for the use of intangible assets should include the value of any items or services received in exchange. Consideration should be given to the impact of the transactions involving these intangible assets on taxable income.
- (3) For patents transferred (other than by gift, inheritance, or devise) by the holder, IRC § 1235 treats the transfer as a sale or exchange of a capital asset held for more than one-year. See IRC § 1235. This special provision excludes the employer of the creator of the patent from the definition of a holder.

F. Direct Costs and Purchases - Domestic Crude

- (1) A significant cost incurred by a refiner will be the purchase of feedstock (crude oil) for the manufacturing processes of the refining operations. Acquisitions of domestic crude are from two primary sources: produced and purchased. In both instances, the acquisitions are treated as purchases, inasmuch the production of crude and purchases by the refiner are from different entities or from another division of an integrated oil company. Refer to Section D, Crude Oil Inventory, and Section A.7, Accounting Practices, if problems arise in the verification of the cost figures that are used by the refinery operating entity.

F.1. Foreign Crude

- (1) Foreign crude oil is a major source of supply for the operation of the refining complex. The agent should be alert to the fact that foreign crude oil, as a part of the raw material for the refining operations, can be from related producers and from unrelated suppliers. The acquisition of foreign crude can pose a problem for examiners. See Section B.1, Foreign Crude Pricing. A Cross-Border Activities Specialist or the Petroleum Industry Specialist can assist.

F.2. Finished Products

- (1) Also included in the cost of goods sold, more specifically as purchases, are finished products that are acquired for use in the manufacturing operations of the refining and petrochemical industry. During examination, attention should focus on inventory sections. See [Exhibit 7: Illustrative Finished Products Inventory](#) for examples of finished products.

F.3. Blending Stocks and Additives

- (1) While blending stocks and additives are used for most finished products, the best-known application involves gasoline. The two most important variables in

gasoline blending are vapor pressure and octane number. Approximate characteristics of some blending components are found in [Exhibit 8: Characteristics of Gasoline Blending Components](#).

- (2) Effective engine performance involves the vaporization of the gasoline. For handling cold starting, there must be enough volatile hydrocarbon in the gasoline to get a vapor-air mixture that will ignite. Measurement of volatility is vapor pressure. Common measurement is Reid Vapor Pressure (RVP), named after the man who designed the test apparatus.
- The RVP of gasoline must meet the extreme conditions of cold starts, normal running when warmed up, and restarting when hot. There is a direct correlation between a gasoline's ability to meet these conditions and the RVP.
 - The most suitable RVP for gasolines varies with the seasons. Cold starting in northern Minnesota's cold winters requires a gasoline with a 3-pound per square inch (psi) RVP. During the hot days of August in South Texas, cars won't restart if the RVP is higher than 8.5 psi.
 - To avoid vapor lock, gasoline RVP may be localized to accommodate local prevailing environmental conditions as the combination of high altitudes and high temperatures can cause problems.
 - A review of Exhibit 8, discussing the approximate RVP characteristics of available blending components, shows that all but one has an RVP below the usual limits of finished gasoline. Therefore, n-butane is used as the pressuring agent. Refinery production of butane, plus butane recovered from natural gas in gas recovery plants, provides an ample supply of relatively inexpensive n-butane for gasoline blending. The amount of n-butane that can be added is limited due to its high RVP.
- (3) The compression of the gasoline vapor and air in the engine heats the mixture, and it will get hot enough to self-ignite without the aid of a spark plug. Premature self-ignition produces knocking. The measurement of whether a gasoline will knock in an engine is in octane numbers. Decades ago, lead was the most common additive to improve the octane number of gasolines. The addition of tetraethyl lead (TEL) or tetramethyl lead (TML) does not affect any other properties, including vapor pressure. The mandated phase-down in the lead content of gasoline led to the introduction of unleaded gasoline and the development of other additives for octane improvements.
- The listed approximate octane numbers of available blending components. See [Exhibit 8: Characteristics of Gasoline Blending Components](#) for raw stock from the processing units. With the addition of lead or other

additives, some components are more susceptible to octane enhancement than others.

- Blending to meet octane specifications includes not only the selection of amounts of the various components, but also the octane enhancement available for each component with variable amounts of additives.
 - The octane number of straight-run gasoline is quite low for finished gasoline. The addition of butane will increase the octane number, but the amount that can be added is limited by the resulting high vapor pressure. A mixture of straight-run gasoline, butane, and other blending stocks is required to obtain the necessary vapor pressure and octane number.
 - Optimal blending of gasoline is not simple in overall refinery operations. Operational costs and seasonal availability of produced components, as well as costs of purchased components and additives, must be considered. Balancing the selection of components for both the desired RVP and octane rating requires the consideration of many alternatives.
 - Refineries utilize computers to blend finished gasoline. Online blending may involve computer selections of streams or blending components from individual processing units and/or intermediate storage tanks, as well as the input of additives.
- (4) Additives for purposes other than octane enhancement are commonly added to the gasoline blended at the refinery. In some instances, chemical inhibitors or antioxidants which delay the formation of gum in gasoline are used. Coloring dyes may be used in gasolines or fuel oils. The production of lubricating oils and grease involves the use of other additives.

F.4. Exchanges

- (1) The nonrecognition rules of IRC § 1031 apply to exchanges of like-kind property held for productive use in a trade or business or for investment. Property is of like kind if it is of the same nature or character. However, § 1031 does not apply to any exchange of stock in trade (or inventory) or other property held primarily for sale. Also, for years after 2017, § 1031 does not apply to exchanges of personal property. Therefore, exchanges of inventoriable goods constitute a taxable transaction.
- (2) Exchange contracts of inventoriable goods are normally one of three types:
- **Spot.** A one-time exchange or an exchange that is for a short period of time.
 - **Continuous Spot.** A recurring short-term contract, often seasonal.
 - **Continuous.** An ongoing, evergreen contract that may run for several years with no fixed expiration date.
- (3) Exchanges are brought about by a need for a specific product at a specific location in a desired quantity that is not available within the system of the

exchanging partner. Differentials attributable to location, handling, and grade are paid in cash and/or product.

F.5. Accounting For Exchanges

- (1) There are generally three methods used within the industry to account for exchanges as follows:
 - **Exchange Inventory Method.** Net balances due to or from exchange partners are merely added or subtracted from inventory balances with no gain or loss being realized until the ultimate sale. Although this method is prevalent in the industry, it is improper because no gain or loss is taken into account at the time of the exchange. See *also* IRC § 1001(c).
 - **Gross Purchases and Sales Method.** Each exchange receipt is treated as a purchase and each exchange delivery is treated as a sale.
 - **Net Purchases and Sales Method.** Using quantity accounting for exchange balances, end of period adjustments are made whereby favorable balances are recorded as both sales and accounts receivable, while unfavorable balances are recorded as both purchases and accounts payable. Although this method is prevalent in the industry, it is improper because it treats exchanges of inventorable goods as non-recognition transactions.

F.6. Examining Exchange Transactions

- (1) The following may be helpful in determining proper treatment of like kind exchanges under IRC § 1031:
 - Ask the taxpayer to identify all material exchanges of property.
 - Review the depreciation schedules for reductions in different classes of assets.
 - On corporate returns, Schedule M-1 or M-3 (as appropriate) should be considered for income not reported for tax purposes.
 - Annual reports to shareholders or filed with the SEC may footnote exchanges of property.
 - Scan the property ledger.
 - Ascertain the treatment of boot received by the taxpayer since boot may have been treated as a reduction in the basis of the asset received.
- (2) As noted above, § 1031 does not apply to the exchange of inventorable goods. When examining such exchanges consider the following:

- Ascertain the accounting treatment used by the taxpayer in accounting for exchanges and treatment of any boot received.
- Ascertain if the taxpayer has consistently followed the accounting method currently being used.
- Review year-end exchanges to identify possible exchange contracts entered into to protect LIFO inventory layers. Such exchange contracts would normally involve a reversal after year-end. The potential for abuse is greater in those instances where one exchange partner uses the exchange inventory method and the other exchange partner uses the gross purchases and sales method. In this instance, both taxpayers can, under their method of accounting for exchanges, include the same goods in physical inventory.
- When proposing a change in method of accounting under IRC § 446 for a taxpayer using the exchange inventory method when accounting for exchanges, consult IRC § 481 and Treas. Reg. § 1.481-1 regarding required adjustments resulting from such a change.
- Ensure that taxpayers using the net purchases and sales method are treating favorable exchange balances (inventory items owed by the taxpayer treated as both sales and accounts receivable) consistent with unfavorable balances (inventory items owed to others treated as both sales and accounts payable).
- Taxpayers using the exchange inventory method can experience instances when quantities deliverable under exchange contracts exceed actual inventory amounts. This can have a material impact depending upon the LIFO pools used by the taxpayer since the LIFO inventory must be adjusted for the “negative” inventory.
- Ascertain if periodic adjustments have been made to adjust exchange balance accounts through sales or purchases. Periodic adjustments are a suggested accounting treatment in COPAS Bulletin No. 17, section 10 entitled, Crude Oil Trading. However, for taxpayers using the LIFO method for valuing inventory this treatment is improper for tax purposes. See TAM 8043017 (July 23, 1980).

F.7. Utilities

- (1) Most large refineries distribute utility costs in their internal cost accounting systems. Their controls may involve a distribution to the various processing units as well as between utilities (fuel for steam generation). Many of the smaller refineries do not distribute or allocate utility expenses, and they control their utility operations through operational reviews and budgetary analysis.
 - With ever-increasing costs, economic operations dictate the effective and efficient use of utilities. In many locations where utility costs are allocated, the initial distribution of utility costs is based on metered volumes. In some

instances, a refiner may use meters, estimates, engineering standards, or a combination of these three methods.

- Electricity is normally purchased from a public utility company with some standby electrical generating capacity for emergency purposes.
- Natural gas may be purchased for intermediate use.
- Refinery operations require considerable amounts of steam, and steam generating units are to be anticipated. Frequently, where refinery or petrochemical operations are contiguous, the steam generating unit in one plant will supply steam to all plants involved. With single ownership of all plants, no sale or exchange of steam is likely involved, thus there are no apparent tax consequences. With separate/variable ownership of multiple plants, however, a sale or exchange of steam may be involved. The contractual agreements and the allocated costs for steam should be reviewed under appropriate circumstances.

F.8. Filter Materials

- (1) Filtering materials are used in the production of petroleum products to remove impurities. The agent should verify that unconsumed filtering materials are inventoried at yearend. See Section F.2. Finished Products, concerning the treatment of this item in inventory.

F.9. Labor and Employee Benefits

- (1) Labor and applicable benefits of the employees directly related to the manufacturing operations of the refining industry are among the costs attributed to the finished product. The entity being examined will normally maintain cost accounting records that accumulate all factors of costs that are component cost factors of the finished product. The agent should obtain these workpapers and verify all direct cost factors of the finished product are included.

G. Indirect Expenses - Depreciation and/or Amortization

- (1) Since depreciation is a major area of expense, the examiner should review the appropriateness of the deduction and consider obtaining the assistance of an engineer.
- (2) Certain incentives impact the depreciation computation and/or provide tax credits. See Sections G.9 through G.12.

G.1. Modified Accelerated Cost Recovery System (MACRS) Problem Areas

- (1) Taxpayers may not use the applicable depreciation method and recovery period provided in IRC § 168(b) and (c), respectively, under General Depreciation System (GDS), for recovery property used predominantly outside the United States. Recovery property used predominantly outside the United States must

be depreciated under the Alternative Depreciation System (ADS). IRC § 168(g)(1)(A).

- (2) Whether property is used predominantly outside the United States is determined under Treas. Reg. § 1.48-1(g). Examiners should verify the following:
 - The taxpayer's property classes are correctly designated, including recovery property used predominantly outside the United States.
 - The applicable percentage for the recovery deduction is consistent with the ADS for property predominantly used outside the United States.
- (3) Refiners should use Asset Class 13.3, Petroleum Refining, for depreciation purposes. Class 13.3 has a General Depreciation System (GDS) recovery period of 10 years and a class life of 16 years. An issue exists where some refiners may propose to change their method of accounting for depreciation under IRC § 446 for certain assets used in petroleum refineries to Asset Class 28.0, Manufacture of Chemicals and Allied Products. Class 28.0 has a GDS recovery period of 5 years and a class life of 9.5 years. See Rev. Proc. 87-56 (Oct. 19, 1987). This issue could also exist for the misclassification of new asset additions. See [Exhibit 13: Guidance on MACRS Asset Categories for Refinery Assets](#) for guidance on this issue which recommends the following two positions:
 - All processing assets involved in the activity of petroleum refining are to be included in MACRS Asset Class 13.3. This would include any incidental manufacturing or waste removal processes, which are integral parts of petroleum refining.
 - Where the taxpayer is engaged in more than one industrial activity, the activity of each asset's primary use should be used for classification.
- (4) ADS must be used for certain property. See IRC § 168(g). ADS generally requires using the straight-line method (without regard to salvage value), the applicable convention under IRC § 168(d), and a recovery period based on the class life of the asset. See IRC § 168(g)(2). Examiners should look for two types of refinery assets:
 - Any tangible property which during the taxable year is used predominantly outside the States. For foreign nonresidential real property ADS is used with a recovery period of 40 years, see IRC § 168(g)(2)(C)(iv), and
 - Any tax-exempt bond financed property. Examiners have found that refiners occasionally receive tax-exempt financing for construction of

equipment to process low-grade fuel supplies but fail to use the ADS method. See IRC § 168(g)(5).

G.2. Patents

- (1) The petroleum refining and petrochemical processes involve the use and development of high technology involving patents and patent rights. The taxpayer may obtain rights to a patent by either purchasing such patents, paying royalties to the patent's holder, or by obtaining a patent for processes developed in-house.
- (2) A patent or a patent right is an intangible asset. The accelerated methods of depreciation under IRC § 168 generally may not be used for patents. Generally, the purchase price and facilitative costs of acquiring a patent are amortizable over either (1) the remaining life of the patent, Treas. Reg. § 1.167(a)-6, (2) a shorter period if it can be estimated with reasonable accuracy, Treas. Reg. § 1.167(a)-3, or (3) as an amortizable section 197 intangible. The method in which the patent is obtained will help determine the method its costs can be recovered. The straight-line method of depreciation is normally used for a patent, but other methods not expressed in term of years may be utilized when appropriate for a patent recovered under I.R.C. § 167. See Treas. Reg. § 1.167(a)-14(c)(4).
- (3) Royalty payments usually extend over the remaining life of the patent rights obtained. Payments over a period substantially shorter than the life of the patent rights obtained may indicate a lease purchase agreement is involved.
- (4) The in-house development of patent rights may include research and experimental expenditures deductible under the provisions of IRC § 174. The cost basis of a patent subject to depreciation includes not only the purchase price but the costs of government fees, drawings and models, materials and labor allocated to perfecting it, attorney fees and the cost of clearing the legal title. Treas. Reg. § 1.167(a)-6(a).
- (5) If the patent is recovered under I.R.C. § 167, and it becomes valueless in any year before its expiration, the unrecovered cost may be deducted in that year. Treas. Reg. § 1.167(a)-6(a).
- (6) Areas of interest in the examination of patents and patent rights include:

- The review of the taxpayer's beginning of the year and end of the year record of patents and patent rights.
- Has taxpayer properly capitalized the costs of the patents?
- Does taxpayer claim excessive depreciation?
- Does taxpayer pay excessive royalties or fees to a controlled foreign corporation (CFC) or related party that may require the application of the provisions of IRC § 482?
- Does taxpayer sell patents in the ordinary course of business? The sale or exchange of patents is discussed in Section E.3, Know-How, Patents and Royalties.
- Has taxpayer transferred a patent to a CFC or other related party which may be reported as long-term gain in error?

G.3. Catalysts

- (1) The various types of catalysts used in the petroleum refining and petrochemical processes include some with a nominal cost and some that are extremely valuable. An overview of the accounting treatment, the identity of, the status of, and the use of catalysts in the refinery processes is included in Section A.4, Catalysts, Section H.2, Types of Catalysts, and Section H.3, Accounting Treatment.
- (2) In most instances, the metal in the catalyst is not consumed, does not lose its identity, and very little, if any, is lost in the refining process. It is not subject to wear and tear, to decay, to exhaustion, or obsolescence. As such, it is not of a character subject to the allowance for depreciation under IRC § 167 and IRC § 168. See Rev. Rul. 2015-11, I.R.B. 2015-21.
- (3) Precious metals in the catalyst that are lost in the refining process or otherwise unrecoverable for reuse is property subject to wear and tear, exhaustion, or obsolescence. Thus, it is of a character subject to the allowance for depreciation under IRC § 167 and IRC § 168. These costs, in addition to the "other capitalized costs" constitute the "depreciable basis" of the catalyst. "Other capitalized costs" include such items as the frame, screen, bedding, freight-in, commissions and fees related to the acquisition of catalysts, and related costs to bring the catalyst to that point in time when it is ready to be placed in service. See Rev. Rul. 2015-11, I.R.B. 2015-21.
- (4) The following are some of the factors to review for examination:
 - The Schedule M (*Reconciliation of Income Per Books with Income Per Return*) amounts should be examined for any unusual deductions claimed on the return, but not deducted in the books, that may involve catalyst depreciation.
 - The catalyst expense included on the return (identified in the tax workpapers, working trial balance, or other document) should be

compared to the monthly book amount for catalyst depreciation, royalties, rents, or any unusual expenses.

- Taxpayer's internal controls for catalysts, and the asset accounts for the inventory of catalysts, should be reviewed together with the title records and agreements for royalties and rent expenses.
 - Tax workpapers for the analysis of the inventory of catalysts, such as the date acquired, whether owned or leased, and the depreciation computation detail, should be examined.
- (5) The problem areas for the examination of depreciation deductions for catalysts include the following:
- The costs may be deducted in error.
 - The acquisition costs and expenditures to bring the catalyst to that point in time when it is ready to be placed in service may be deducted in error.
 - The cost of economically recoverable precious metals (and in some cases, the cost of nonprecious metals) may be included in depreciable basis in error.
 - Determining the appropriate amount of previous metal that is ultimately recoverable for reuse vs. the amount that is not recoverable for reuse.

G.4. Certified Pollution Control Facility

- (1) Petroleum refining and petrochemical processing may involve various measures to abate or control water or atmospheric pollution or contamination. A taxpayer may elect to deduct the amortizable basis of any certified pollution control facility over a 60-month period. See IRC § 169(a). This 60-month amortization period may be extended to 84 months for any atmospheric pollution control facility placed in service after April 11, 2005. See IRC § 169(f)(5).
- (2) A "certified pollution control facility" must be certified by the Federal certifying authority. See IRC § 169(d); Treas. Reg. § 1.169-2(a)(1). The Federal certifying authority shall not certify any property to the extent it appears that, by reason of estimated profits to be derived through the recovery of wastes or otherwise in operation of such property, its costs will be recovered over the useful life of such property. See IRC § 169(e); Treas. Reg. § 1.169-2(d)(1).
- (3) The deduction of the amortizable basis of certified pollution control facilities are subject to recapture to the extent of any gain on the sale of the facility. See IRC § 1245(a)(3)(C).

G.5. Overhead

- (1) Overhead items are those costs necessary for production which cannot be conveniently traced to a specific unit of finished product.

- (2) The cost accounting system groups all such individual items together or applies them to products through the use of some allocation method and base.
- (3) An improper choice of the method or base may distort income through an erroneous inventory valuation.
- (4) Examiners should carefully review overhead allocations to ensure the taxpayer is complying with the uniform capitalization rules of IRC § 263A. Treasury Regulations §§ 1.263A-1 through 1.263A-3 set forth the guidelines for these rules and should be reviewed.
- (5) Consideration should also be given to the impact of Treas. Reg. § 1.861-8, regarding the computation of taxable income from sources within the United States, on overhead allocations.
- (6) Commonly accepted accounting terminology to use in analyzing overhead is provided in [Exhibit 5: Classification of Costs](#).
- (7) A good source of examination leads might be cost of production reports. An example of the contents of a cost of production report is shown in [Exhibit 9: Cost of Production Report](#).

G.6. Repairs

- (1) Refinery repairs are normally very substantial due to the nature of refining processes. Examination focus on the most substantial amount items is recommended.
- (2) Amounts may not be deducted as repair or maintenance costs if they are for improvements to a unit of tangible property. Amounts paid or incurred for improvements are required to be capitalized under Treas. Reg. § 1.263(a)-3. When analyzing whether refinery repairs are capital expenditures, examiners should apply the “Plant Property” rules contained in Treas. Reg. § 1.263(a)-3(e)(ii).
- (3) For tangible real or personal property other than buildings, Treas. Reg. § 1.263(a)-3(e)(3) defines a unit of property (UOP) as all the components that are functionally interdependent. Under this “functional interdependence test,” components are functionally interdependent if the placing in service of one component by the taxpayer is dependent on the placing in service of another component by the taxpayer. However, if the non-building property is comprised of “plant property” or “network assets,” a taxpayer must conduct further analysis to identify the UOP.
- (4) For plant property (*i.e.*, machinery or equipment used to perform an industrial process, such as manufacturing, generation, warehousing, distributions, automated materials handling, or other similar activities), the UOP is determined by first applying the functional interdependence test and then dividing the functionally interdependent property into each component (or group of components) that perform a discrete and major function or operation within

such functionally interdependent property. See Treas. Reg. § 1.263(a)-3(e)(3)(ii)(B).

- (5) In determining whether an amount is paid for an improvement to a unit of plant property, another important inquiry is whether the expenditure is for the betterment to the unit of property, the restoration of a unit of property, or adapting the unit of property to a new and different use. See Treas. Reg. §§ 1.263(a)-3(j), (k), and (l) for detailed rules for applying these criteria.
- (6) Under Treas. Reg. §§ 1.263(a)-3(k)(1)(vi) and (k)(6), amounts paid to restore a unit of property include amounts paid for the replacement of a part or combination of parts that comprise a major component or a substantial structural part of a UOP. A major component is further defined under Treas. Reg. § 1.263(a)-3(k)(6)(i)(A) as a part, or combination of parts, that performs a discrete and critical function in the operation of the UOP. An incidental component meeting this criterion will not, by itself, constitute a major component. Thus, once the taxpayer identifies the appropriate UOP, to apply the restoration criteria for improvements, the taxpayer may have to complete further analysis of the UOP by identifying its major components and determining whether a component is incidental.
- (7) Taxpayers may also claim deductions under the safe harbor for routine maintenance under Treas. Reg. § 1.263(a)-3(i). Routine maintenance for property other than buildings, such as plant property, includes the recurring activities that a taxpayer expects to perform as a result of the taxpayer's use of the unit of property to keep the unit of property in an ordinarily efficient operating condition. In cases where taxpayers claim deductions under the routine maintenance safe harbor, examiners should review Treas. Reg. §§ 1.263(a)-3(i)(1)(ii) and (i)(6) for more detailed requirements and examples.
- (8) For the treatment of removal costs, see the rules and examples under Treas. Reg. § 1.263(a)-3(g)(2). Examiners should contact the DCE Practice Network to obtain internal guidance regarding petroleum industry upstream and downstream units of property for purposes of applying Treas. Reg. § 1.263(a)-3.
- (9) Refinery repair accounts normally have a large volume of activity. Due to this large volume of activity, it is often an area well suited for the use of statistical sampling methods to detect misclassified items. Because of the technical nature of refinery assets, however, the assistance of an IRS engineer is beneficial.

G.7. Turnarounds

- (1) The term "turnaround" in the context of refining refers to a period of time that the refinery is shut down to perform preventive maintenance. The agent should expect to see a large portion of the yearly repair expense incurred during this brief interval of time. Depending on the process unit impacted and the amount of maintenance or repair needed, the length of turnaround time can range from one to four weeks or even longer.

- (2) During turnarounds, the taxpayer may also make some capital improvements, *i.e.*, exchanging old equipment for new equipment, adding new units, etc. Even though the primary purpose of the turnaround is to perform preventive maintenance, capital expenditures may be incurred simultaneously.
- (3) When analyzing whether refinery turnaround expenditures are capital expenditures, examiners should apply Treas. Reg. § 1.263(a)-3 as discussed in Section G.6, Repairs, of this ATG.

G.8. Royalty and Licensing Fees

- (1) The task of successfully operating refineries and petrochemical plants necessitates the use of various royalty or licensing arrangements. During the examination, the agent should be alert to the payment of these fees. Such payments may be to related entities and if so, the contracts requiring their payment should be analyzed for arm's-length pricing. The contracted arrangements for the payment of these fees are usually related to units of throughput or units of production.
- (2) The payment of royalty or licensing fees become obvious and are more likely to occur when acquisition, construction, and/or expansion of plant facilities is undertaken. The agent should be alert to any advance payments of these fees that would be payable on future production as throughput in the manufacturing processes of the refining and petrochemical plants.

G.9. Tax Incentives for Refining and Use of Renewable Fuels - IRC §§ 179B, 45H, and 179C

- (1) Beginning with tax year 2003 certain tax incentives for refining and use of renewable fuels were added to the Internal Revenue Code. These incentives include:
 - IRC § 179B - Deduction for Capital Costs Incurred in Complying with Environmental Protection Agency Sulfur Regulations
 - IRC § 45H - Credit for Production of Low Sulfur Diesel Fuel
 - IRC § 179C - Election to Expense Certain Refineries

G.10. IRC § 179B

- (1) *Deduction for Capital Costs Incurred in Complying with Environmental Protection Agency (EPA) Sulfur Regulations*, IRC § 179B. This provision permits small business refiners to claim an immediate deduction for up to 75 percent of the qualified costs, with respect to any facility, paid or incurred to comply with the EPA's Highway Diesel Sulfur Fuel Control Requirements. IRC § 179B was created by the American Jobs Creation Act of 2004.
- (2) A small business refiner is defined under IRC § 45H(c)(1) as a refiner of crude oil that employs 1,500 or less individuals engaged in the refinery operations of the business on any day during the taxable year, and whose average daily

domestic refinery run, or average retained production for all facilities, for a 1-year period ending on December 31, 2002, did not exceed 205,000 barrels.

- (3) Qualified costs are defined in IRC § 45H(c)(2) to include expenditures for the construction of new process operation units or the dismantling and reconstruction of existing process units to be used in the production of low sulfur diesel fuel, associated adjacent or offsite equipment (including tankage, catalyst, and power supply), engineering, construction period interest, and sitework.
- (4) Where a small business refiner's average daily domestic refinery runs for the 1-year period ending on December 31, 2002, exceeds 155,000 barrels, the percentage of costs allowed as deduction under IRC § 179B(a) is reduced.
- (5) The basis of any property must be reduced by the portion of the cost of such property taken into account for purposes of this deduction. See Temp. Reg. § 1.179B-1T(e) and Prop. Reg. § 1.179B-1, for further guidance on this basis reduction.
- (6) The provision is effective for expenses incurred after December 31, 2002. As a result, examiners will need to be alert for potential claims that may be filed for tax years ending after this date.

G.11. IRC § 45H

- (1) *Credit for Production of Low Sulfur Diesel Fuel*, IRC § 45H. This section provides a general business credit with respect to any facility of a small business refiner equal to 5 cents for each gallon of low-sulfur diesel fuel produced during the taxable year that complies with EPA's Highway Diesel Fuel Sulfur Control Requirements. IRC § 45H was created by the American Jobs Creation Act of 2004.
- (2) The total production credit claimed by the taxpayer cannot exceed 25 percent of the qualified costs incurred with respect to any facility to comply with the EPA's Highway Diesel Fuel Sulfur Control Requirements, reduced by the aggregate credits claimed for all prior taxable years with respect to such facility.
- (3) To obtain the credit, the taxpayer must secure certification within a specified time period that the taxpayer's qualified costs with respect to such facility will result in compliance with the applicable EPA regulations under the procedures of IRC § 45H(e).
- (4) The provision is effective for expenses incurred after December 31, 2002 and ending on the earlier of the date that is one year after the date on which the taxpayer must comply with the applicable EPA regulations or December 31, 2009.

G.12. IRC § 179C

- (1) *Election To Expense Certain Refineries*, IRC § 179C. Under present law, petroleum refining assets are depreciated over a 10-year recovery period using

the double declining balance method. Under this IRC § 179C a taxpayer may elect to expense 50 percent of the cost of qualified refinery property. Any cost so treated is allowed as a deduction for the taxable year in which the qualified refinery property is placed in service. The remaining 50 percent is recovered under present law. IRC § 179C was created by Energy Policy Act of 2005 and extended by the Energy Improvement and Extension Act of 2008.

- (2) In general, “qualified refinery property” means any portion of a qualified refinery that is located in the United States that:
- Is designed to serve the primary purpose of processing liquid fuel from crude oil or qualified fuels if such property is placed in service after August 8, 2005, and on or before October 3, 2008; or
 - Is designed to serve the primary purpose of processing liquid fuel from crude oil, qualified fuels, or directly from shale or tar sands if such property is placed in service after October 3, 2008, and before January 1, 2014.
- (3) Specific rules regarding the property include:

Rule	Date Placed in Service
original use commences with taxpayer	after August 8, 2005, and before January 1, 2014
meets all applicable environmental laws in effect	placed-in-service date
increases the capacity of an existing refinery by at least 5 percent or which increases the percentage of total throughput attributable to qualified fuels such that it equals or exceeds 25 percent	not a factor
with respect to the construction of which there is a binding contract	in the case of self-constructed property, the construction of which began after June 14, 2005, and before January 1, 2010

- (4) In the case of any portion of a qualified refinery, the production capacity requirements under IRC § 179C(e) must be met to be considered “qualified refinery property”. The increased capacity requirements refer to the output capacity of the refinery, as measured by the volume of finished products other than asphalt and lube oil, rather than input capacity as measured by rated capacity. Capacity under this requirement is determined as of the date the property is placed in service. Any reasonable method may be used to determine the appropriate baseline for measuring capacity increases and to demonstrate and substantiate the required increase in capacity.

- (5) The expensing election is not available with respect to identifiable refinery property whose primary purpose is for use as a topping plant, asphalt plant, lube oil facility, crude or product terminal, or blending facility or is built solely to comply with consent decrees or projects mandated by Federal, State, or local governments. For example, a taxpayer may not elect to expense the cost of a scrubber, even if the scrubber is installed as part of a larger project, if the scrubber does not increase throughput or increased capacity to accommodate qualified fuels and is necessary for the refinery to comply with the Clean Air Act. This exclusion applies regardless of whether the mandate or consent decree addresses environmental concerns with respect to the refinery itself or the refined fuels.
- (6) A taxpayer may not claim a deduction under IRC § 179C for any taxable year unless it makes a valid election under IRC § 179C(b). Such election is made for the taxable year the qualified refinery property is placed in service and filed no later than the due date for the taxpayer's Federal income tax return for such taxable year. The taxpayer must also file a report with its election containing the required information specified in Treas. Reg. § 1.179C-1(f).
- (7) Effective Date: The provision is effective for property placed in service after August 8, 2005, the original use of which begins with the taxpayer, provided the property was not subject to a binding contract for construction on or before June 14, 2005.

H. Joint Operations

- (1) The petroleum industry has a long history of using joint operations as a vehicle for its activities. The basic premise involved in the examination of joint operations is the classification of the organization as a partnership, an association taxable as a corporation, or merely as tenants-in-common.
- (2) A tenants-in-common arrangement usually involves the mere co-ownership of property that is maintained, kept in repair, and rented or leased with no operations involved. Such an arrangement is not a separate entity for Federal tax purposes. See Treas. Reg. § 301.7701-1(a)(2).
- (3) The participants in joint operations are pooling their resources, know-how, and services for the purpose of sharing the risk and the potential economic rewards. The operator of the refinery may be involved in several different joint operations.
- (4) The construction of plants for further manufacturing of refinery products frequently involves joint operations. The refinery products that constitute resource material for fertilizers, chemicals, plastics, etc., may be the subject of the joint construction of a plant and/or the joint operations of such a plant or facility. The instruments governing the joint operations provide authority for the construction and/or the management of the facility, the conduct of the operations, and the division of the profits and losses, or the delivery of the plant products.

- (5) Occasionally, the participants organizing the joint operations as tenants-in-common for sharing expenses, etc., find that, in fact, they meet the standards requiring the organization to be recognized as a partnership. Under certain circumstances the participants may qualify to be excluded from the provisions of Subchapter K of the Code regarding the requirement to file partnership returns. See IRC § 761(a). The most common organization formed in a joint operating arrangement is the partnership entity. See IRC § 7701(a)(2).

H.1. Areas of Interest in Examination of Joint Operations

- (1) If a partnership return has been filed, the control of the returns of the participants should be inaugurated as early as possible in the examination process so the determination may be uniformly applied, and the statute of limitations protected.
- (2) If a partnership return has not been filed, information reports should be disseminated as early as possible in the examination to ensure uniform application of the determination of a potential issue and to protect the statute of limitations.
- (3) Does the co-ownership arrangement constitute an “association” taxable as a corporation under IRC § 7701(a)(3) because it is a business entity that has filed an election to be treated as an association under § 301.7701-3?
- (4) If the joint operations qualify as a “partnership,” have the partners made an election under IRC § 761(a) to be excluded from the provisions of Subchapter K?
- (5) Do the partners jointly sell services or products produced or extracted which may negate the election under IRC § 761(a) to be excluded from Subchapter K?
- (6) Does the partnership have “startup” expenditures that should be capitalized under IRC § 195?
- (7) Are the organization expenditures properly capitalized?
- (8) Do any of the partners have losses allocated to them in excess of their adjusted basis in the partnership per IRC §§ 704(d) and 705?
- (9) Does the operator of the refinery engage in any activity described in IRC § 465(c) subject to the at-risk rules in IRC § 465?

H.2. Types of Catalysts

- (1) As discussed in Section A.4, Catalysts, many substances are used as catalysts. The royalty or licensing agreement for use of a particular type processing unit may also include an agreement for use of the designer’s catalyst or any subsequently developed catalyst for the unit. The catalyst may be purchased or rented from parties other than the designer/licenser of the processing unit. The refiner may design its own processing unit and manufacture its own catalyst or purchase/rent the catalyst on the open market.

- (2) It is not feasible to establish guidelines based on the type processing unit or on the content of the catalyst alone. Similar processing units will utilize different catalysts in different refineries. Sometimes the catalyst in a particular unit will be switched to a new improved variety. The catalyst for a particular process at one installation may involve precious metals while at another installation the precious metals are absent. One installation of a particular type process may use a liquid catalyst while another installation uses a solid catalyst with differences in operational factors. Analysis based on catalyst content alone is insufficient, as operational factors often are more indicative of proper accounting treatment.
- (3) As shown in [Exhibit 10: Suggested Techniques for Examining Catalyst Accounts](#), the named processing units are indicative of the type of process involved. For each type of process, there are different licensed processes available with variables in type of catalyst, type of reactor, method of regeneration (if applicable), method and timing of catalyst recharging, and other processes.
- (4) Particle size of solid catalyst varies by the type of operation. In fixed bed reactors, the catalyst stays put in a chamber (reactor), and the hydrocarbon flows through or is dribbled through the catalyst. An extended residence time is usually found where fixed bed reactors are involved. Frequently, there are several reactors, and a cyclic operation is involved. Where regeneration is involved, several reactors may be on stream (processing the hydrocarbons) while others are in a regeneration cycle (burning off the carbon) or in a recharging cycle. The size of the catalyst in fixed bed reactors is larger than in moveable bed reactors.
- (5) With moveable beds, both the hydrocarbon and the solid catalyst flow through the reaction chamber. In catalytic cracking, after a very short residence time, the mixture is separated with the catalyst circulated to the regeneration chamber. The type of catalyst is generally bead or particle.
- The beads are approximately 1 to 1/4 inch in diameter and extremely porous to provide extensive reaction surface area. The small size permits movement through the chambers. Beads are not now as acceptable, as particles are more effective.
 - The particles are much smaller and have the appearance of fine sugar or baby powder. The particle type (it also is very porous) is now more prevalent due to its fluidity. If the particles are placed in a container and the container is tilted or shaken, they react just like a fluid (liquid). The nomenclature, fluid catalytic cracker, is with reference to particle type catalysts. This type cracker utilizes the enhanced fluidity/mobility for internal movement of the catalyst through the reactor, regenerator, or other component.
- (6) One example of the use of liquid catalysts is in alkylation units where the catalyst is usually sulfuric acid or hydrofluoric acid. The mixture of hydrocarbons

and acid is pumped through a battery of chilled reactors to provide an extended residence time. The mixture then moves to a vessel (acid settler) where no mixing takes place, and the acid and hydrocarbons separate like oil and water. As the acid circulates through the process, it gets diluted with water and picks up tar. As the acid concentration declines, it is partially drawn off, and it may be sent back to the acid supplier for reformation (purification). Internal regeneration of the catalyst is not found in this type of process. The partial withdrawal of a diluted catalyst, with additions of a fresh catalyst, is an ongoing operation. It should be noted that some alkylation units utilize a solid catalyst, rather than a liquid catalyst.

- (7) The reclamation costs for some catalysts may be so great, in relation to the original purchase price, that they are dumped when their effectiveness declines. Some catalysts may be used up in the manufacturing process in one way or another, even though they do not enter into the reaction itself.
- (8) The use of catalysts is also involved in petrochemical operations. The production of ammonia provides an example of the extensive use of catalysts in the petrochemical field. As seen in the above formula, ammonia contains one-part nitrogen and three-parts hydrogen. In many installations, the source of the nitrogen is air, and the source of the hydrogen is methane gas. The liquefaction and separation of nitrogen from air does not involve a catalyst. A mixture of methane and steam flow through furnace tubes packed with a catalyst to produce a stream of hydrogen, carbon dioxide, steam, and carbon monoxide. This stream then flows through a vessel packed with a catalyst for shift conversion of the carbon monoxide to carbon dioxide (with the generation of additional hydrogen). The produced hydrogen is separated and proportionately mixed with the nitrogen for conversion to ammonia. Such conversion requires high pressure and a catalyst. If the subsequent production of nitric acid is involved, a catalyst is also involved.

H.3. Accounting Treatment

- (1) There are often tax accounting inconsistencies in proper capitalization, depreciation, or treatment when catalysts are involved. The internal accounting instructions and procedures for catalysts (for unit cost accounting or financial accounting) of different companies vary. However, an understanding of general internal accounting procedures may be helpful in clarifying the treatment of catalyst costs. An understanding of a particular taxpayer's internal accounting procedures is essential in the agent's examination of the taxpayer.
- (2) In most cases, a company will have specific procedures when catalysts with precious metals are involved. This is due to the significant costs involved and the arrangements for reclamation with credit for the precious metal(s). A single processing unit may require several million dollars' worth of such catalysts.

- The precious metal content alone may comprise 50-65 percent of the total cost of such catalysts. The balance of the total cost would be the manufacturer's production fee, freight, and sometimes a royalty fee.
 - When the catalyst is purchased, the total cost may be charged to a prepaid inventory account. Later, when the catalyst is issued to the process unit, a cost may be capitalized and amortized for internal unit cost accounting purposes or deducted as a current expense. The amortized cost may be the total cost, or it may be a net cost (total cost, less original metal cost or less salvage value of the metal and projected reclamation costs).
 - Some companies may maintain the original charge in inventory on an indefinite basis and expense/amortize only the replacement quantities.
 - It should be noted that some refiners may own excess quantities of the precious metal itself or of such catalysts, and they are sometimes rented to other companies.
- (3) While those metallic base catalysts without precious metals are less costly, in many instances the cost is still substantial. As such, with reclamation and credits for spent catalysts, the nonprecious base metal(s) may require the same treatment as precious metal(s).
- (4) Beyond special procedures for precious metals, some companies will (for unit cost accounting purposes) segregate catalysts based on operational differences: those that are used in quantity each month or those that are used in quantity every 12-24 months or a further extended period.
- Monthly utilization (make-up) might be found at some cracking units or alkylation units. Some of the catalyst is regularly partially withdrawn and is either reclaimed, sold at its salvage value, or junked. The original charge of such catalysts is normally capitalized to the cost of the processing unit and amortized (for unit cost purposes) over the useful life of the unit. The reason for such treatment is that there always is an equivalent amount of catalyst in the unit. The net cost of a fresh catalyst added (make-up) is normally expensed. Some refiners may expense the original charge for unit cost purposes.
 - Extended utilization, without significant make-up between recharges, might be found at a reformer where the catalyst may have an effective life of 12-18 months and only small quantities are added between turnarounds. At the end of the operating period, the entire catalyst charge is removed and either reclaimed or sold for its salvage value. For unit cost accounting, some companies may expense the initial charge, as well as any subsequent additions. Others may amortize the initial charge over the life of the unit or over the effective life of the catalyst itself. From a unit cost accounting viewpoint, the preferable method would be to amortize the net cost (after crediting the cost for the salvage value of the spent

material) over the effective life of the catalyst itself. With complete replacement at turn- arounds, the amortization of the initial charge over the life of the unit is illogical for unit cost accounting (i.e., complete replacement at 12 months versus a unit life of 15 years).

- It should be noted that some catalysts have an effective life of many years before recharging is required.
- (5) Proper accounting for catalysts must include coordination of the amount capitalized, the appropriate life, the accountability of reclamation credits, and treatment of sales proceeds or salvage value of spent catalysts.

H.4. Depreciation

- (1) Section G.3, Depreciation and/or Amortization – Catalysts provides general information on depreciation of catalysts.
- (2) [Exhibit 10: Suggested Techniques for Examining Catalyst Accounts provides some useful examination techniques for catalyst accounts.](#)
- (3) It is not feasible to provide guidelines for a specific processing unit or specific catalyst. However, with some understanding of how catalysts are used and with a review of the taxpayer's internal product cost accounting, the examiner should be able to properly resolve any problem areas. Engineering assistance is available for resolving questionable areas.
- (4) Petroleum refiners use precious metal-bearing catalysts to improve the chemical processes employed in the manufacture petroleum products. Because of harsh operating conditions in the process units the effectiveness of catalysts degrade over time. The refiner must eventually regenerate or replace the catalyst. At that time some portion of the precious metal used in the original fabrication of the catalyst can be recovered.
- (5) Revenue Ruling 2015-11 addressed whether the capitalized cost of unrecoverable precious metal that is used in various manufacturing processes depreciable under IRC §§ 167 and 168. The Facts section of the ruling contains the following:
- *Situation 2.* *B* is a petroleum refiner. As part of its refining process, *B* uses a catalyst called prills, fabricated from platinum and other chemicals. Based upon engineering studies performed by *B*, *B* determines that approximately 10 percent of the platinum initially utilized to fabricate prills is lost over the course of the platinum's reasonably expected useful life in the refining process. The remaining 90 percent of the platinum is recoverable and becomes available to *B* for other uses. *B* capitalizes the cost of the platinum.
- (6) The Analysis section stated in part:
- In Situation 2, approximately 10 percent of the platinum is lost over the course of its expected useful life and is not recoverable for reuse.

Accordingly, approximately 10 percent of the platinum will undergo exhaustion, wear and tear, or obsolescence over a determinable useful life. To the extent that the platinum will be lost and is not recoverable for reuse (i.e., approximately 10 percent of the total amount), *B* may depreciate the capitalized cost of such platinum under §§ 167 and 168. To the extent that any of the platinum is recoverable for reuse (i.e., approximately 90 percent of the total amount), *B* may not depreciate the capitalized cost of such platinum.

- (7) Examiners should review Revenue Ruling 2015-11 in its entirety. An IRS engineer should be consulted if depreciation of precious metal catalyst is material.

H.5. Extraordinary and Casualty Losses

- (1) Refineries are prone to have fires and explosions occasionally due to the inherent nature of refining operations and the highly volatile nature of the products involved.
- (2) The agent should check local publications, company news items, annual reports, and SEC filings for such losses.
- (3) If an extraordinary loss has occurred in a year under examination, the agent should determine if there has been a write-off concerning the casualty loss.
- (4) Any casualty loss claimed should be verified to determine that the write-off is limited to the property lost in the casualty and that proper consideration has been given to potential insurance recoveries. Treas. Reg. § 1.165-7(b) prescribes that the deductible casualty loss is the lesser of the amount of the loss (as determined per the two methods in Treas. Reg. § 1.165-7(a)(2)) or the amount of the adjusted basis of the property involved. The two methods for determining the amount of the loss are generally:
 - competent appraisal of the change in fair market value before and after the casualty, and
 - the cost of reasonable repairs to return the damaged property to the condition prior to the casualty. Refer to Treas. Reg. § 1.165-7(a)(2) for more detail.
- (5) The casualty loss may involve lawsuits and damages of property owned by unrelated parties. The agent should check for contingency reserves which have been set up for the possible liability resulting from the casualty.

- (6) Two of the more disputed issues with casualty losses are:
- the interplay of IRC § 162 and IRC § 165 for casualty repair expenses, and
 - single, identifiable property (“SIP”) related to the basis limitation. Both are discussed below.

H.6. Interplay of IRC § 162 and IRC § 165 for Casualty Repair Expenses

- (1) Regarding utility and telecommunications taxpayers that claim casualty losses, examiners should be aware of the rules for casualty losses contained in the Treas. Reg. § 1.263(a)-3(k)(4). In general, Treas. Reg. § 1.263(a)-3(k)(4) of the regulations provide that a taxpayer must capitalize amounts paid for the restoration of damage to a unit of property for which the taxpayer is required to take a basis adjustment as a result of a casualty loss under section 165 or relating to a casualty event under section 165
- (2) However, the amount that must be capitalized under this rule is limited to the excess, if any, of the adjusted basis of the single identifiable property (SIP) for determining the loss allowable on account of a casualty over the amount paid for restoration damage to the UOP that also constitutes an improvement under any other provision of § 1.263(a)-3(k)(1) (the other restoration “tests”). In other words, casualty-related restoration costs are required to be capitalized up to the amount of basis reduction of the SIP taken as a result of the casualty loss or casualty event.
- (3) If there are casualty-related restoration costs paid in excess of the adjusted basis of the SIP (after reducing this amount for other capitalized restoration costs), the excess amount must be analyzed under the other improvement criteria to determine if those amounts should be treated as repairs or as capital improvements. If any part of the excess represents amounts that would otherwise be considered an improvement under other provisions of the regulations, this part must be capitalized, regardless of the adjusted basis of the SIP. If any part of the excess represents amounts that would otherwise be treated as repairs, this part may be deducted. If the adjusted basis of the SIP is more than the total restoration expenses, then all restoration costs are capitalized under the casualty loss restoration rule.

- (4) See Treas. Reg. § 1.263(a)-3(k)(7) for the following casualty-related restoration cost examples:
- Ex.3) Restoration cost less than SIP basis - cost capitalized;
 - Ex. 4) Casualty loss covered by insurance – cost capitalized;
 - Ex. 5) Restoration cost exceeds SIP basis – cost in excess of basis allowed as a repair deduction.

H.7. Single Identifiable Property (SIP)

- (1) IRS examiners have experience with the SIPs used by taxpayers. An IRS Directive issued June 19, 2009, provides guidance to the field in determining the SIPs that may be used by an electric utility for its transmission and distribution properties, in calculating its casualty losses under IRC § 165. Some taxpayers have designated their entire utilities transmission and distribution system or their entire telecommunication system as the SIP.
- (2) The rationale of the “single, identifiable property” rule is to arrive at a logical, reasonable, and practical unit for valuation and accounting purposes, while preventing the borrowing of basis from unharmed property, without segregating the damaged property into artificially small subunits. In making these determinations, the field should consider the specific facts and circumstances of the taxpayer, taking into account the factors utilized by the courts as summarized in TAM 200902011 (Jan. 9, 2009).

- (3) Factors listed in TAM 200902011 to be considered in determining a SIP include:
- whether the unit chosen is reasonable in relation to the nature and scope of the casualty;
 - whether it reflects all the physical damage caused by the casualty;
 - whether it remains constant and identifiable for tax purposes, and has a cost or adjusted basis that is not changed except by elimination of an asset or by injection of capital;
 - whether it is consistent with the taxpayer's other tax accounting practices;
 - whether it is accounted for and identifiable as a unit for non-tax accounting purposes;
 - whether it is a unit whose utility derives from its functioning as a whole;
 - whether it is separately treated for operational and management purposes;
 - whether it is a commercially segmental unit likely to be bought or sold as such; and
 - whether it is consistent with industry practice.
- (4) For casualty losses involving damages to refinery assets, an IRS Engineer should be consulted in determining the appropriate SIP and the adjusted basis of those assets.
- (5) Most refineries are comprised of a mixture of very old assets that are fully depreciated and newer assets with substantial remaining basis. Examiners should pay particular attention to taxpayers that are "borrowing basis" from assets not involved in the casualty by proposing an inappropriately large SIP. For example, it would be inappropriate to treat an entire refinery as the SIP even though the damage is limited to older assets that are not functionally related to the new assets. Nearly all refineries have redundancy for important assets, and often operate with substantial assets out of service for maintenance.

H.8. Abandonments and Discontinued Operations

- (1) Examiners should ensure that any deductions for property claimed to be worthless are valid.
- (2) Examiners should ascertain whether the plant has actually been closed permanently or is merely being placed on a standby basis. This can often be determined in the following ways:

- A review of corporate minutes or other internal documents should ascertain who authorized the shutdown or abandonment.
 - A review of maintenance expenses could disclose extensive maintenance not normally present in an abandoned plant.
 - Contacts with local taxing authorities will often provide data as to any changes in assessed valuation of property in question.
- (3) In the event the taxpayer claims the loss as a result of suits brought by environmental groups or agencies, the examiner should ascertain the status of pending appeals.
 - (4) Examiners should insure that property held to be abandoned is not being offered for sale.
 - (5) When facilities are shutdown (abandoned or placed on standby) and the expensive catalysts are recovered, was proper tax accounting treatment given to the recovery and disposition of such catalyst?
 - (6) Examiners should also be certain to review Schedule M for any possible differences between book and tax treatment.

H.9. Fines, Penalties, and Settlements

- (1) Fines and penalties can be common in the oil and gas industry because of the nature of operations, especially for refineries. Most commonly, they are due to violations of federal, state, and local laws, including EPA regulations on atmospheric emission or discharge into waterways or groundwater. However, they can also be due to violations of [OSHA](#) safety rules and violations of OSHA-approved workplace safety and health programs operated by individual states and U.S. territories. The upstream segment could have fines or penalties related to underpaid oil and gas royalties from production on federal or Indian lands, for failure to permit an audit and for submission/ maintenance of false, inaccurate, or misleading royalty reports. An “upstream segment” includes production and exploration activities such as creating geological surveys, obtaining land rights, and onshore and offshore drilling, while a “downstream segment” includes activities related to refining and marketing of oil and gas.
- (2) The Tax Cuts and Job Act, P.L. 115-97, section 13306, amended IRC § 162(f). Effective for amounts paid or incurred on or after December 22, 2017, IRC § 162(f) disallows all chapter 1 deductions for amounts paid to, or at the direction of, a government or specified nongovernmental entity for the violation of any law or incurred pursuant to a court order, settlement agreement, or otherwise to, or at the direction of, a government, governmental entity, or nongovernmental entity treated as a governmental entity with respect to the violation of any law, or with respect to the investigation or inquiry into the potential violation of any law.
- (3) On January 19th, 2021, the IRS issued final regulations to implement the TCJA amendments to IRC § 162(f). See Treas. Reg. § 1.162-21, T.D. 9946, 86 FR

4970-01. In general, the final regulations apply to tax years beginning on or after January 19, 2021 provided the amounts paid or incurred were pursuant to a suit or agreement that became binding on or after that date. The final regulations do not apply to amounts paid or incurred pursuant to a suit or agreement that became binding under applicable law before January 19, 2021, determined without regard to whether all appeals have been exhausted or the time for filing an appeal has expired.

- (4) **NOTE:** IRC § 162(f), as amended by TCJA, applies to amounts paid or incurred on or after December 22, 2017 even if the final regulations do not apply because the amount paid or incurred was pursuant to an order or agreement entered into before January 19, 2021.
- (5) The deduction disallowance rule of TCJA IRC § 162(f) does not apply to
- Amounts identified in the order or agreement, and established by the taxpayer, as restitution (including remediation of property) or paid to come into compliance with the law;
 - Restitution for title 26 taxes excluding federal income taxes;
 - Private party suits in which no government or governmental entity is a party; and
 - Taxes and related interest.
- (6) To be excepted from the general rule prohibiting deductions under TCJA IRC § 162(f), an amount must be **identified** and **established** as **restitution or paid to come in compliance with the law**.
- **Identification Requirement** -- A court order or an agreement must identify a payment by stating the nature of, or purpose for, each payment each taxpayer is obligated to pay and the amount of each payment identified. The identification requirement is met if an order or agreement specifically states the amount of the payment and that the payment constitutes restitution, remediation, or an amount paid to come into compliance with a law. If the order or agreement uses a different form of the required words (such as "remediate" or "comply with a law") and describes the purpose for which restitution or remediation will be paid or the law with which the taxpayer must comply, the order or agreement will be treated as stating that the payment constitutes restitution, remediation, or an amount paid to come into compliance with a law. Similarly, if an order or agreement specifically describes the damage done, harm suffered, or manner of noncompliance with a law and describes the action required of the taxpayer to provide restitution, remediation, or to come into compliance with any law, the order or agreement will be treated as stating that the payment constitutes restitution, remediation, or an amount paid to

come into compliance with any law. For further information, see Treas. Reg. § 1.162-21(b)(2)

- **Establishment Requirement** -- The establishment requirement is met if the taxpayer, using documentary evidence, proves the taxpayer's legal obligation, pursuant to the order or agreement, to pay the amount identified as restitution, remediation, or to come into compliance with a law; the amount paid or incurred; the date the amount was paid or incurred; and that, based on the origin of the liability and the nature and purpose of the amount paid or incurred, the amount the taxpayer paid or incurred was for restitution or remediation (as defined in 1.162-21(e)(4)(i) or to come into compliance with any law (as defined in § 1.162-21(e)(4)(ii)). For further information, see Treas. Reg. § 1.162-21(b)(3).
 - **Amounts for restitution or remediation** – An amount is paid or incurred for restitution or remediation if it is paid or incurred to restore, in whole or in part, the person; government; governmental entity; property; environment; wildlife; or natural resources harmed, injured, or damaged by the violation or potential violation of any law to the same or substantially similar position or condition as existed prior to such harm, injury or damage. For additional information, see Treas. Reg. § 1.162-21(e)(4).
- (7) Taxpayers may not deduct amounts paid or incurred to reimburse the government or a government entity for the costs of any investigation or litigation.
- (8) Under IRC § 6050X and the related regulations, if the aggregate amount the payor is required to pay pursuant to the order or agreement equals or exceeds \$50,000, the governmental or governmental entity must file an information return. In the information return, the government or governmental entity reports the total amount required to be paid as a result of the order or agreement, the amounts to be paid for the violation or potential violation of the law, the amount to be paid as restitution or remediation, and the amount to be paid to come into compliance with the law. In general, the reporting requirement under IRC § 6050X applies to amounts to be paid or incurred pursuant to orders or agreements entered on or after January 1, 2022. Information report is due by February 28 (or by March 31 if filed electronically) of the year following the calendar year in which the order or agreement becomes binding.
- (9) **PRIOR LAW** -- For amounts paid or incurred by a taxpayer before December 22, 2017, former IRC § 162(f), in effect prior to the TCJA amendments, applies. Thus, for these amounts, Examiners should refer to prior law, the regulations prior to the amendment of § 1.162-21 addressed above, and applicable case law. The general rules under prior law are summarized in the bullets below:

- For amounts paid or incurred before December 22, 2017, former IRC § 162(f) provided that no deduction shall be allowed under IRC § 162(f) for any fine or similar penalty paid to a government for a violation of law.
- Under prior law, a fine or similar penalty for which a deduction was prohibited generally included any amount paid or incurred (1) pursuant to a conviction or a plea of guilty or nolo contendere in a criminal proceeding; (2) as a civil penalty imposed by Federal, State or local law; (3) paid in settlement of the taxpayer's actual or potential liability for a fine or a penalty (civil or criminal); or (4) forfeited as collateral posted in connection with a proceeding which could result in imposition of such a fine or penalty. However, compensatory damages were not considered fines or penalties under the prior law and were therefore deductible. In contrast, amounts paid for punitive purposes were not deductible under prior law.
- For amounts paid or incurred under prior law, Examiners must determine whether a taxpayer's settlement payment was for compensatory or punitive purposes. For these purposes, examiners should look to the origin and character of the liability giving rise to the payment. *Bailey v. Commissioner*, 756 F.2d 44, 47 (6th Cir. 1985); *Ostrum v. Commissioner*, 77 T.C. 608 (1981); *Middle Atlantic Distributors v. Commissioner*, 72 T.C. 1136, 1144-45 (1979). If the law is designed to compensate the injured party for its damages, former section 162(f) was likely to be inapplicable. See, e.g., *Mason and Dixon Lines, Inc. v. United States*, 708 F.2d 1043, 1047 (6th Cir. 1983) (liquidated damages for violating state truck weight limits were compensatory based on the structure and language of the relevant provision). If the law is designed to be punitive or to deter the type of conduct committed by the taxpayer, then the payment is likely covered by former § 162(f). See, e.g., *True v. United States*, 894 F.2d 1197, 1205 (10th Cir. 1990) (amounts paid for violating the Federal Water Pollution Control Act were penalties because "on balance" the civil penalty provision served "a deterrent and retributive function similar to a criminal fine").
- Under the "Origin of Claim Doctrine", examiners should first look to the underlying statute to see if its purpose is punitive or remedial. Legislative history can provide guidance. If a statute is both punitive and remedial or compensatory, or if the lawsuit covers both statutes, then the examiner should obtain and review the settlement agreement. If the settlement agreement is not clear on penalties, requesting the original complaint from the taxpayer may provide clarity. If no lawsuit was filed, then review all the facts and circumstances through documents, testimony, or substantiating material. The burden is on the taxpayer to support any amounts deducted as compensatory. See *Talley Indus. v. Comm'r*, T.C. Memo 1999-200.

H.10. Obtaining Case Documents from DOJ and EPA

- (1) IRS subject matter experts liaise with the U.S. Department of Justice (DOJ) for False Claims Act (FCA) cases or EPA attorneys to obtain documents pertaining

to litigation and settlement agreements. Examiners can search the intranet for current contacts for these agencies and request assistance in obtaining documents not otherwise provided by the taxpayer. Persons who violate FCA are subject to a mandatory penalty for each false claim and liable for treble damages – three times the actual damages.

(2) For FCA cases settled by the DOJ, certain procedures apply:

- The subject matter expert makes the initial request to the DOJ. Then the expert provides the examiner the DOJ attorney contact so specific follow-up and details about the penalties and settlement agreement can be obtained.
- A Financial Management Information System (FMIS) report may be requested which shows the DOJ's disbursement of funds received from the taxpayer to various federal agencies and regulators. In royalty cases, the report may not be as helpful in determining how much of the settlement amounts were single or multiple.

Exhibits

A. Exhibit 1: Hydrocarbon Series in Petroleum

- (1) Paraffin Series (Saturated). The “type formula” is C_nH_{2n+2} and the suffix is “-ane.” Distinguished by having single bonds between the carbon atoms.

<i>Examples</i>	Type formula
Methane	CH_4
Ethane	C_2H_6
Propane	C_3H_8
Butane	C_4H_{10}
Pentane	C_5H_{12}
Hexane	C_6H_{14}

- (2) Isomers of Paraffin Series

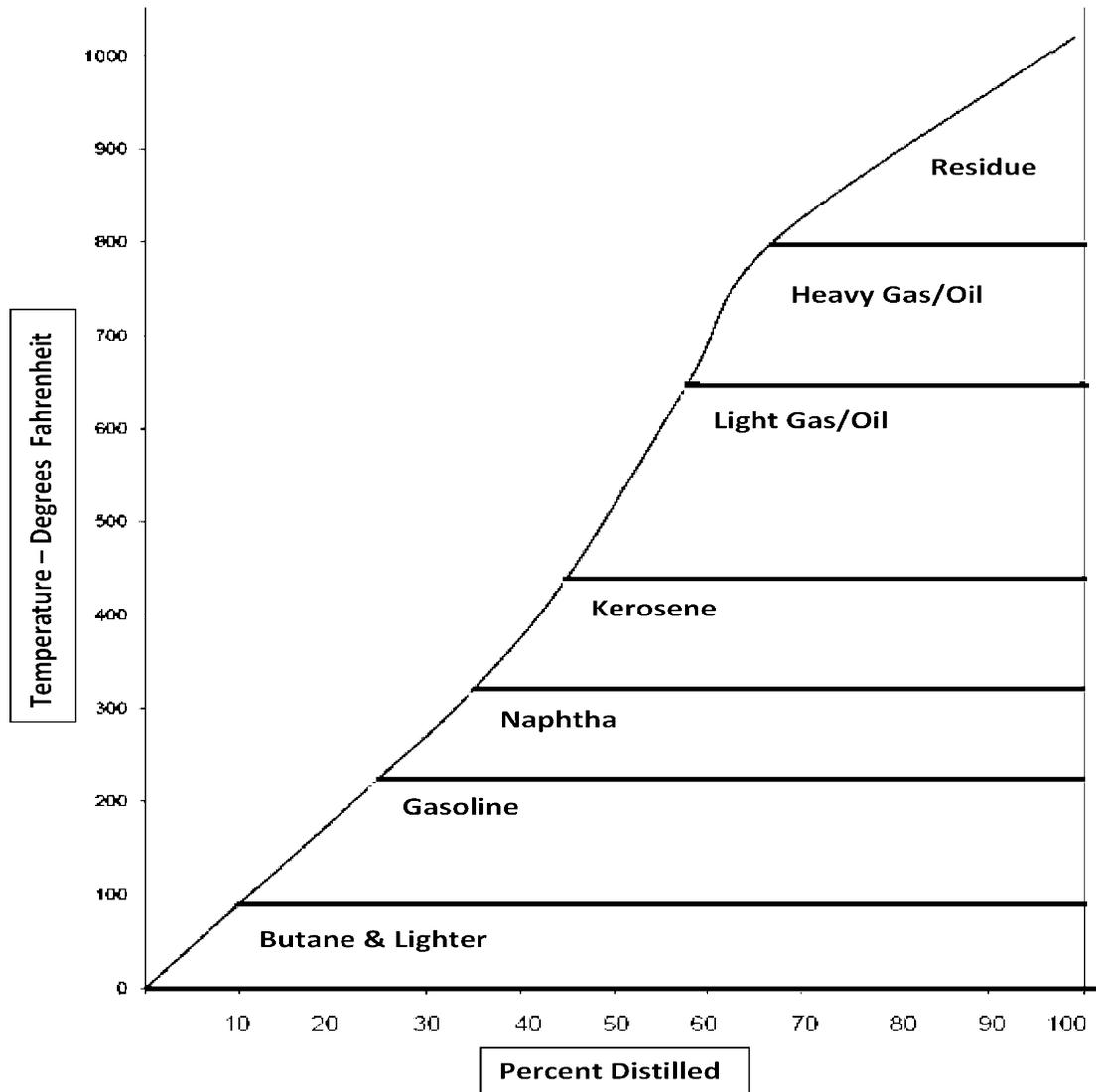
- Starting with the formula C_4H_{10} the carbons may be arranged either in a straight chain, or in a branched chain. The straight chain is designated as normal butane (n-butane) and the branched chain as isobutane. These compounds have entirely different physical properties as well as different chemical (reactive) properties. The number of possible isomers increases rapidly as the number of carbon atoms in the hydrocarbon molecule is increased (i.e., three pentanes, five hexanes, nine heptanes, eighteen octanes, etc.).

- (3) Olefin (Ethylene Series Unsaturated). The “type formula” is C_nH_{2n} . The suffix is either “-ene” or “-ylene.” Distinguished by having a double bond between carbon atoms.

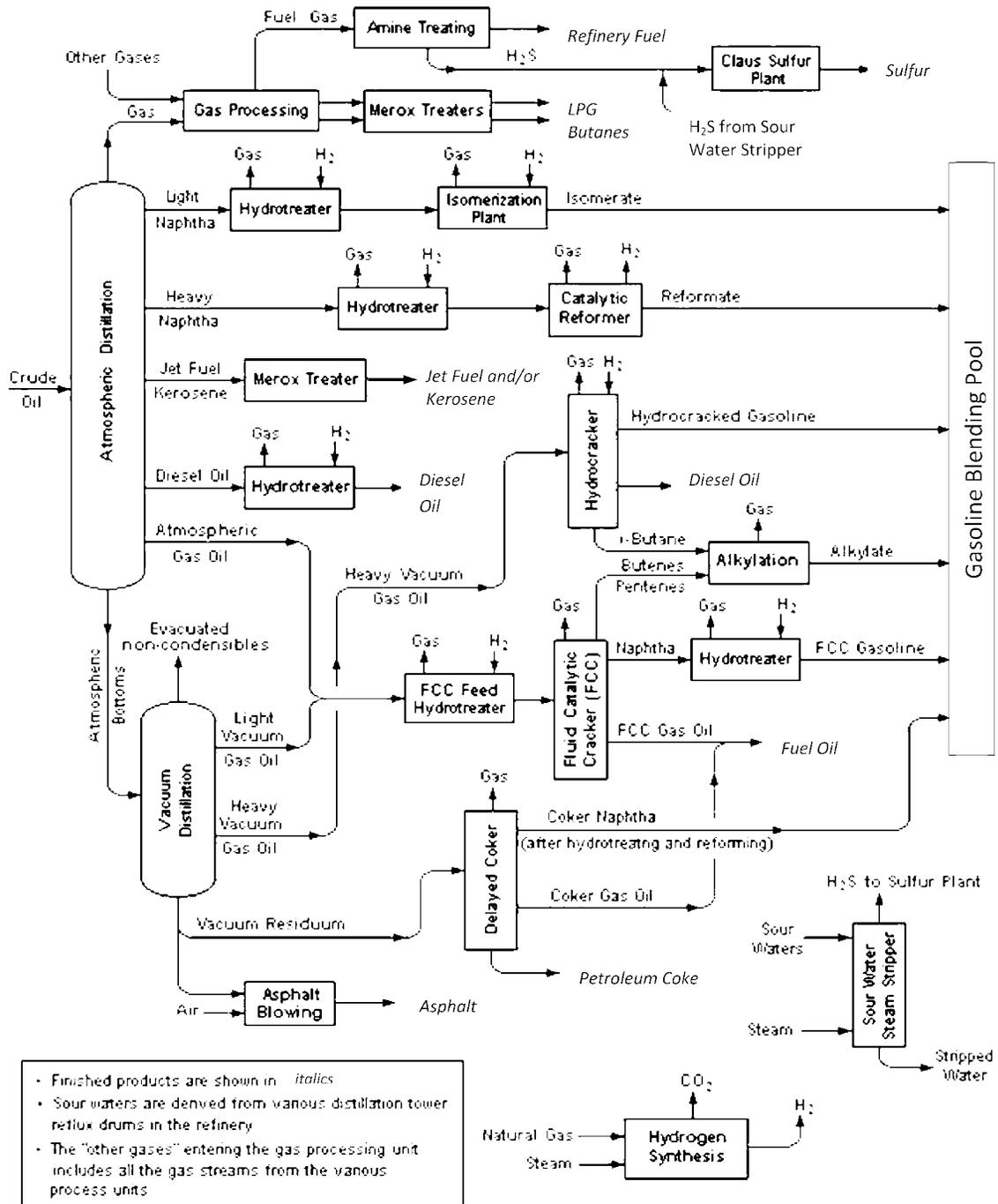
<i>Examples</i>	Type formula
Ethene (Ethylene)	C_2H_4
Propene (Propylene)	C_3H_6
1-Butene (Butylene)	C_4H_8
2-Butene (Butylene)	C_4H_8

- (4) Napthene Series (Saturated). The “type formula” is also C_nH_{2n} . The suffix is either “-ene” or “-ylene.” Also called “cycloalkane” or “cycloparaffin.” The carbon atoms are arranged in a structure containing a single ring (possibly with side chains), and all of the carbon-carbon bonds are single.
- (5) Aromatic (Benzene) Series. The “type formula” is C_nH_{2n-6} . The suffix is “-ene.” Common refinery ones are benzene, toluene, and xylene.
- (6) Diolefin (dienes) Series (Unsaturated). The type series is C_nH_{2n-2} . The most important one is butadiene. Contains two double bonds between carbon atoms.
- (7) Acetylenes (Highly Unsaturated). Also called alkynes. There is no type formula. Suffix is “-yne.” Have a triple bond between two carbon atoms.

B. Exhibit 2: Distillation Fractions - Typical Crude Oil



C. Exhibit 3: Petroleum Refining Process Diagram



D. Exhibit 4: Illustrative Information Document Request - Accounting System

- (1) Shown below are the contents of a typical Form 4564 (*Information Document Request*) which can be used to survey a taxpayer's accounting system.
- In order that we might conduct the examination of your tax return in the most efficient manner, we would like to review the accounting system used. Would you please make available the listed items? We would like to have a member, or members, of your accounting department available to answer any questions that might arise.
 - Organization Chart listing key personnel
 - Chart of Accounts & description of accounting system
 - Data Processing Department Systems Manual
 - Tax workpapers
 - Consolidated Profit & Loss Statements
 - Divisional Profit & Loss Statements
 - Analysis of consolidating eliminations
 - Internal Control Manual
 - Internal Audit Procedures Manual
 - Capitalization Policy Manual
 - Cost Accounting Policy Manual

E. Exhibit 5: Classification of Costs

- (1) Classification of costs is necessary in order to determine the most suitable method of accumulating and allocating cost data. The principal methods of accumulating costs are described below.
- (2) Function:
- *Manufacturing*. Costs applied to producing a product.
 - *Marketing*. Costs incurred in selling a product or service.
 - *Administrative*. Costs incurred in policy-making activities.
 - *Financial*. Costs related to financial activities.
- (3) Elements:
- *Direct material*. Material which is an integral part of the finished product.
 - *Direct labor*. Labor applied directly to components of the finished product.

- *Overhead*. Indirect materials, indirect labor, and the manufacturing expenses that cannot logically be charged directly to specific units, jobs, or products.

(4) Product:

- *Direct*. Costs which are charged to the product and require no further allocation.
- *Indirect*. Costs which are allocated.

(5) Department:

- *Production*. A unit in which operations are performed on the part or product and whose costs are not further allocated.
- *Service*. A unit not directly engaged in production and whose costs are ultimately allocated to a production unit.

(6) When Charged to Income:

- *Product*. Costs included when product costs, as defined above, are computed. Product costs are included in inventory and in cost of sales when the product is sold.
- *Period*. Costs associated with the passage of time rather than with the product. These are closed out to the income summary each period since no future benefits are expected.

(7) Relation to Volume:

- *Variable*. Costs which change in total in direct proportion to changes in related activity. The unit cost remains the same regardless of volume.
- *Fixed*. Costs which do not change in total over wide ranges of volume. The unit costs decrease as volume increases.

(8) Period Covered:

- *Capital*. Costs which are expected to benefit future periods and are classed as assets.
- *Revenue*. Costs which benefit only the current period and are thus expenses.

(9) Degree of Averaging:

- *Total*. The cumulative cost for the established category.
- *Unit*. The total cost divided by the number of units of activity or volume.

F. Exhibit 6: Examples - Computer Application Programs

- (1) *Stratification*. Divides an account into dollar ranges and accumulates amounts in each range as well as the number of items in each range. The account is then totaled to show total dollars and total items. The stratification program can be applied to all real accounts as well as all nominal accounts.
- (2) *Regression Analysis*. A comparative analysis of certain accounts which have an apparently normal inter- relationship. Prior years are evaluated electronically to determine a range of normality over a representative number of years. Those relationships are then compared against current year account balances and aberrations identified for examination action.
- (3) *Selected Invoices Listed by Account*. After the stratification program has helped identify examination areas, this program protects vouchers within selected accounts and stratas.
- (4) *Selected Invoices Listed in Filing Sequence*. If the original selection (item 3) is not in filing sequence, the vouchers can be resorted to expedite voucher extraction from files.
- (5) *Vendor Analysis*. Identifies number of records, total charges, and all accounts to which the charges of a particular vendor appear.
- (6) Cost of Sales.
 - This voluminous area can be examined through use of statistical sampling techniques.
 - Every nonrecurring vendor can be printed. Based upon an examination by exception, nonrecurring vendors may indicate a potential examination area.
- (7) *Sales*. Extraction of sales to foreign affiliates for the purpose of comparing foreign pricing to domestic pricing.
- (8) *Fragmentation*. This program formats invoices (or vouchers) into an unfragmented listing. Can be used for lists by vendors and/or accounts.
- (9) *Employment Tax Program*. Produces a computer generated Form 4668, FUTA tax report, social security data file, and W-4 analysis identifying employees with little or no withholding.
- (10) *Depreciation*. Calculates depreciation on each class of asset by year as each class is capitalized producing a listing by year and class of asset and cost component breakdown.
- (11) *Foreign Sales*. Computes the gross margin on unrelated customer sales and compares with gross margin on related customer sales.
- (12) *Statistical Sampling*. (PAL) Produces random sample of universe and calculates adjustment based on an examined sample.

(13) Analysis of Expenses for Application of Regulation 1.861.8.

(14) Calculation of Foreign Tax Credits.

(15) Examination of Investment Tax Credits.

G. Exhibit 7: Illustrative Finished Products Inventory

(1) Main Line of Petroleum Finished Products

- Products tailored to meet rigid specifications by appropriate treating and blending of unfinished stocks and inclusion of additives.
- Subcategories:

All gasolines	Liquified Petroleum Gas
Special Naphtha	Gas Oils (i.e., Diesel)
Jet Fuels	Fuel Oils
Kerosenes	Asphalt

(2) Specialty Products

- Generally low volume, high value products manufactured from otherwise saleable stocks.
- Subcategories:

Lubricating Oils
Finished Waxes. and
Greases Petrochemicals

(3) Byproducts

- Products resulting from processing designed primarily for other objectives.
- Subcategories:

Sulfur (from quality improvement processes)
Coke (from converting residual stocks)

H. Exhibit 8: Characteristics of Gasoline Blending Components

Gasoline Component	Vapor Pressure (RVP)	Octane Number (Motor Method)	Octane Number (Research Method)
N-butane	52.0	92	93
Reformate	2.8 - 4.2	84 – 88	94 – 100
Hydrocrackate	1.7 - 3.9	73 – 76	75 – 79
Alkylate	4.6	96	97
Straight-run Gasoline	11.1	61	66
Catalytic Cracked Gasoline	4.4	77	92

I. Exhibit 9: Cost of Production Report

- (1) The cost of production report shows all costs chargeable to a department or cost center for the period. Since its principal objective is the control of costs, detailed data relating to total and unit costs are provided. Typically, the cost breakdown is made by cost elements for each department (or cost center). This report is also a good source for summary journal entries at the end of the month.
- (2) The cost of production report generally contains three sections:
 - *Quantities*. This section accounts for the physical flow of units into and out of a department.
 - *Costs to account for*. This section accounts for the incurrence of costs that were:
 - In process at the beginning of the period
 - Transferred in from previous departments
 - Added by the department
 - *Costs accounted for*. This section accounts for the disposition of costs charged to the department. Were the costs:
 - Transferred out to another department or to finished goods?
 - Completed and on hand?
 - Still in process at end of the period?
- (3) It should be noted that the total of the costs to account for must equal the total of the costs accounted for.
- (4) The cost of production report may be very detailed or may only show totals.
- (5) The examiner should peruse these sections to ensure that improper adjustments are not being made for tax purposes via Schedule M and that various types of overhead items are being properly allocated.

J. Exhibit 10: Suggested Techniques for Examining Catalyst Accounts

- (1) Review taxpayer's internal accounting manuals to ascertain systems/methods of accounting for catalysts.
- (2) Obtain a simplified flow diagram of refinery operations.
 - Identify all units using catalysts
 - Segregate those utilizing precious metals
 - From refinery operating handbooks or manuals, ascertain operational factors (on-going change out versus turnaround change-out, etc.)

- Obtain specifics as to type of each catalyst
- (3) Is spent catalyst reclaimed, sold for salvage value, or junked?
- If reclaimed:
 - What are the charges? How are they handled?
 - Is there a credit for a spent catalyst?
 - How are the credits handled?
 - If sold, how are the sales proceeds handled?
- (4) When precious metal catalysts are involved:
- What is the total cost of the catalyst?
 - What is the cost of the precious metal?
 - What percentage of precious metal initially used to fabricate catalyst was assumed to be lost over the course of the precious metal's reasonably expected useful life? Can the taxpayer support this assumption?
 - Does taxpayer's depreciation of the cost of precious metal utilized to fabricate catalyst comport with the holding of Revenue Ruling 2015-11?
- (5) Internal cost accounting records for operational purposes/financial purposes may provide additional information.

K. Exhibit 11: Regulatory Agency Filings with Respect to Refinery Volumes

- (1) Although there is no standard system of accounting employed across all oil refineries, they are subject to numerous regulatory rules and reporting requirements associated with hazardous chemicals and inventories. Some of the primary ones include:

Mandating Agency or Statute	Pertinent Rule or Requirement
EPA Risk Management	Reporting of hazardous materials. See 40 CFR § 68
OSHA Process Safety Management	Safety management of highly hazardous chemicals. See 29 CFR § 1910.119.
Superfund Amendments and Reauthorization Act Title III (“SARA Title III”)	The Emergency Planning and Community Right to Know Act. See 42 USC Chapter 116.
Emergency Planning and Community Right to Know Act (EPCRA)	Tier II reporting requirements; see 42 USC § 11022 and 40 CFR parts 311 and 312
Energy Information Administration Form	EIA-810 “Monthly Refining Report”; mandatory pursuant to Section 13(b) of the Federal Energy Administration Act of 1974 (PL 93-275) which must be completed by the operators of all operating and idle petroleum refineries located in the 50 states, DC, and U.S. possessions
State Emergency Response Commission (SERC)	SERC or Local Emergency Planning Commission (LEPC), local fire department rules.
Foreign Trade Zone (FTZ) -- if refinery is located in one	FTZ reporting rules and inventory control, record- keeping (ICRS). See 48 Stat. 998-1003; 19 CFR §§ 146.6(b)(4) and 146.21(b) and Part 146 Subpart H Petroleum Refineries in Foreign-Trade Subzones.
Bureau of Customs and Border Protection (CBP)	Repository of admittance and entry documents for FTZ zones

- (2) Most refineries operating in the U.S. are located in Foreign Trade Zones and Subzones. Operators must maintain an inventory and recordkeeping system of the zone in accordance with Foreign Trade Zone regulations. See 19 CFR Part 146 (19 CFR §§ 113.73(a)(2), 146.4(d)). Regulations concerning protection of the revenue are approved by the Secretary of the Treasury. See 19 USC § 81p, and the regulations established in 19 CFR Part 146. All merchandise admitted to the zone is recorded in a receiving report or document using a zone lot number (ZLN) or unique identifying number (UIN). The unique identifier

specified in 19 CFR Part 146, Subpart B. refers to the unique numerals, letters or other characters used to identify a specific inventory category, including fungible merchandise. See Foreign Trade Zone Manual (FTZM), section 7.8(5)(b), 2003 edition.

- (3) A zone operator may request approval from Customs Headquarters for an authorized inventory method in lieu of the zone lot number system. FIFO is an approved method under Customs Service Decision 81-61 for Customs, and an operator need not request approval for the zone if the inventory method is already approved for general use by Customs Headquarters. Merchandise may be identified by an inventory method authorized by Customs, which is consistently applied, such as FIFO and using a UIN. See 19 CFR § 146.23(a)(2). Aside from FIFO, the FTZA specifically authorizes a unique inventory method called “Industry Standards of Potential Production on a Practical Operating Basis” as verified and adopted by the Secretary of the Treasury (known as “producibility”) as an inventory method for feedstocks for petroleum refineries operating in zones. See 19 USC § 81c(d); FTZM §§ 7.8(c)(5) and 11.6(j), 2003 edition. Specific regulations for petroleum refineries are set forth in 19 CFR Part 146, Subchapter H - Petroleum Refineries in Foreign Trade Subzones.
- (4) The refinery producibility standards are set forth in Treasury Decision 66-16. Refineries in U.S. Foreign Trade Zones use this inventory method for attributing final products to feedstocks (authorized by 19 USC § 81(d), the FTZA, and 19 CFR § 146.95(a)(1). Annual reconciliations are required and contain the following information:
 - zone status of merchandise processed;
 - item description for each UIN;
 - quantity on hand at beginning of year;
 - cumulative receipts and transfers (by UIN); and
 - quantity on hand at year-end, pursuant to 19 CFR § 146.25(b).
- (5) Within the acceptable inventory tracking systems is the concept of “work in progress” as a “black box” that Customs is not allowed to penetrate. This means that if an operator can demonstrate raw material balance, inputs to production, finished products balance and some form of correlation between the three, this is satisfactory to Customs. “Customs shall accept the operator’s operating conventions to the extent that the operator demonstrates that it actually uses these conventions in its refinery operations. Whatever conventions are elected by the operator, they must be used consistently in order to be acceptable to Customs.” See 19 CFR § 146.95(b).
- (6) Because of the black box concept, actual inventory work-in-progress amounts are not reported to Customs. The operator need only demonstrate to Customs that the attribution and yield accounting within the refinery is reflective of actual

operating conventions. The inventory attribution system in Treasury Decision 66-16 is not meant to be an inventory control system to reflect actual feedstocks at any given time. It is a method to account for import duties owed on privileged foreign feedstocks.

L. Exhibit 12: MACRS Asset Classes Commonly Used in the Petroleum Industry

			Recovery Period (in years)	
Asset Class	Description of Assets Included	Class Life (in years)	General Depreciation System - IRC § 168(a)	Alternative Depreciation System - IRC § 168(g)
00.3	Land Improvements: Includes improvements directly to or added to land, whether such improvements are IRC § 1245 property or IRC § 1250 property, provided such improvements are depreciable. Examples of such assets might include sidewalks, roads, canals, waterways, drainage facilities, sewers (not including municipal sewers in Class 51), wharves and docks, bridges, fences, landscaping, shrubbery, or radio and television transmitting towers. Does not include land improvements that are explicitly included in any other class, and buildings and structural components as defined in IRC § 1.48-1(e) of the regulations. Excludes public utility initial clearing and grading land improvements as specified in Rev. Rul. 72-403, 1972-2 C.B. 102.	20	15	20
13.0	Offshore Drilling: Includes assets used in offshore drilling for oil and gas such as floating, self-propelled and other drilling vessels, barges, platforms, and drilling equipment and support vessels such as tenders, barges, towboats and crew-boats. Excludes oil and gas production assets.	7.5	5	7.5

13.1	<p>Drilling of Oil and Gas Wells: Includes assets used in the drilling of onshore oil and gas wells and the provision of geophysical and other exploration services; and the provision of such oil and gas field services as chemical treatment, plugging and abandoning of wells and cementing or perforating well casings. Does not include assets used in the performance of any of these activities and services by integrated petroleum and natural gas producers for their own account.</p>	6	5	6
13.2	<p>Exploration for and Production of Petroleum and Natural Gas Deposits: Includes assets used by petroleum and natural gas producers for drilling of wells and production of petroleum and natural gas, including gathering pipelines and related storage facilities. Also includes petroleum and natural gas offshore transportation facilities used by producers and others consisting of platforms (other than drilling platforms classified in Class 13.0), compression or pumping equipment, and gathering and transmission lines to the first onshore transshipment facility. The assets used in the first onshore transshipment facility are also included and consist of separation equipment (used for separation of natural gas, liquids, and solids), compression or pumping equipment (other than equipment classified in Class 49.23), and liquid holding or storage facilities (other than those classified in Class 49.25). Does not include support vessels.</p>	14	7	14
13.3	<p>Petroleum Refining: Includes assets used for the distillation, fractionation, and catalytic cracking of crude petroleum into gasoline and its other components.</p>	16	10	16
15.0	<p>Construction: Includes assets used in construction by general building, special trade, heavy and marine construction contractors, operative and investment builders, real estate subdividers and developers, and others except railroads.</p>	6	5	5

28.0	<p>Manufacture of Chemicals and Allied Products: Includes assets used to manufacture basic organic and inorganic chemicals; chemical products to be used in further manufacture, such as synthetic fibers and plastics materials; and finished chemical products. Includes assets used to further process man-made fibers, to manufacture plastic film, and to manufacture nonwoven fabrics, when such assets are located in the same plant in an integrated operation with chemical products producing assets. Also includes assets used to manufacture photographic supplies, such as film, photographic paper, sensitized photographic paper, and developing chemicals. Includes all land improvements associated with plant site or production processes, such as effluent ponds and canals, provided such land improvements are depreciable but does not include buildings and structural components as defined in Treas. Reg. § 1.48- 1(e). Does not include assets used in the manufacture of finished rubber and plastic products or in the production of natural gas products, butane, propane, and byproducts of natural gas production plants.</p>	9.5	5	9.5
46.0	<p>Pipeline Transportation: Includes assets used in the private, commercial, and contract carrying of petroleum, gas and other products by means of pipes and conveyors. The trunk lines and related storage facilities of integrated petroleum and natural gas producers are included in this class. Excludes initial clearing and grading land improvements as specified in Rev. Rul. 72-403, 1972-2 C.B. 102, but includes all other related land improvements.</p>	22	15	22
49.21	<p>Gas Utility Distribution Facilities: Includes gas water heaters and gas conversion equipment installed by utility on customers premises on a rental basis.</p>	35	25	35

49.221	Gas Utility Manufactured Gas Production Plants: Includes assets used in the manufacture of gas having chemical and/or physical properties which do not permit complete interchangeability with domestic natural gas. Does not include gas producing systems and related systems used in waste reduction and resource recovery plants which are elsewhere classified.	30	20	30
49.222	Gas Utility Substitute Natural Gas (SNG) Production Plant (naphtha or lighter hydrocarbon feedstocks): Includes assets used in the catalytic conversion of feed- stocks or naphtha or lighter hydrocarbons to a gaseous fuel which is completely interchangeable with domestic natural gas.	14	7	14
49.23	Natural Gas Production Plant.	14	7	14
49.24	Gas Utility Trunk Pipelines and Related Storage Facilities: Excluding initial clearing and grading land improvements as specified in Rev. Rul. 72-403.	22	5	22
49.25	Liquefied Natural Gas Plant: Includes assets used in the liquefaction, storage, and regasification of natural gas including loading and unloading connections, instrumentation equipment and controls, pumps, vaporizers and odorizers, tanks, and related land improvements. Also includes pipeline interconnections with gas transmission lines and distribution systems and marine terminal facilities.	22	15	22
57.0	Distributive Trades and Services: Includes assets used in wholesale and retail trade, and personal and professional services. Includes IRC § 1245 assets used in marketing petroleum and petroleum products.	9	5	9
57.1	Distributive Trades and Services Billboard, Service Station Buildings and Petroleum Marketing Land Improvements: Includes IRC § 1250 assets, including service station buildings and depreciable land improvements, whether IRC § 1245 property or IRC § 1250 property, used in the marketing of petroleum and	20	15	20

	petroleum products, but not including any of these facilities related to petroleum and natural gas trunk pipelines. Includes car wash buildings and related land improvements. Includes billboards, whether such assets are IRC § 1245 property or IRC § 1250 property. Excludes all other land improvements, buildings and structural components as defined in Treas. Reg. § 1.48-1(e).			
	Per IRC § 168(e)(3)(C) 7- year property includes - (iv) any natural gas gathering line the original use of which commences with the taxpayer after April 11, 2005.	14	7	14
	IRC § 168(e)(3)(E) 15-year property includes - (iii) a retail motor fuels outlet (whether or not food or other convenience items are sold at the outlet). See Rev. Rul. 97-29 or Pub 946 for the applicable definition of “retail motor fuels outlet”.	20	15	20

M. Exhibit 13: Guidance on MACRS Asset Categories for Refinery Assets

- (1) This Exhibit provides direction to effectively utilize resources in the classification of petroleum refinery assets for MACRS depreciation. This Exhibit is not an official pronouncement of the law or the position of the Service and cannot be used, cited, or relied upon as such.
- (2) Some taxpayers are seeking to change their method of depreciation for certain assets used in petroleum refineries from Class 13.3, Petroleum Refining to Class 28.0, Manufacture of Chemicals and Allied Products or other depreciation classes. This Exhibit provides direction to examiners in determining whether assets that are used in a variety of refinery operations should be classified as petroleum refining assets.
- (3) It is recommended that examiners take the following positions:
 - All processing assets involved in the activity of petroleum refining are to be included in MACRS Asset Class 13.3. This would include any incidental manufacturing or waste removal processes, which are integral parts of petroleum refining. See Treas. Reg. § 1.167(a)-11(b)(4)(iii)(b).
 - In cases where a taxpayer is engaged in more than one industrial activity, the activity in which the asset is primarily used controls the asset's classification. For example, in addition to using methyl tertiary butyl ether (MTBE) produced primarily from intermediate refinery process streams as an additive in their own gasoline blending process (classified under Asset

Class 13.3), a taxpayer may sell the MTBE produced to third parties as a finished chemical (classified under Asset Class 28.0). Thus, the primary use of the MTBE asset in either the refining activity or the chemical manufacturing activity will be determinative as to which Asset Class (13.3 or 28.0) is used.

- (4) Examiners are reminded that any change in a taxpayer's asset classification generally causes a change in the asset's depreciation method and recovery period. A change in depreciation method or recovery period is a change in method of accounting to which the provisions of IRC §§ 446 and 481 and the regulations thereunder apply. See Treas. Reg. § 1.446-1(e)(2)(ii)(d).

N. Exhibit 14: Accounting Method Changes

- (1) This Exhibit provides guidance on accounting method changes. Section 446 governs the general rules for methods of accounting. The two basic concepts are timing and consistency. If the accounting practice does not permanently affect the taxpayer's lifetime taxable income, but changes, or could change, the taxable year in which taxable income is reported, it involves timing. Therefore, the practice is considered a method of accounting. Although a method of accounting may exist without a pattern of consistent treatment of an item, in most instances, a method of accounting is not adopted without consistent treatment. Treas. Reg. § 1.446-1(e)(2)(ii)(a).
- (2) For a method of accounting to be adopted, the focus is on the actual treatment on the tax return. A taxpayer may adopt any **permissible** method of accounting for a material item by treating the item properly on the first return that reflects the item. Treas. Reg. § 1.446-1(e)(1). To be considered as having adopted an **impermissible** method of accounting, the taxpayer must improperly treat the material item the same way on two or more consecutively filed returns. Rev. Rul. 90-38, 1990-1 C.B. 57. Thus, a taxpayer adopts a permissible method by properly treating a material item on its first return, and may thereafter change its method only with permission from the Service. If the taxpayer reports the material item incorrectly only once, it may make the change as the correction of an error. If an impermissible method is reported on two or more consecutively filed returns, the taxpayer must seek permission from the Service to change its method of accounting.
- (3) Once a method of accounting has been adopted, it may only be changed with the consent of the Commissioner. IRC § 446(e). A change in method of accounting includes a change in an overall plan of accounting (e.g., cash to accrual), or a change in the treatment of any material item. For accounting method purposes, a "material item" is any item that involves the proper time for the inclusion of the item in income or the taking of a deduction. For example, the treatment of a capital expenditure, recovered through depreciation, versus a current repair expense is a material item. Treas. Reg. § 1.446-1(e)(2)(ii)(d)(2).

- (4) A taxpayer may voluntarily request consent to change a method of accounting by filing Form 3115, Application for Change in Accounting Method. The general procedures under IRC § 446 to obtain both **non-automatic** consent as well as **automatic** consent of the Commissioner to change a method of accounting can be found in Rev. Proc. 2015-13, 2015-5 I.R.B. 419.
- (5) An examining agent who determines that a taxpayer's method of accounting is impermissible may propose an adjustment with respect to that method under IRC § 481 only by changing the taxpayer's method of accounting under IRC § 446. Guidance for Service-initiated (involuntary) method changes and the basis for such changes can be found in Rev. Proc. 2002-18, 2002-1 C.B. 678.

O. Exhibit 15: Glossary of Petroleum Refining Terms

- **American Petroleum Institute (API):** The largest U.S. trade association for the oil and natural gas industry. It claims to represent nearly 600 corporations involved in production, refinement, distribution, and many other aspects of the petroleum industry. One of API's functions is the establishment and certification of industry standards.
- **Ash:** Inorganic residue remaining after ignition of combustible substances, measured by standard prescribed methods.
- **Ask:** The price at which a commodity or security is offered for sale.
- **Barrel (BBL):** A standard measure of volume for crude oil and liquid petroleum products. A barrel is 42 U.S. gallons.
- **Basic Sediment and Water (BS&W):** A combination of impurities and water that is often produced with crude oil. BS&W is heavier than oil and will settle to the bottom of a tank of produced oil.
- **Benzene Ring:** A six-member ring of carbon atoms, joined together by alternate single and double bonds. A benzene ring is present in all aromatics.
- **Bid:** An offer to buy securities or a specific quantity of a commodity.
- **Biodiesel:** A fuel typically made from soybean, canola, or other vegetable oils; animal fats; and recycled grease. It can serve as a substitute for petroleum: derived diesel or distillate fuel.
- **Bit:** A drilling tool that cuts a hole.
- **Bitumen:** A naturally occurring viscous mixture, mainly of hydrocarbons heavier than pentane, that may contain sulfur compounds and that, in its natural occurring viscous state, is not recoverable at a commercial rate through a well. Typically used to refer to the hydrocarbon material in Canadian oil sands.
- **Black Oil:** A general term used to describe liquid crude oil or heavy fuel oils. (Also referred to as "dirty cargoes".) It is necessary to clean a tank

car, storage tank, etc., that has contained black oils before it can be used for clean fuels.

- **Blending:** 1) Mixing refinery products to suit market conditions. 2) Mixing on-specification fuel with off-specification fuel to bring the latter within use limits (reclamation).
- **BOE:** Barrel of Oil Equivalent. A unit which expresses volumes of natural gas in terms of equivalent barrels of oil. IRC § 613A(c)(4) and IRC § 776(b)(3)(B) equate 6 MCF of natural gas to 1 barrel of oil.
- **Boiling Points:** Initial boiling point is the temperature at which a liquid begins to be converted into a vapor. End boiling point is the temperature at which a liquid becomes completely vaporized. These two points are called cut points or fractions.
- **Bottoms:** In a distilling operation, that portion of the charge remaining in the still at the end of the run, i.e., that portion that does not vaporize called the residuals.
- **British Thermal Unit (BTU):** A measure of the amount of heat required to raise the temperature of 1 lb. of water 1° F.
- **Bulk Petroleum Products:** Large volume of products normally transported by pipeline, rail tank, tank truck, barge or tanker.
- **Butane:** An inflammatory gaseous hydrocarbon belonging to the methane series. It is gaseous at ordinary atmospheric conditions, but it is readily convertible to a liquid state.
- **Carbon Dioxide (CO₂):** An inert, noncombustible, odorless gas at normal temperature and pressure conditions. Small amounts are often contained in natural gas produced from wells. A small number of reservoirs in the U.S. contain pure or nearly pure CO₂. Pure CO₂ is a valuable resource employed in tertiary oil recovery methods. CO₂ is a major component of the exhaust (flue gas) caused by combustion of fossil fuels.
- **Cash Price:** Price in the cash market for actual or spot commodities with delivery through customary market channels.
- **Catalyst:** A substance that affects, provokes, or accelerates chemical reactions without being altered itself.
- **Catalytic Cracking:** A method of cracking in which a catalyst is employed to bring about the desired chemical reaction.
- **Charge:** In the context of refining, the amount of feedstock which is fed into a processing unit.
- **Coke:** See Petroleum Coke.

- **Common Carrier:** Any cargo transportation system that may be accessed by any appropriate shipper and all shippers are charged the same rate schedule. Many pipelines are common carriers.
- **Condensate:** A light hydrocarbon liquid that is in a gaseous state in the reservoir but becomes liquid when temperature and pressure are reduced.
- **Contract Price:** See Term Price.
- **Cracker:** The unit where a cracking process takes place. Prime examples are the catalytic cracker (“cat” cracker) and the hydrocracker.
- **Cracking:** The refinery process of breaking down the larger, heavier, and more complex hydrocarbon molecules into simpler and lighter molecules.
- **Crude Oil:** For income tax purposes, a mixture of hydrocarbons that exist in a liquid phase in natural underground reservoirs and which remains liquid at atmospheric pressure after passing through surface separating facilities. In the United States, crude oils are classified as paraffin base, naphthene base, asphalt base, or mixed base. The properties of the residuum left from nondestructive distillation determine the appropriate classification.
- **Cut:** See Fraction.
- **Distillation:** This generally refers to vaporization processes in which the vapor evolved is recovered by condensation. Thus, a separation is effected between volatile fractions that vaporize at a specific temperature and those that do not.
- **Dry Gas:** Natural gas composed of vapors with only small amounts of dissolved liquid. Dry gas generally is composed of almost 100% methane (CH₄). Often associated with the output of a natural gas processing plant and called “pipeline quality gas.” The raw natural gas from many wells does not meet this definition because it commonly contains small amounts of ethane, butane, propane, contaminants, and water vapor.
- **Dual Capacity Taxpayer:** One who is subject to a foreign tax levy, but who also receives a specific economic benefit (directly or indirectly) from that foreign country. In the oil and gas context, the most frequent concern is whether payments made by companies to the sovereign are income taxes or royalties.
- **E10:** Motor gasoline with up to 10 percent ethanol. Widely mandated by the EPA, especially in urban areas.
- **E85:** Motor gasoline containing 85 percent ethanol. Only available in certain regions of the United States.
- **Energy Information Administration:** A branch of the U.S. Department of Energy that collects, analyzes, and disseminates information and reports about many types of energy and fuels.

- **Ethanol:** A clear, colorless, flammable alcohol. Ethanol is typically produced biologically from biomass feedstocks such as agricultural crops and cellulosic residues from agricultural crops or wood. Ethanol can also be produced chemically from ethylene.
- **Exchange Oil:** Name given to oils exchanged between companies. Company A has excess oil on the West Coast but needs oil on the East Coast. Company B has excess oil on the East Coast but needs oil on the West Coast. Rather than incur large transportation costs, Company A exchanges oil with Company B.
- **Federal Energy Regulatory Commission:** The U.S. Agency that regulates interstate natural gas and oil pipelines.
- **Feedstock:** Crude oil or other hydrocarbons that are the basic input to a refinery, petrochemical plant, or intermediate processing units.
- **Field (oil or gas):** An area consisting of one or more reservoirs that are generally related to the same geological feature or condition.
- **Field Price:** Posted price of oil taken from a specific field.
- **Flashing:** To vaporize from heated charge stock, to distill. Vacuum flashing of straight-run residue allows further distillation without cracking.
- **Foreign Oil and Gas Extraction Income:** Taxable income derived from all sources outside the United States and possessions from the extraction of minerals from oil or gas wells, or taxable income from the sale or exchange of assets used by the taxpayer in the business of extracting minerals from oil or gas wells.
- **Foreign Oil Related Income:** Taxable income derived from sources outside the U.S. and its possessions from the processing of oil and gas into their primary products; the transportation, distribution and sale of oil and gas and their primary products; the disposition of assets used in these activities, excepting the sale of the stock of any corporation; or the performance of any directly related services.
- **Forward Contract:** A transaction common to many industries, including commodity merchandising, in which the buyer and seller agree upon delivery of a specified quality and quantity of goods at a specified future date for a price agreed upon in advance or to be determined at the time of delivery.
- **Fraction:** A portion of distillate (having a particular boiling range) separated from other portions in the fraction distillation of petroleum products.
- **Futures Contract:** A firm commitment to deliver or receive, at a specified price and grade, a specified quantity of a commodity during a designated month that is traded through an exchange.

- **Futures Price:** The price of a given commodity futures unit determined on a futures exchange, via open outcry or electronic trading.
- **Gasohol:** Motor gasoline containing alcohol (generally ethanol but sometimes methanol) at a concentration between 5.7 percent and 10 percent by volume. See also E10.
- **Gasoline:** A volatile liquid fuel that is derived from the distillation of crude oil and is well suited for use in spark-ignited internal combustion engines. Motor gasoline is gasoline that contains additives that allows it to meet certain ASTM requirements.
- **Gravity:** Short for “Specific gravity”. It is a measure of the density of oil relative to water. In the oil industry, gravity is usually expressed in degrees API, which has a scale that is inversely proportional to specific gravity. Light oils have a high API gravity (e.g., 40° API). Heavy oils have a low API gravity (e.g., 20° API). Extra-heavy oils have an API gravity near 10° API, which is the same density as water at 60°F. The API Gravity is calculated from the specific gravity at 60°F using a formula. $API\ Gravity = [(141.5 / \text{Specific Gravity at } 60^\circ F) - 131.5]$
- **Heavy Crude Oil:** Crude oil of 20° API gravity or less (adjusted to 60° F). There are perhaps billions of barrels of heavy oil still in place in the United States that require special production techniques, notably steam injection or steam soak, to extract them from the underground formations.
- **Hedge:** A transaction entered into primarily to manage price risk by taking a position in a financial product equal and opposite to an existing or anticipated cash position or by shorting a security similar and equal to one in which a long position has been established.
- **Henry Hub:** A pipeline hub on the Louisiana Gulf coast. It is the delivery point for the natural gas futures contract on the New York Mercantile Exchange.
- **Hydrocarbon:** Any of the compounds made up exclusively of hydrogen and carbon in various ratios.
- **Hydrocarbon Gas Liquids (HGLs):** Is a term developed by the U.S. Energy Information Administration to encompass hydrocarbons that occur as gases at atmospheric pressure and as liquids under higher pressures. HGLs are found in raw natural gas and crude oil. HGLs are extracted from natural gas at natural gas processing plants and when crude oil is refined into petroleum products. Includes ethane, normal butane, isobutane, propane, natural gasoline, and refinery olefins.
- **Hydrocracking:** Catalytic cracking in the presence of hydrogen. The combination of the hydrogen, the catalyst, and the operating conditions (temperature and pressure) permit cracking low quality gas oils that would

otherwise be made into distillate fuel. The heavy hydrocrackate product contains aromatics.

- **Hydro-desulfurization (HDS) Unit:** A unit within a refinery that uses hydrogen in a catalytic process to remove sulfur from natural gas and from refined petroleum products such as gasoline, jet fuel, kerosene, diesel fuel, and fuel oils. Many refineries constructed or expanded their HDS unit in order to produce ultra-low sulfur diesel fuel when it was mandated by the EPA.
- **Hydroforming:** A special catalytic hydrogen reforming process employed for upgrading straight run gasolines.
- **Hydrogen (H):** A colorless, odorless, tasteless, flammable gaseous substance that is the simplest member of the family of chemical elements. Refineries use hydrogen in many processes, such as to lower the sulfur content of diesel fuel. Refineries purchase hydrogen from merchant suppliers or produce it the hydrogen unit where it is extracted from methane.
- **Integrated Oil Company:** A company engaged in all phases of the oil business, i.e., production, transportation, refining, and marketing. It frequently also includes petrochemicals/chemicals.
- **Isomerization:** Process for altering the fundamental arrangement of the atoms in a molecule without adding or removing anything from the original materials. In petroleum refining, straight-chain hydrocarbons are converted to branched-chain hydrocarbons of substantially higher-octane rating, in the presence of a catalyst, usually at moderate temperatures and pressures.
- **Jobber:** A buyer of oil products from refiners for resale to retail outlets.
- **Joule:** A unit of energy. One joule is equivalent to 9.48×10^{-4} BTUs (.000948 BTU).
- **License (technology):** Refineries often employ processes that were developed by other companies. The refiner will pay a royalty to the developer under a license agreement.
- **Light Ends:** In any given batch of oil, that portion of lowest boiling point. In gasoline, it is the portion distilling off up to 158° F. In making lubricating oils, the light ends must be removed in order to produce finished oils of high flash point.
- **Limited Partnership:** A form of organization, frequently employed in financing oil and gas ventures, by which an investor of funds becomes a limited partner with limited liability and limited management rights. Under certain conditions the interests in a limited partnership can be publicly traded. Such as partnership is referred to as a Master Limited Partnership (MLP).

- **Line Fill:** The volume of product required in a liquids pipeline at all times to allow for normal operations. IRS examiners may also use the term to describe the volume of partially processed product within a refinery.
- **Line Pack Gas:** The volume of gas maintained in a pipeline to maintain minimum operating pressure.
- **Liquefied Natural Gas:** Composed almost entirely of methane. The temperature at which methane becomes liquid at normal pressure is -260° F. In liquid form, natural gas retains only 1/600 of its original volume.
- **Low Sulfur Diesel Fuel:** Diesel fuel containing more than 15 but less than 500 parts per million (ppm) sulfur.
- **M:** Readers should be aware that some parties (typically scientists and engineers) treat “M” as meaning *thousand*. To them “1 MCF” means one thousand cubic feet and “1 MMBTU” means one million British Thermal Units (because 1000×1000 is one million). Conversely, other parties (typically financial and accounting professionals) treat “M” as meaning *million*. To them, “\$1M” means one million dollars.
- **Mark to Market:** This is a procedure in which the broker debits or credits the available balances of customers’ accounts daily for changes in the value of open contracts.
- **MCF:** Thousand cubic feet. According to the U.S. Energy Information Administration, natural gas can be priced in units of dollars per therm, dollars per MMBtu, or dollars per cubic feet (or per MCF). The heat content of natural gas per physical unit (such as Btu per cubic foot) is needed to convert these prices from one price basis to another. In 2019, the U.S. annual average heat content of natural gas delivered to consumers was about 1,037 Btu per cubic foot. Therefore, 100 cubic feet (Ccf) of natural gas equals 103,700 Btu, or 1.037 therms. One thousand cubic feet (MCF) of natural gas equals 1.037 MMBtu, or 10.37 therms.
- **Mercaptans:** Organic compounds having the general formula R-SH, meaning that the thiol group (SH) is attached to a radical, such as CH₃ or C₂H₅. The simpler mercaptans have a strong, repulsive, garlic like odor which becomes less pronounced with increasing molecular weight and higher boiling points.
- **Methane:** Methane (CH₄) is a simple gaseous hydrocarbon associated with petroleum. Natural gas used by residential and industrial customers is nearly 100 percent methane.
- **MMBTU:** Million British Thermal Units.
- **MMCF:** Million cubic feet.
- **MOGAS:** Motor gasoline.

- **Natural Gas:** Any hydrocarbon product (other than crude oil) of an oil or gas well if a deduction for depletion is allowable under IRC § 611 with respect to such product. Specifically, natural gas refers to any hydrocarbon gas.
- **Natural Gas Liquids:** Natural gas liquids are the heavier hydrocarbon liquids produced along with natural gas, including butane, propane, natural gasoline, and ethane. See also Hydrocarbon Gas Liquids.
- **Neutral Oils:** Term used quite generally to mean a lubricating oil of medium viscosity made from a wax bearing crude.
- **Normal:** When used to refer to a chemical compound, this means the straight-chain version. Branched-chain molecules have higher octane numbers.
- **New York Mercantile Exchange:** A commodities futures exchange that lists several types of crude oil, natural gas, heating oil, gasoline, and ethanol.
- **Octane Number (Motor Method):** Octane number of automotive gasolines determined by a method of test that indicates the knock characteristics under severe conditions (high temperatures and speed).
- **Oil Sands:** A term commonly used in Canada to describe heavy and extra heavy deposits of petroleum. Shallow deposits are recovered by mining. Deeper deposits are recovered by in situ methods. The term “tar sands” is more commonly used in the United States.
- **Oxidation:** In general, the process in which oxygen reacts with a compound. The oxidation reaction in petroleum may lead to degrading gum or resin formation, which is common in gasolines and jet fuels, particularly those that contain considerable unsaturated compounds.
- **Paraffinic:** Refers to a petroleum product containing large amounts of alkyl compound of the formula C_nH_{2n+2} . Alkyl compounds are saturated organic molecules with important lubricating properties found in the heavier members of the series.
- **Petrochemicals:** Chemicals derived from petroleum feedstocks for the manufacture of a variety of plastics, synthetic rubber, etc.
- **Petroleum:** Sometimes viewed as analogous to (liquid) crude oil. A more precise definition by the Society of Petroleum engineers is “[N]aturally-occurring liquids and gases which are predominately comprised of hydrocarbon compounds. Petroleum may also contain non-hydrocarbon compounds in which sulfur, oxygen, and/or nitrogen atoms are combined with carbon and hydrogen. Common examples of non-hydrocarbons found in petroleum are nitrogen, carbon dioxide, and hydrogen sulfide”. The non-hydrocarbons are considered impurities. See *Sour Oil or Gas*.

- **Petroleum Coke:** A solid residue high in carbon content and low in hydrogen that is the final product of thermal decomposition in the condensation process in cracking. Produced at a refinery in the coker unit.
- **Pour Point:** The lowest temperature at which an oil will pour or flow when chilled without disturbance under specified conditions. By American Society for Testing and Materials instruction, it is taken as the temperature 5° F above the solid point.
- **Propane:** Propane (C₃H₈) is a gaseous hydrocarbon associated with petroleum. Commonly used for heating and cooking when natural gas (methane) is not available. When compressed to a moderate pressure it becomes a liquid, which facilitates transportation and storage.
- **Reduced Crude:** The bottoms from a distillation of crude oil.
- **Reformate:** Liquid product from the reforming process (increased percentages of aromatics and iso-paraffins) and feedstock for gasoline blending and/or further processing into petrochemicals.
- **Reforming:** A catalytic process for converting low octane number naphthas or gasolines into high octane number products.
- **Regeneration:** In catalytic cracking, removal of carbon from the catalyst in order to make it suitable for reuse.
- **Residual (Residue or Residuum):** The dark colored, highly viscous oil remaining from oil after the more volatile portion of the charge has been distilled.
- **Residue Gas:** Natural gas, mostly methane, which remains after processing in a separator or plant to remove liquid hydrocarbons contained in the gas when produced.
- **Retorting:** Generally, refers to heating a substance, such as oil shale, to a very high temperature in the absence of oxygen so that destructive distillation occurs.
- **Run Statement:** A statement supplied by the purchaser of oil or gas to an interest owner setting forth the gross volume of product taken, sales value, taxes paid, and net payment to the owner. The run statement usually accompanies the payment for the runs.
- **Run Ticket:** Evidence of receipt or delivery of oil issued by a pipeline or other carrier or purchaser.
- **Runs-to-Stills:** The amount of crude oil withdrawn from inventory and placed into production by a refiner.
- **Society of Automotive Engineers (SAE) Viscosity:** A system for classifying motor oils according to their viscosities established by the SAE.

- **Saturated Hydrocarbons:** Hydrocarbons with no double bonds. All the carbon atoms are “saturated” with hydrogen atoms. Examples are ethane and propane. Generally, are less reactive than unsaturated hydrocarbons.
- **Schedular (Crude Oil):** Coordinates the physical moves associated with crude oil supply to a refinery, including delivering via pipelines, barges, and railcars.
- **Short:** A trader obtains a short position by selling a security he does not own and making delivery with borrowed securities.
- **Sour Oil or Gas:** Oil or gas containing more than a certain proportion of hydrogen sulfide or other sulfur compounds, usually 0.5 percent or more.
- **Speculator:** An individual, or entity, that is not a hedger. One who trades for profits by anticipation of price movements.
- **Spot price:** The price at which a physical commodity is selling at a given time and place, often involving prompt delivery. Same as cash price. The spot price differs from a contract or term price in that the latter involves multiple sales over time, whereas the former usually involves a single cargo or transaction.
- **Spread (or Straddle):** The purchase of one futures delivery and the sale of another futures delivery month of the same or similar commodity, or the purchase of a commodity in one market against the sale of that commodity or a like commodity in another market to take advantage of differences or anticipated differences in price relationships.
- **Straight Run:** In the context of refining crude oil, the gasoline that is obtained by distillation with no additional processing.
- **Stripper Oil:** Oil recovered from a stripper well. See IRC § 613A(c)(6)(E).
- **Sweet Oil or Gas:** Crude oil or natural gas which contains little or no sulphur or hydrogen sulfide.
- **Tank Farm:** A number of oil storage tanks located together where oil gathered by a pipeline company is stored prior to transportation to the refinery. Refineries also have tank farms to hold crude oil waiting to be processed or final products waiting to be shipped.
- **Term Price:** A contract price, usually involving multiple deliveries over time. See Spot Price.
- **Terminal Rack:** A loading facility with pipes suspended from a rack that is connected to the refinery’s fuel storage tanks. Tank trucks and rail cars pull under the rack to be filled with fuel.
- **Topped Crude:** Crude oil from which some of the lighter constituents have been removed by distillation. A “topping plant” can remove specific

portions of the crude (like diesel) and send the remainder to more sophisticated refineries.

- **Turnaround:** The planned periodic inspection and overhaul of the units of a refinery or processing plant requiring the shutting down of a refinery (or individual units) for inspection, cleaning, repair, or upgrading.
- **Ullage:** The distance from a given point at the top of a container down to the surface of the liquid.
- **Ultra-Low Sulfur Diesel Fuel:** Diesel fuel containing a maximum 15 parts per million (ppm) sulfur.
- **Unrealized Profit or Loss:** The profit or loss on open positions that has not become actual. It is realized when the security or commodity futures contract in which there is a gain or loss is actually sold.
- **U.S. Department of Energy (DOE):** A cabinet-level department of the United States Government concerned with the United States' policies regarding energy and safety in handling nuclear material. Its responsibilities include the nation's nuclear weapons program, nuclear reactor production for the United States Navy, energy conservation, energy-related research, radioactive waste disposal, and domestic energy production.
- **Unsaturated Hydrocarbons:** Hydrocarbons with double or triple bonds between the carbon atoms. Examples are ethylene and propylene. Generally, are more reactive than saturated hydrocarbons.
- **Viscosity:** That property of a liquid which causes it to offer resistance to flow. The higher the viscosity of an oil the less readily it will flow; the lower the viscosity of the oil the more readily it will flow. Motor oil with a viscosity of SAE 10 will flow more readily than a SAE 20.
- **Volatility:** A measure of the propensity of a substance to change from the liquid or solid state to the gaseous state. A volatile liquid is one which readily vaporizes at comparatively low temperatures.
- **Wash Sale:** A fictitious transaction to make it appear that there was a trade. This is prohibited by the Commodity Exchange Act. See wash trading.
- **Wash Trading:** Entering into, or purporting to enter into, transactions that give the appearance of purchases and sales but usually do not result in a change in the traders' market position.
- **West Texas Intermediate (WTI):** A crude stream produced in Texas and southern Oklahoma which serves as a reference or "marker" for pricing a number of other crude streams and which is traded in the domestic spot market at Cushing, Oklahoma. WTI is considered a light, sweet crude.

- **Yield:** In petroleum refining, the percentage of product or intermediate fractions based on the amount charged to the processing operation.