Charles L. Whetstone, M. D.
Assistant Medical Director

Continental Oil Company
P. O. Box 1267
Ponca City, Oklahoma 74601
(405) 762-3456

July 7, 1977

Dr. Pierre Decoufle
Environmental Epidemiology Branch
National Cancer Institute
Landow Building, A521
Bethesda, Maryland 20014

Dear Doctor Decoufle:

After a number of unanticipated delays, Continental Medical Division has extracted the additional information you requested. At the time of your visit to Ponca City, Viola Smith, Conoco Personnel, supplied lists of present and past employees of the Baltimore plant. Medical Division has retained identical copies of the lists and it is from these that points of reference will be made. Shown below are the headings on each list so that the information can easily be correlated.

1. "Terminated Employees (have kardex)" - Out of a total of 111 names we were able to locate only eight (8) medical files.

2. "1971-1976 Retirees" - Out of a total of 30 names, we have available thirteen (13) medical files.

3. "Still Employed" - Out of a possible 49 individuals we have all forty-nine (49) medical files available in our Medical Division.

4. "Terminated Employees (not having kardex)" - In searching our files, no medical records could be found on this group of employees.

Altogether this makes a total of seventy (70) medical files available for your study through to 1960. These records are included. In order not to violate medical/legal ethics, a simple code system has been devised with each individual lab test and date shown, but the name is omitted.

My knowledge of the stability and long service of employees at the Baltimore plant is consistent with the observations you made in your May 10, 1977, letter reporting your review of the employee history and mortality there. I agree that any study is best considered to be of petrochemical workers in general rather than benzene specifically. The potential for employee exposure to many other chemicals besides benzene has, as you know, always led me to believe that a simple cause and effect linkage between benzene in any abnormal

health effect was scientifically unsound, unless great care to quantify the levels of benzene exposure and isolate them from other significant exposures, could be carefully accomplished. If we were to develop a simplistic benzene/health effect conclusion, it might divert our focus from real causes. Consequently, any future study should be approached objectively, with an open mind, so we can have fully as much effort directed on analyzing cause as we do determining effect. This was the major point we were trying to make in the meeting we had with you prior to your initial efforts.

At that meeting we presented a table of chemicals present in the plant over the years. We rated these according to their potential for hazardous exposure based on a qualitative assessment of 5 criteria.

(1) How the chemical is handled.
(2) The volume present in the plant.
(3) The physical properties of the chemical.
(4) The length of time it was present in the plant.
(5) The chemical's toxic properties.

You will recall that it was on the basis of this table that you chose to limit the cohort of your initial study to between 1947 and 1960, because that tended to minimize the multiplicity of chemical exposure. Now you indicate you wish to include only those who were hired after 1947 and the present and future work force. This means that your cohort will include those who have had exposure to the many additional chemicals in the plant in recent years. To refresh your memory in this regard, here is the list of chemicals and the qualitative potential exposure we presented in our first meeting.

POTENTIAL FOR HAZARDOUS EXPOSURE

HIGH	MEDIUM	LOW
Aluminum Chloride	Toluene	Nonene
Hydrogen Chloride	Xylene	Naphthalene
Benzene	Eicosine	Acetylene
Chlorine	Caustic Soda	Dialkylbenzene
n-paraffins	Dodecylbenzyl chloride	Diphenylalkane
Methyl cellosolve	Dodecylbenzyltrimethyl ammonium chloride	Calcium Carbide
Formaldehyde	Dodecylbenzene	Thiourea
Ammonia	Tridecylbenzene	Sulfonated coker gas oi
bis(chloromethyl) ether	n-chloroparaffins	Sulphur dioxide/sulphur trioxide

POTENTIAL FOR HAZARDOUS EXPOSURE (Continued)

HIGH	MEDIUM	LOW
Isopropyl alcohol	Dodecene	Mercury
Trimethylamine	Carbon black	
Asphalt distillation product (Chevron)		Gasoline (Citco)
Asbestos		Tetraethyl lead (Citco)
		Sulfuric acid

If we proceed with the study I believe we can help out by supplying the time intervals each of these chemicals were in the plant.

Your letter implies a desire to extend the study beyond looking at mortality, to include examination of our medical surveillance records to try to correlate these with benzene exposure. You note, for instance, certain abnormalities that have not been previously associated with benzene. The more valuable approach of this work may be to tie those abnormalities to chemicals where they have been noticed before, as the measure of the effect of that chemical on the work force.

In summary, I think the study should go forward provided:

(1) The same care is used to analyze the causative chemical as is used to determine the health effect.
(2) That conclusions be drawn in the best spirit of scientific objectivity.
(3) That all information regarding the study be made available to Conoco Chemicals to help us manage the Baltimore plant consistent with ample regard for the health of our employees.

Charles L. Whetstone M.D.

Charles L. Whetstone, M.D.
Assistant Medical Director

Attachments
cc: Mr. Dave Kuhn - Houston
(attachments not included)
bjc

January 21, 1977

J - Balto -

Pierre Decoufle, Sc.D.
Environmental Epidemiology Branch
National Cancer Institute
Landow Building, A521
Bethesda, Maryland 20014

Dear Doctor Decoufle:

Your letter of December 21, 1976, requesting Conoco undertake an epidemiology study at the Baltimore Chemical plant has been reviewed by Management. Chemicals Division has responded favorably to your request and asked Medical Division to notify your office of this decision.

Even though Chemicals proposes a willingness to cooperate fully with the National Cancer Institute, we would be remiss in not pointing out certain potential problem areas which might dilute the anticipated impact you wish to derive from such an epidemiology study. You should be well briefed on the history of the plant; i.e. how it evolved at one time from a refinery to the present day petrochemical plant, and that older employees or retirees will have had exposures to bi or end product interim compounds. We are concerned that this plant will not provide as pure an exposure to benzene that you seek because of the presence of significant amounts of many other chemicals that have gone heretofore.

Accordingly, I think it appropriate that designated key officials from Conoco and NCI at some suitable time have a session to evaluate these variables and conduct a briefing as to how you propose to undertake this study.

We look forward to meeting with you and your staff.

Sincerely,

Charles L. Whetstone, M.D.
Assistant Medical Director

bjc

Conoco Chemicals Company

Conoco Inc.
P.O. Box 2197
Houston, TX 77001

September 10, 1980

RECEIVED
SEP 11 1980
VIRGINIA MOORE

Dr. Pierre Decoufle
School of Health Related Professions
Health Sciences Center
University of Arizona
1935 North Freemont
Tuscon, Arizona 85719

Dear Dr. Decoufle:

Enclosed is the plant process information we have discussed. I trust this is detailed enough to satisfy your needs. As you are aware, it was difficult to obtain information on the plant prior to 1947, when it was a refinery. I have also enclosed a history of the refinery with my summary description.

It is our understanding that we will review the report in draft form before publication, to assure the accuracy of information as it relates to plant operations, as well as other aspects of the study. Please let us know when this can be done. If further information is needed at this time, please feel free to call.

Sincerely,

Thomas G. Grumbles
Director, Industrial Hygiene

/yp

cc: Dr. Whetstone
Virginia Moore
R.E. Lehmkuhl

CHRONOLOGICAL HISTORY OF BALTIMORE PLANT

1915	Refinery built by Prudential Refining Co.
1929	Refinery purchased by Marland Oil Co.*
1947	Refinery converted to Chemical Plant to make detergent alkylene.
1949	Began producing "Neolene".
1954	Hydrotrope (STXS) unit start-up.
1955	DoDecyl Benzyl Chloride (DBCL) unit start-up.
1960	"ADOQUAT" production started.
1961	Calcium Intermediate Unit start-up.
1964	Main product switched from Neolene to Nalkylene.
1964	Trainer Feed Stock production started.
1964	Bollestra Unit start-up.
1965	A-390 production started.
1968	Adoquat production stopped.
1971	DBCL production stopped.
1972	Calcium Intermediate plant shut-down.
1973	Baltimore Base Oil (BBO) production started.

* Marland Oil Co. merged with Continental Oil in late 1929.

Exposure Potential - Chemical Plant

NEOLENE/NALKYLANE PRODUCTION (1950 - PRESENT)

The major process at the Baltimore plant has been the production of detergent Alkylates. This is a continuous process utilizing benzene, paraffins and chlorine. Muriatic Acid and aqueous aluminum chloride are produced as by-products. Basically, paraffins are received and fractionated into specified cuts. Chlorine is vaporized with steam and reacted with the paraffin cuts. The chloroparaffin is then sent to an alkylation reactor where it is reacted with benzene. This is a conventional aluminum chloride Friedel-Krafts Reaction.

HYDROTROPE (STXS) UNIT (1954 - PRESENT)

This unit consists of a small batch reactor that produces sodium toluene, sylene sulfonates and ammonium sylene sulfonate. These materials are hydrotropes, used as detergent additives. The process involves reacting xylene or toluene with 99% H_2SO_4 in the presence of heat to produce sulfonic acid. This product is then neutralized with caustic solution and dilute aqueous ammonia.

DODECYL BENZYL CHLORIDE (DBLC) UNIT (1955 - 1971)

This is a batch operation involving two reaction steps in a stirred pot reactor. The initial step involves the reaction of paraformaldehyde, methanol and phosphorus tirchloride to form methyl chloromethyl ether (MCME). MCME was then reacted with Neolene/Nalkylene (alkylate) in the presence of concentrated sulfuric acid to produce DBCL. Bis-chloromethyl ether (BCME) is an intermediate reaction product in this process.

"ADOQUAT" was produced in the same vessel as DBCL. "ADOQUAT" is manufactured by reacting DBCL with an aqueous solution of trimethylamine in the presence of aqueous 2-propanol and heat. The product is used as an inhibitor of bacterial growth and corrosion in secondary oil recovery and water injection systems.

CALCIUM INTERMEDIATE UNIT (1961 - 1972)

This is a continuous process utilizing calcium carbide, methyl cellosolve (2-methoxyethanol) and carbon dioxide in a two step reaction to produce calcium intermediate (calcium ethylene glycol monomethyl ether mono carbonate). Calcium Intermediate is the neutralizing and overbasing agent used in producing calcium sulfonate from heavy alkylbenzene sulfonic acid.

Calcium carbide and methyl cellosolve are reacted and Acetylene is formed as by-product. This reaction product is mixed with carbon dioxide to form the Calcium Intermediate product.

TRAINER FEED STOCK UNIT (1964 - 1978)

This unit produced several different products including A-390 ~~and~~ Baltimore Base Oil (BBO), and H-380 (trainer feedstock). This unit produced high molecular weight defergent alkylates from Olefins and Benzene for conversion into oil soluble sulfonates. The process involves the dimerization of dodecene, a Friedel-Crafts alkylation of benzene using powdered Aluminum Chloride and a distillation of the reaction products.

BOLLESTRA PLANT (1964 - 1966)

This was basically a sulfonation unit. Sulfur was burned to produce SO_2 which was then converted to SO_3 in a catalytic reactor. The SO_3 gas is then reacted with alkylate (Neolene) to form sulfonic acids. The sulfonic acid is then neutralized with caustic.

Refinery Process Information

Enclosed is a history of the Baltimore Plant from 1915 until it's conversion to a chemical plant in 1947. This history puts emphasis only on the type and capacity of equipment or processing units at the Refinery. However, in knowing this and the products produced, some estimates of exposure potential can be made.

The Plant produced a full line of refinery products that included light oils, bunker, lube oils and wax. It appears no petrochemical operations (aromatic extraction, ethylene production, etc.) were done. Knowing this, exposures of concern would be those encountered in any refinery producing similar products. Acid gases (H_2S, SO_2), aromatics (benzene, toluene, xylene), gasoline additives (TEL, dyes, etc.) and PNA's associated with asphalt production were present.

The degree of exposure to these chemicals is difficult to estimate without knowledge of the refinery operations. The aromatics were present only as stream constituents and exposure to them could be estimated as low to moderate on an 8-hour basis. Without knowing more about what crude the plant processed the exposures to SO_2 and H_2S are hard to estimate also. However, they would probably be in the same range of low to moderate. Exposures to the gasoline additives were intermittent, and the PNA exposures were most likely very low.

The Baltimore Plant

The Baltimore Plant was born in 1915 when the Prudential Oil Company began construction of an 11,000 barrel refinery; additional equipment was added in 1920 and 1921 to increase the capacity of the plant by 50% when running light Mexican crude to coke.

The original plot consisted of 150 acres with over twelve hundred feet of water front property. The dock is connected by an eighteen hundred foot channel, 35 feet deep, with the 42 foot deep Fort McHenry channel which connects the Chesapeake Bay with the Port of Baltimore.

In 1921 five additional 55,000 barrel tanks were added, in 1922 three 80,000 barrel tanks, and in 1923 four Dubbs (Thermal Cracking) cracking units with necessary equipment including ten, 30,000 barrel tanks, and six additional 80,000 barrel tanks were added. Hot oil pumps and recirculating flue gas systems were added in 1925 to two of the Dubbs cracking stills.

During this period we produced a full line of refinery products that included light oils, bunker, lube oils, and wax.

The plant had three distinct water systems, one supplying river water for plant operations, the second supplying well water for plant operations, and the third was river water for fire protection. These river water systems were effective enough normally, but occasionally we had to shut down to remove the fish and crabs that had slipped through the strainers.

In addition to the water and truck facilities, Prudential Oil Company maintained a fleet of 400 tank cars with a combined capacity of 77,000 barrels.

The Major share of crude oil was shipped by tanker from Mexico and California.

We also had four asphalt converters (12½ x 35½ feet each), and all were connected to one common 80 foot radial brick stack.

The converters were elevated so that the contents could gravitate into tank cars or drums. The converters were fired by gas from the main gas system.

The main distillation unit consisted of four (14' x 40 foot) end-fired reducing stills.

Eighteen (14 x 40 foot) side-fired coke stills built in pairs, each pair equipped with one 60 foot stack. Each still was equipped with one tower.

We also had two (14 x 40 foot) side-fired lube stills.

These twenty-four stills and two topping plants were served by two receiving houses that were equipped with look boxes and manifolds so that complete fractions could be cut to any one of the seventeen (35 x 12 foot) run-down tanks.

We had four (six cubic foot) Connersville Gas Exhausters that pulled gas from the stills thru two cast iron scrubbers and discharged to burners throughout the refinery. The lines also connected to one 250,000 cubic foot and one 500,000 cubic foot gas holders for storage of surplus gas and holding tanks for transfers to the Baltimore Gas and Electric Company who distributed it to homes and industry throughout the City.

Interest in an East Coast outlet prompted Marland Oil Company to purchase Prudential in 1929. Baltimore employees became members of the Conoco family later that year when the merger between Continental and Marland was completed.

Since that time we, along with the other Conocoans have seen many, many changes.

One of the biggest in the eyes of the Baltimore employees was the conversion from the refinery to a petrochemical plant. In 1946 the refinery was shut down and converted into Continental Oil Company's first petrochemical plant.

Initital work on the production of dodecylbenzene was begun early in June 1949 in the Baltimore Sales Service Laboratory. The object was to determine if a product could be produced that would be comparable to Oronite Chemical Company's "Alkane" using benzene and Continental Oil Company's dodecene. This alkylation was to be catalyzed by anhydrous aluminum chloride.

The initial laboratory work proved that a dodecylbenzene alkylate comparable to Alkane could be produced by using aluminum chloride as the catalyst (AD-LIB reasons for Alkane, i.e. HF catalyst, bottoms no good for Trainer and Oronite's patents, etc.). The procedure was very similar to the procedure used to produce dodecyltoluene in the plant.