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REVISED DRAFT OF 10/25/88

CHRONOLOGY OF BROWN & WILLIAMSON SMOKING AND HEALTH RESEARCH

1906 Brown & Williamson Tobacco Company is formed.

1927 Brown & Williamson Tobacco Company is purchased by British-American Tobacco Company ("BATCo") and incorporated in Delaware under the name of Brown & Williamson Tobacco Corporation ("Brown & Williamson").

1946 Prior to 1946, the only research done at Brown & Williamson was performed in a laboratory established under the control of the Manufacturing Department. In 1946, the Technical Research Department was formed with Dr. R. C. Ernst as the Director of Research on a consulting basis. Four divisions were created within the Technical Research Department: Central Control, Product Services, Basic Research, and Developmental Research. The majority of research conducted at this time was still in the form of technical support for the Manufacturing Department. (See The Technical Research Department of Brown & Williamson Tobacco Corporation. A Comprehensive Report of its History, Current Status and Recommendations, 650032904/2943)

1948 Brown & Williamson's Technical Research Department begin investigating several components of cigarette smoke for their effect on smoke flavor. These include: acids, alcohols, aldehydes, alkaloids, ketones, phenols, aminos and heterocycles, resin acids, and sulfur compounds. Brown & Williamson also begins development of a cellulose acetate filter for cigarettes invented by Swiss scientist, M. Ponterman. (See The Technical Research Department of Brown & Williamson Tobacco Corporation. A Comprehensive Report of its History, Current Status and Recommendations, 650032904/2943)

1949 The Technical Research Department semi-annual report for the second half of 1949 reveals research in the areas of leaf analysis, tobacco processing developments, product improvements in taste and flavor, and product preference testing. Brown & Williamson scientists also evaluate reconstituted sheet tobacco and synthetic menthol for use in cigarettes. At this time the only work done on the physiological effects of cigarette smoke had been "a thorough review of chemical abstracts." (1950 1st Semi-Annual Report of the Technical Research Department, 650200002/0031)

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1950 Brown & Williamson begins work with Tamas of Rand Development Corporation to develop a synthetic cigarette wrapper that would eliminate the harsh, irritating smoke in a cigarette that comes from the paper wrapper. The project failed. Rand later revisited the project and applied for a patent in 1954 for a "non-carcinogenic cigarette wrapper." (See Rand Cigarette Film, 650340814/0844)

In June, the first paper wrapped cellulose acetate filter rods were produced by the Research Department This improved product was adopted as the Health-Guard Filter Tip. (650032904/2943)

The second semi-annual report for the Technical Research Department for 1950 indicates that the majority of the work conducted was leaf analysis, quality control, tobacco processing, product development, evaluations of casings and humectants, and preference testing. At this time significant improvements were being made in the development of the cellulose acetate filter. (See 1950 Semi-Annual Report of the Technical research Department, 650200032/0079)

1952 The Tennessee Eastman cellulose acetate filter known as the "Health Guard Tip" is reported to be in production. Cigarettes with this filter produce 42-46% less tar and 19-35% less nicotine than the non-filtered competitors. A review of scientific literature on arsenic and cancer and the presence of arsenic in smoke and insecticides is conducted. Cancer is "investigated from a literature standpoint" in light of "frightening testimony" from epidemiology studies. A carcinogenic hydrocarbon, benzo(a)pyrene, is partially isolated from tobacco leaf and smoke. (See Report of Progress - Technical Research Department, 650200084/0095)

1953 On April 16, 1953, I. W. Tucker becomes the first full-time director of Brown & Williamson's Technical Research Department, a position he held until September 30, 1959. Tucker replaces Dr. R. C. Ernst, who officially stepped down as Research Director on April 1, 1954. In his departmental report of December 1953, Tucker states that the smoking and health situation "will be an important factor in establishing the direction which our research department will take." (See The Technical Research Department of Brown & Williamson Corporation. A Comprehensive Report of its History, Current Status and Recommendations, 650032905/2943)

650200084-0095 Box

1954 On January 4, 1954, Brown & Williamson and the other major cigarette companies announce the formation of the Tobacco Industry Research Committee ("T.I.R.C."), later the Council on Tobacco Research, to sponsor independent research into questions on the relationship between smoking and disease. ("A Frank Statement to Smokers," New York Times, Jan. 4, 1954.)

In April of 1954, I. W. Tucker, Director of Research at Brown & Williamson, presents paper, at a conference in Bristol, England, which discusses how the tobacco companies research departments must now conduct work on smoke constituents not only for technological improvements but also for better understanding of their products as a result of the smoking and health controversy. Tucker states that carbon monoxide deserves serious investigation because of its biological activity. (See "Smoke Constituents and Their Relation to Quality," 650379408/9449)

2 Brown & Williamson publishes and distributes to the medical community a pamphlet reporting recent studies demonstrating the nontoxicity of menthol and mentholated cigarettes. (See A Report on Recent Studies of Menthol and Mentholated Cigarettes, 650332840/2862)

Following the first statement of the Medical Research Council, which suggested that smoking was a possible cause of cancer, British cigarette manufacturers donate 1/4 million pounds to the Medical Research Council for a seven-year research program into smoking and lung cancer. (650344436)

1956 The British manufacturers establish the Tobacco Manufacturers' Standing Committee to assist research into the question of smoking and health, to keep in touch with scientists and others working on the subject in the U.K. and abroad, and to make information available to scientific workers and the public. (650379408/9449)

1957 Surgeon General Burney issues the first statement of the Public Health Service on the smoking and health issue, stating that the weight of the evidence indicates a causative relationship between excessive smoking and lung cancer. (103 Cong. Rec. 11792 (1957))

BATCo Research Report RD14 dated March 1, 1957, discusses work to test hypothesis that tobacco smoke contains a substance or substances that cause "ZEPHYR" (cancer?). This report provides preliminary findings from analysis of two possible ZEPHYR-causing agents in tobacco smoke, BORSTAL (arsenic?) and 3, 4, 9, 10-DBP

(Dibenzo(a)pyrene?). Final results of this experiment are not included in this or other documents. (See "Smoke Group: Program for Coming 12-16 Week Period," 650312917/2930)

1958 Prior to 1958 Brown & Williamson and BATCo pool research and sharecosts under informal agreements. On April 15, 1958, Brown & Williamson and BATCo agree, to pool research and share costs according to ratio of Brown & Williamson sales to BATCo sales. (680503137/3138)

Thomas Wade becomes Brown & Williamson's Vice President of Research and Development, a position he would hold until October 1, 1965. (See K&S memorandum on Brown & Williamson Research Department Heads)

Brown & Williamson broadens its Research and Development department and hires additional chemists. (Esterle interview of 6/11/87)

Felton of BATCo prepares summaries of the literature on smoking and health which are forwarded to Brown & Williamson, a task he would continue until the late 1970's. (Esterle interview of 6/11/87)

As a result of published reports by Roffo and others, Imperial Tobacco Co., an affiliate of the BATCO Group, devises method to estimate quantity of 3,4 benzo(a)pyrene in tobacco smoke condensate and leaf extracts. Results show cigarette smoke contains about 5 micrograms of 3,4 benzo(a)pyrene per 500 g. of cigarette and that ninety percent of 3,4 benzo(a)pyrene was formed during combustion. Imperial also conducted methods for reducing 3,4 Benzo(a)pyrene in smoke by the treatment of tobacco with a catalyst. Copper nitrate at 2.5-5.0% is found to give the best results. (See Polynuclear Hydrocarbons in Tobacco Smoke: Parts I-III, 650022157/2209)

1959 Surgeon General Burney publishes a position paper of the Public Health Service stating that the principal factor in the increased incidence of lung cancer was smoking, particularly smoking of cigarettes. (Burney, L.E. "Smoking and Lung Cancer - A Statement of the Public Health Service," Journal of American Medical Association, 171: 1829-1837, 1959.)

1960 Robert Griffith becomes Brown & Williamson's Director of Research and Development on June 7, 1960, a position he would hold until July 31, 1969. (See K&S memorandum on Brown & Williamson Research Department Heads)

1961 In a note dated June 1, 1961, Sir Charles Ellis first discusses the concept of PROJECT ARIEL's alternative smoking device. (680275756/5759)

On October 1,1961, Brown & Williamson and BATCo agree, to pool research results but to bear their own research costs. (680503128/3132)

1962 Report of the Royal College of Physicians of London on Smoking in Relation to Cancer of the Lung and Other Diseases concludes that smoking is a cause of lung cancer and bronchitis and probably contributes to the development of coronary heart disease. (See "Smoking and Health," Summary and Report of the Royal College of Physicians on Smoking in Relation to Cancer of the Lung and Other Diseases, Pitman Publishing Co., 1962.)

Brown & Williamson and BATCo agree on March 6, 1962, to pool research free of charge. (680503124)

At a BATCo Research Conference in Southhampton held shortly after the release of the Report of the Royal College of Physicians, Sir Charles Ellis states that the BATCo Board of Directors had decided that it would support the other British manufacturers who had adopted an industry-wide approach to the smoking and health controversy. Under this industry-wide approach, all biological testing would be done by the Tobacco Merchants' Standing Committee ("T.M.S.C."). The physical and chemical testing of cigarette smoke would be done by the individual companies. Ellis also reviewed the proposed experiments to be done at T.M.S.C.'s laboratories. At this time BATCo began funding large scale mouse skin painting, epidemiology, and pharmacology studies through T.M.S.C. Dr. Green of BATCo suggested that "we should adopt the attitude that the causal link between smoking and lung cancer was proven." Esterle, Griffith, Upfield, and Wade of Brown & Williamson were in attendance. (See "Smoking and Health: Policy on Research," 650344434)

Following Lorillard's announcement of Kent's selective filtration of phenols, Sir Charles Ellis chairs a BATCo Research Conference and discusses the BATCo Group's failure to recognize and solve the problem with phenols. Esterle, Griffith, and Wade of Brown & Williamson attend. ("The Importance of Phenols to the Health Question and Their Possible Elimination from Cigarette Smoke," 650344392/4432)

On March 1, Battelle begins PROJECT ARIEL in conjunction with Sir Charles Ellis to develop an alternative smoking device. (See Ellis Patents memoranda

Griffith, Brown & Williamson's Director of Research, receives a copy of a paper entitled, "Some Aspects of the Chemistry and Biology of Tobacco Smoke" from a colloquium given by W. W. Reed of Central Laboratories, W. D. & H. O. Wills (Aust.) Ltd. which contains an extensive survey of the anomalies of the chemical and biological evidence that smoking causes disease. (650345662/5693)

1964 The first Surgeon General's Report on Smoking and Health released January 11, 1964 states that cigarette smoking is causally related to lung cancer in men. "Smoking and Health," Report of the Advisory Committee to the Surgeon General of the Public Health Service, U.S. Dept. of Health, Education, and Welfare, Public Health Service, Center for Disease Control, PHS Publication No. 1103, 1964.)

Brown & Williamson and the other major cigarette manufacturers begin funding of American Medical Association Education and Research Foundation ("AMA/ERF"). The manufacturers agree to provide $10 million to the AMA/ERF from 1964 to 1968 with Brown & Williamson contributing $1 million. (See K&S memorandum on Brown & Williamson's Contributions to the AMA/ERF)

BATCo studies influence of additives on delivery of tar and nicotine. (See Report No. L-132-R)

In August of 1964, BATCo develops a method for the determination of carbon monoxide (CO) in cigarette smoke. This method revealed that burley cigarettes yielded 6.85% CO while flue-cured blend cigarettes yielded 6.5% CO. It was also shown that cellulose acetate filters have no effect on carbon monoxide levels. (650012850/2860)

A BATCo study reveals that the fermentation process used in Argentina has little effect on the delivery of tar, phenols or volatile acids. Further tests show that the fermentation process increases the hydrogen cyanide deliveries. (See Report No. L.191-R, 650012867/2890)

1965 On April 9, 1965, the BATCo Additives Guidance Panel advises against use of DEG. (See Additives Guidance Panel minutes of 4/9/65, 500012811)

Battelle Institut, Frankfurt am Main, begins examination of the biological activity of cigarette smoke for BATCo in PROJECT JANUS using a number of different tests including skin painting, inhalation and

hyperplasia tests. PROJECT JANUS would continue through 1978.

A report on a method for measuring the ciliastatic activity of smoke using paramecium states that this method is already being used at BATCo to test filters designed to reduce the ciliastatic components of smoke. (See Report No. L.157-R, 650012891/2909)

Battelle Institut, Frankfurt am Main, begins examination of the inhibition of delivery activity by smoke of various samples of cigarettes in PROJECT CONQUEROR. (See Report No. B-2)

BATCo conducts research that grows that cigarettes treated with additives aluminum sulfate/ammonia, sodium phosphate, and potassium carbonate reduced toxicity of the smoke, while ammonium carbonate produced a smaller valuation. (See Report No. 360-R)

1966 Brown & Williamson provides $2000 to fund research at Spindletop Research, Inc. entitled, "Analysis and Control of the Products of Pyrolysis of Tobacco." (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

In August of 1966, the final report on PROJECT ARIEL is issued which states that the Projects objective can be achieved within two years if financial resources are committed. (See K&S Memorandum on Project Ariel)

On June 6, 1966, Battelle reports results of hyperplasia tests conducted for BATCo in PROJECT JANUS attempting to develop a short-term test which could be used as a substitute for long-term skin painting tests as an indication of probable tumorigenicity. Initial testing fails to discover the direct correlation between the hyperplasia and skin painting tests results found by the Tobacco Research Council laboratories. (See Report B-1)

On April 4, 1966, Battelle reports results of goblet cell tests conducted for BATCo in PROJECT CONQUEROR which show that cigarette smoke exposure results in increased goblet cell formation in rat trachea with burley smoke causing a greater increase in goblet cells than flue-cured smoke. (See Report RD. 396-R, "Project CONQUEROR: Goblet Cell Test," 650009534)

On February 28, the U.S. Patent Office issues formal notice of allowance of claims in original PROJECT ARIEL device. (See K&S Memorandum on Project Ariel)

On November 11, 1966, Battelle issues 2nd progress report for BATCo on the inhibition of ciliary activity by cigarette smoke in PROJECT CONQUEROR. Changes in smoke chemistry of plain cigarettes did not result in an improvement of smoke toxicity. Non-charcoal filtered smoke was less toxic than plain smoke with carbon filtered smoke being least toxic. (See Report B-2)

Imperial Tobacco Co., (an affiliate in the BATCo Group, develops a method for the determination of acrolein in cigarette smoke, which had been shown to induce ciliastasis in mammals and to inhibit cell growth in human cells. (650335794/5815)

BATCo studies the production of phenols due to the pyrolysis of phenolic substances in tobacco. Acids, specifically chlorogenic acid, are found to be a major contributor to phenol production. Experiments show that the use of additives to oxidize chlorogenic acid did not decrease phenol production. (See Report No. L.192-R, 650012835/2849)

BATCo tests the efficiency (i.e. removal of all smoke components) of carbon filters bonded with trisodium phosphate. With the addition of 10% trisodium phosphate and 4% polythene, these filters are comparable in efficiency to the BONDEX plugs. Above the 10% level there is a reduction in filtration efficiency. (See Report No. L.200-R, 650012821/2834)

BATCo evaluates the meerschaum cartridge filter. This tatachable plastic filter, which was filled with meerschaum granules, was claimed to be effective for about 20 cigarettes. Filtration tests show that, while the filter is effective for the vapor phase of smoke, it does not work well on the particulate phase of smoke. (See Report No. L.204-F, 650012808/2820)

BATCo experiments with two different methods for the determination of aldehydes in both the vapor phase AND whole smoke from cigarettes. The absolute accuracy of each test could not be determined, but the 3MBTH method was recommended. (See Report No. L.205-F, 650012783/2807)

BATCo determines that there is a causal relationship between sulphydryl-binding activity and the toxicity of smoke to paramecium. This study shows that wet paper filters are very effective for reducing the toxicity of smoke, but the addition of sulphydryl compounds to the water in these filters is unlikely to be useful. (See Report No. L.210-R, 650012768)

BATCo analyzes the use of additives for the modification of smoke chemistry. The second report issued on this topic reports that the deliveries of tar, nicotine, phenols, aldehydes, hydrogen cyanide, oxides of nitrogen, and carbonyls could be significantly altered by. It is also shown that certain salts could markedly reduce nicotine deliveries. (See Report No. L.211-R, 650012716/2750)

1967 Industry scientists from all six major cigarette manufacturers critique study by Hudson that contends that introduction of chemosol as an additive prevents the formation of benzo(a)pyrene. (680142203/2215)

5 Preliminary PROJECT JANUS results show that a reduction of benzo(a)pyrene as the result of the addition of potassium carbonate does not reduce tumorigenicity in mouse skin painting tests. Based on this, Griffith B & W's Director of Research suggest that Wynder's work incriminating benzo(a)pyrene and other polycyclic hydrocarbons may have been given too much attention. (680142144)

6 BATCo Additives Guidance Panel reviews the use of monomethyl maleate because its probable pyrolytic product, maleic anhydride, had been shown to be mildly carcinogenic. (See Additive Guidance Panel notes of 1/25/67, 500012793)

On February 15, 1967, Battelle issues a report as a part of PROJECT JANUS on hyperplasia tests which show that smoke from flue-cured, sodium nitrate treated cigarettes causes lower hyperplasia response. (See Report B-4)

Battelle conducts tests in PROJECT JANUS comparing the development of goblet cells in rat trachea after exposure to flue-cured and burley tobacco. The control animals became diseased and the experiment did not yield significant results. (See Report B-7)

Ciliastasis tests using clam gill and rabbit trachea tests are conducted as a part of PROJECT JANUS. Addition of zinc acetate to a filter resulted in reduced hydrogen cyanide and hydrogen sulfide but did not reduce smoke toxicity. (See Report No. B-9)

In December of 1967, Battelle reports that interim results from the PROJECT JANUS short-term hyperplasia tests reveal that a reasonable correlation exists between the hyperplasia tests and the long-term skin painting tests. (See Report No. B-10)

On October 24, 1967, BATCo holds a R&D Conference in Montreal. One of the assumptions made at this conference is that "smoking is an addictive habit attributable to nicotine and the form of nicotine effects the rate of absorption by the smoker." After a review of the American, Canadian, and German government's position on smoking and health, it is suggested that industry scientist should come together and initiate contact with government authorities in an attempt to influence policy. (See BAT: R & D Conference - Montreal, 1967)

Dr. Johnson of Brown & Williamson visits BATCo laboratory at Southhampton to exchange information with BATCo scientists. He reports that the 3,4 benzo(a)pyrene yield of cigarettes is substantially reduced by the addition of potassium carbonate. Johnson states that Dr. Hook was in charge of PROJECT ARIEL and that two models had been made, "one free of tobacco smoke and one having a small amount of tobacco smoke." Sir Charles Ellis is reported to have said, "We are in a nicotine rather than a tobacco industry" and that Projects MAD HATTER and HIPPO were set up to sell this concept to management. (500012128).

BATCo studies the effects of some sodium salts on smoke chemistry. From these tests there is no indication that puff temperature effects the nicotine alkaloid delivery. The addition of sodium formate and sodium acetate produce a significant reduction in the tar to nicotine ratio along with a large decrease in nitrogen oxides and hydrogen cyanide. Further studies will combine sodium nitrate, which lowers biological activity but yields high amounts of nitrogen oxides and hydrogen cyanide, with sodium formate and sodium acetate. (See Report No. L.240-R, 650012596/2613)

BATCo studies the transfer of some benzoic esters and paraffins from cigarettes to smoke. This study attempts to develop a method for predicting the delivery of semi-volatile materials from a knowledge of the amount of these materials present in the tobacco. At this time only an approximate prediction could be made because of several factors effecting pyrolysis of the chemical compounds. (See Report # L.248-R, 650012570/2595).

BATCo evaluates fermented and non-fermented Mexican cigarettes for differences in smoke chemistry. Only minor differences in smoke chemistry are found. (See Report No. L.250-R, 650012530/2550)

BATCo examines the effect of additives and tobacco types on formaldehyde deliveries. Tests show that flue-cured tobaccos yield up to five times more formaldehyde than burley and air-cured tobaccos. Tests with additives indicate that the addition of 8% sodium nitrate doubles the formaldehyde yield, while 3% potassium carbonate addition halves the yield. Ammonia treatment results in an even greater decrease in formaldehyde yield. Humectants have little effect. It is found that there is a strong correlation between formaldehyde yield and toxicity to Paramecium and that any method of reducing formaldehyde yield should decrease Paramecium toxicity. (See Report # L. 251-R, 650012551/2569).

BATCo develops a simple method for the determination of benzo[a]pyrene in cigarette smoke. This method uses a gas liquid chromatographer which is extremely sensitive. (See Report L.253-R, 650012504/2529)

On August 16, 1967, BATCo issues the third progress report on PROJECT HART. This project was initiated so that BATCo would be in a position, if required, to produce cigarettes delivering lower amounts of tar with normal amounts of nicotine through selection of tobaccos. (See Report L.256-R, 650033353)

BATCo studies the breathing pattern of humans during smoking. The majority of subjects did reproduce their individual breathing pattern in several tests. Results showed that some participants used their natural breathing pattern in smoking cigarettes. (See Report L.261-R, 650012436/2464)

BATCo attempts to develop a short-term in vitro test for carcinogenesis. Previous publications indicated that mutagens can produce measurable chromosome damage in human lymphocytes. In these tests, however, no known carcinogens in smoke produced any visible chromosome damage and work was discontinued. (650012465/2480)

At a June 30, 1967 meeting of BATCo scientists to discuss past work on nicotine, Sir Charles Ellis states that BATCo is in the nicotine rather than the tobacco industry. The results of PROJECT MAD HATTER and PROJECT HIPPO are discussed. PROJECT MAD HATTER investigates ways to maximize the desirable constituents of smoke and to minimize the undesirable ones. The first part of the study was a complete literature search on the pharmacology, sociology, and psychology of smoking. The second part was designed to determine what the body does with nicotine. PROJECT HIPPO is designed to delineate the paradoxical effect

of nicotine as a stimulant and tranquilizer. It was also revealed at this meeting that PROJECT ARIEL is dormant after the first samples gave a tremendous kick, even though the nicotine delivery was small. ARIEL would be reinitiated soon. (See Johnson's notes of June 30, 1967 meeting, 500012128)

BATCo studies the change in smoke condensate viscosity due to filtration. Smoke from fermented tobacco and smoke from filters containing PEI, silica gel, or calcium chloride showed an increase in viscosity. The increase in viscosity was not related to the toxicity of the smoke to paramecium and the work was discontinued. (See Report No. L. 222-R, 650012630)

BATCo examines the effect of collodion and pyroxlin on filter efficiency. Neither substance significantly increased the filtration efficiencies for such smoke constituents as baked tar, total particulate matter or total nicotine alkaloids. (See Report No. L. 239-R, 650012614)

BATCo evaluates the use of PEI, sodium carbonate and trisodium phosphate as filter additives. PEI is the most effective additive for reducing the ratio of the deliveries of nicotine to tar and reducing hydrogen cyanide deliveries. (See Report No. L.262-R, 650012651/2673)

BATCo investigates several different methods for the removal of aldehydes from tobacco smoke. The most effective system is the use of a wet filter containing a polyamine or amine acetate salt. This method shows a marked reduction in smoke toxicity to paramecium. Efforts to overcome obstacles to Commercial use of this filter (i.e. cost, toxicity, smoke quality, and imparticulity of manufacture) (See Report No. L.274-R, 650012695/2715)

On December 15, the U.S. Patent Office issues Patent No. 3,356,094 for improved PROJECT ARIEL device. (See K&S Memorandum on Project Ariel)

1968 R. A. Sanford becomes Brown & Williamson's Acting Director of Research and Development in July of 1968, a position he would hold until January, 1970. (See K&S memorandum on Brown & Williamson's Research Department Heads)

As a result of outside developments in the smoking and health controversy, Brown & Williamson contracts with Battelle Memorial Institute to test the biological activity of its products in acute and chronic mouse inhalation tests in projects entitled BOSTON HILTON and

ATLANTA HILTON. PROJECT BOSTON HILTON involves efforts to design, construct, and operate a forced inhalation smoking machine. PROJECT ATLANTA HILTON involves efforts to determined the acute toxicity of smoke to mice. Information concerning the results of these projects will be released By Bahelle only at the request or discretion of Brown & Williamson. Results showed that there was no scientific justification for acute toxicity tests. No further work done after September, 1969. (See Kennedy File Notes of 7/14/69 and 9/11/69, 500013534/3535)

Brown & Williamson provides $20,000 to fund general research at Spindletop Research, Inc. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

On September 24-30, at the BATCo Group Research Conference, results of biological testing are discussed, including how features of a cigarette (e.g., incorporation of PCL and CRS, additives, filters, ventilation) can reduce biological activity. There is general agreement that a cigarette of reduced biological activity should be produced. It was also agreed that a new product could and should be introduced without conclusive proof of lower biological activity. (See Green's notes of 1/27/69.)

BATCo develops a simple and cheap piece of equipment to produce a pattern of small holes in cigarette paper to reduce the tar and nicotine contents of cigarette smoke. (650313402/3418)

Mouse skin painting studies investigating a potential problem with the tumorigenicity of tobacco treated with Penar are forwarded to Brown & Williamson by BATCo. (680143165/3168)

Further testing by Battelle in PROJECT JANUS shows a connection between the results of the hyperplasia tests and long-term skin painting tests. BATCo informs the Tobacco Research Council that hyperplasia tests should be used to indicate probable tumorigenicity. (See Report Nos. B-12 and B-13)

Studies are begun on smoke retention in the mouth and smoke deposition in the upper respiratory tract. Work is discontinued on smoke retention in the lung. (See Report Nos. RD-624-R, 650017512; RD-613-R, 650017435)

On November 6, BATCo recommends developing the Chorioallantoic Membrane ("CAM") procedure into a routine in vitro bioassay. (See Report No. RD. 622-R, 650017221).

BATCo investigates the effects of cigarette smoke on the pH of human mucous. Studies show that smoke from flue-cured tobacco lowered the pH of tissue culture media and paramecium culture solution more than air-cured tobacco. Five-cured tobacco was also more toxic to paramecium and cultured tissue. The results showed that pH could influence the toxicity of smoke in a human system and that this should be taken into consideration in further tests. (See Report L.269-R, 650012419/2435)

BATCo evaluates the efficiency of two new filter additives, PEI and zinc acetate. The addition of 5% PEI and 5% zinc acetate to cellulose acetate filters is found to give the best reduction of hydrogen cyanide and hydrogen sulphide deliveries in smoke. Results were good and further tests are proposed. (See Report L.279-R, 650012396/2418)

1969 On July 9, 1969, BATCo and Brown & Williamson agree to pool mechanical and product development research and share costs for a period of five years according to a ratio of Brown & Williamson sales to BATCo sales. The agreement is made retroactively effective to January 1, 1969. (680503113/3122)

On February 11, the BATCo Additives Guidance Panel reviews position on coumarin following ban of coumarin as cigarette additive in Germany. (See Additive Guidance Panel minutes of 2/11/69, 500012759)

Kennedy of Brown & Williamson is assigned the task of keeping abreast of the scientific literature on smoking and health, a task which he performed until 1975. Prior to that time no specific Brown & Williamson employee is responsible for staying abreast of the literature. (See Esterle interview of 6/11/87)

Brown & Williamson funds project entitled, "Protocol for Investigation of Chemosol" at Hazleton Laboratories, Inc. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Projects)

BATCo conducts preliminary evaluation of octahydrocoumarin as a possible substitute for coumarin, which is banned in foods by the FDA. (680259307/9317)

Battelle reports results of PROJECT JANUS rat inhalation tests conducted for BATCo examining the development of goblet cells after smoke exposure Tests result in hyperplasia and metaplasia without goblet cell proliferation. (See Report No. B-14)

Battelle reports results of PROJECT JANUS skin painting tests conducted for BATCo, which do not reveal the correlation between mast cell concentration and progress of carcinogenesis as reported by Riley. A discontinuation of this work is recommended. (See Report No. B-15)

Battelle reports results of ciliastasis tests conducted for BATCo. Paramecium toxicity tests confirm that the addition of water to a filter plug leads to a marked reduction in smoke toxicity. Ciliastasis tests are terminated after the next series of samples did not show a reduction in smoke toxicity. (See Report No. B-16, B-17)

Imperial Tobacco Co., a BATCo affiliate, reports that the paramecium test offers a rapid routine technique for measuring the toxic and ciliastatic properties of cigarette smoke's vapor phase. A new machine for this test has been developed. (See File No. 0410-01)

On June 2-6, at the BATCo Research Conference in Kronberg all companies again agree to pursue a safer cigarette and to develop short-term tests for determination of carcinogenic activity in smoke. The ARIEL project is reviewed and it is decided that this is a worthy project but should not be pursued at this time. R. B. Griffith and Dr. Sanford were in attendance for Brown & Williamson. (See BATCo Research Conference 6/2-6/69)

Phenol is removed by the use of PEG as a filter additive. (See BATCO Research Conference, 6/2-6/69)

Fractionation work to identify specific initiators and promoters is conducted by the T.S.C. at the Harrogate laboratories. (See BATCo Research Conference, 6/2-6/69).

BATCo evaluates the performance of "Lucky Filters" designed by American Tobacco Company. This polymer filter removes more tar and nicotine than a cellulose acetate filter but not as well as other polymer filters The "Lucky Filter" was also ineffective in removing vapor phase constituents and did not reduce the smoke toxicity to paramecium. (See Report L.296-R, 650012368/2381)

BATCo tests a new filter, marketed by Reemsta that contains an acidic additive. This filter is shown to reduce the total TPM delivery, suggesting a selective filtration of semi-volatile constituents. This filter

On November 9-13, at the BATCo Group Research Conference in Quebec, water filters, duolite and charcoal filters, zinc oxide and zinc acetate filters are discussed in "response to a vapor phase situation." There is also much discussion about recent developments in reconstituted tobacco, non-tobacco fillers, freeze-dried tobacco, and puffed tobacco and their effect on the biological activity of smoke. (See 1970 BATCo Group Research Conference)

BATCo studies the effect of filters containing water on the composition of smoke from cigarettes submitted for PROJECT JANUS. Filters containing water and water mixed with sodium carbonate, or zinc acetate, or citric acid do not significantly change the biological activity of the smoke. (See Report No. L. 318-R, 650011747/1761)

BATCo investigates the extraction of nicotine and other chemical components of smoke by methanol. When methanol is used as a solvent on ground tobacco, TPM and benzoapyrene deliveries are reduced by 30%. Further work is suggested that would test the biological activity of the extracted tobacco. (See Report No. L. 328-R, 650011712/1731)

BATCo develops an objective method for measuring the mouth irritation caused by smoke. By measuring the rate of saliva production, cigarettes could be ranked in order of irritation. (See Report No. L. 329-R, 650011732/1746)

BATCo issues the second report of an effort to develop a routine bioassay using the CAM of fertile hens' eggs. This report describes a method of applying cigarette smoke coagulate to the CAM of hens' eggs and measuring the response as an indication of biological activity. (See Report No. L. 331-R, 650011690/1711)

BATCo conducts an examination of coliform bacteria in cigarettes. While the strains of bacteria are not positively identified, they appear to have no known health or hygienic significance. (See Report No. L. 337-R, 650011670/1689)

BATCo studies the effect of additives on the concentration of aromatic polycyclic hydrocarbons ("PAH") in smoke. These studies have been underway since at least 1968 and this is the third report of the series. Maleic acid or copper nitrate was found to reduce PAH levels and produce a condensate of lower activity in mouse skin paintings. Cigarettes with co-

axial rods of gas-releasing material also lowered the PAH levels of smoke. (See Report No. L. 355-R, 650011650/1669)

1971 BATCo conducts research that shows that adding bismuth oxide and calcium oxalite to cigarettes causes a reduction of over 50% of the PAH in cigarette smoke. (680145603-5605)

BATCo conducts study on the effect of the breathing pattern on the retention of smoke in the human respiratory system which showed that the magnitude of retention depended on the inhalation/exhalation pattern. (See Report No. R.D. 824-R)

Brown & Williamson begins funding Cancer Immunology Research Project at Washington University. Funding continues until 1981. (See K&S memorandum on Brown & Williamson Funding of Smoking & Health Projects)

Battelle conducts mouse skin painting tests for BATCo to measure the promotion activity of smoke condensates. A Gerlach sheet made from ethanol extracted tobacco is found to be less tumorigenic than condensate from 60% CN 102 and 40% flue cured lamina. (See Report No. B-23)

BATCo conducts human smoking study to determine whether smokers compensate through puffing and inhaling behavior when smoking reduced tar and nicotine cigarettes. A degree of compensation is found. (See Report No. 837-R)

BATCo attempts to develop a bioassay test utilizing human embryo lung cells. These tests prove unsuccessful and are discontinued. (See Report No. L. 326-R, 650011827/1838)

BATCo modifies the tetrahymena test for measuring the toxicity of smoke. The new method produces a substantial improvement in day-to-day reproducibility. (See Report No. L. 359-R, 650011808/650011826)

BATCo attempts to create a fractionation procedure that could isolate biologically active sub-fractions of selected condensates. Work terminated when it was discovered that use of the NMFl, a simpler method, was related to biological activity. Work with the NMFI continued. (See Report No. L. 363-R, 650011780/1807)

BATCo conducts a follow-up study for assessing smoke irritation by measuring salivary flow rates. A positive correlation between flow rate and irritation is confirmed. (See Report No. L. 370-R, 650011764/1779)

1972 Brown & Williamson patents invention to reduce nicotine content without loss of desirable smoking qualities. (650201837/1846)

Kennedy of Brown & Williamson surveys literature on "Beneficial Aspects of Smoking." (690008455/8464)

Brown & Williamson begins funding the Harvard Medical School Tobacco and Health project. (See K&S memorandum on Brown & Williamson Funding of Smoking & Health Projects)

BATCo establishes a Biological Research Committee with representatives from the various affiliated companies. The committee's purpose is to make recommendations to BATCo management concerning areas where biological testing is needed. (Esterle interview of 6/11/87).

Battelle reports on PROJECT JANUS inhalation tests conducted for BATCo investigating smoke of two different cigarettes for their mutagenic effect. Smoke exposed animals were found to have significantly reduced fertility. (See Report No. B-25).

Battelle conducts PROJECT JANUS mouse skin painting tests for BATCo using condensate from a standard 100% CN102 lamina cigarette which reveal a dose-response relationship which will be used for later experiments. (See Report No. B-26).

Battelle conducts 36-week long mouse skin painting tests for BATCO as a part of PROJECT JANUS. Condensate from five different cigarettes reveal a promoting activity, which parallels results observed in long-term skin painting experiments and short-term hyperplasia tests of the same condensates. (See Report No. B-27).

Nicotine

Bioassay Ltd. conducts research at Bath University for BATCo on nicotine analogues as the result of BATCo's concern that the tobacco industry's future would be less secure if nicotine became less attractive to smokers. Results show that nicotine analogues have an inhibitory effect on some of the pharmacological effects of nicotine. (See Report No. RD953-R)

BATCo studies the smoke properties of cigarettes containing BATEX, a reconstituted tobacco, or BATEX filled with carbon or calcium carbonate. Cigarettes

containing 16% BATEX did not reduce hyperplasia response. However, chalk-filled and carbon-filled BATEX did show a reduced hyperplasia response. (See Report No. L. 848-R, 650011088/1101)

BATCo evaluates the use of polymeric materials as tobacco substitutes using a short-term biological test. Smoke from cigarettes containing these materials show a higher activity towards paramecium but no difference in other activity compared to CN102 tobacco. (See Report No. L. 856-R, 650011102/1124)

BATCo evaluates LBA-5RT, a reconstituted tobacco sheet made by Le Tabac Reconstitute, reported to have low biological activity. All short-term tests showed little or no reduction in biological activity. (See Report No. L. 860-R, 650011123/1139)

BATCo studies the use of NMFI as a measure of biological activity. The report shows a correlation between the NMFI and biological activity. (See Report No. R.D.869-R, 650011140/1163)

BATCo conducts a study on the effect of dimethylbenzanthracene ("DMBA") as an initiator in tumor-promoting activity to mouse skin. This study finds that DMBA increases the rate of skin tumors in mice. (See Report No. R.D.869-R, 650011164/1182)

BATCo evaluates the use of a carbon fabric produced by Siche Gorman as a filter material. This material reduces the vapor phase constituents to a level comparable to granular activated carbon filters. It also shows a reduction in smoke toxicity to paramecium. (See Report No. R.D.884-R, 650011183/11197)

BATCo conducts research on the effects of pressure drop and smoke delivery on human smoking patterns. This study reported "no evidence of compensation" when a subject smoked a cigarette with a higher pressure drop and lower delivery. This paper states that changes in pressure drop could alter smoking behavior. (See Report No. R.D.897-R, 650010989/11006)

BATCo conducts study comparing the retention in the human respiratory system of smoke from cigarettes made from flue-cured tobaccos and air-cured tobaccos. This study shows that significantly more nicotine and less particulate matter is retained with air-cured tobacco cigarettes than with flue-cured cigarettes. (See Report No. R.D.907-R, 650011007/1036)

BATCo investigates reports that normal and malignant tissues possess different patterns of lactate dehydrogenase isoenzymes. Attempts are made to determine whether known carcinogens or smoke condensate could cause these changes in isoenzyme patterns to occur in a variety of cells in culture. No changes were observed. It was recommended that if animal facilities became available this study should be reconsidered as a possible indicator of premalignant change. (See Report No. R.D.910-R, 650011037/1055)

D. J. Wood of BATCo conducts a literature review of studies on why people continue to smoke. Some of the causes reviewed are: nicotine and nicotine dependence; oral gratification; obsessional ritual; personality characteristics; and means of controlling emotion. (See Report No. R.D.926-R, 650011056/1085)

On Oct. 14-19, 1972 at the BATCo Group R&D Conference in Chelwood, it is suggested that "our aim should be to provide smoking pleasure accompanied by a risk no greater than that with comparable habits," such as alcohol. It is felt that the main objective of the research department should be to "design cigarettes preferred by smokers." Dr. Green presented a paper on "The Association of Smoking and Disease." (1972 Research Conference 680048899.)

Battelle reports the results of a quantitative study of the suppression of enzyme activity by condensates of several different B-series cigarettes. (See Report No. B-24)

1973 Dr. I. W. Hughes serves as Vice President of Research and Development from November, 1973 until January, 1976. (See K&S memorandum on Brown and Williamson Research Department)

Brown & William contracts with A. D. Little to conduct ciliostasis tests (500007335)

Brown & Williamson requests that BATCo conduct biological work on menthol. (See April 26, 1973 letter from Hughes to Green.)

In March of 1973, Battelle reports results of mouse skin painting tests conducted for BATCo in PROJECT JANUS which investigated the effect of puff volume on the tumorigenicity of condensate. These tests reveal a highly significant correlation between puff volume and tumorigenicity. (See Report No. B-28)

In September Battelle reports results from mouse skin painting tests for BATCo, in PROJECT JANUS comparing

cocoa-containing condensate with a control condensate, which show that cocoa-containing condensate has less tumorigenicity than control condensate. (See Report No. B-29)

1974 On June 20, Brown and Williamson and BATCo extend the July 9, 1969 research pooling and cost sharing agreement. (680503112)

Hughes proposes that BATCo conduct an experiment to examine the correlation between nicotine and carcinogenicity as the result of National Cancer Institute's report, "Towards Less Hazardous Cigarettes - Report No. 1." (680142403/2404)

A. D. Little conducts second ciliostasis test for Brown & Williamson. (500007335)

Brown & Williamson begins funding research by Dr. Martin J. Cline at the University of California at Los Angeles relating to a possible relationship between tobacco and disease, particularly lung cancer; investigation into the means of early detection of cancer; and research on therapeutic techniques involving immunotherapy and chemotherapy. Funding continues through 1981. (See K&S memorandum on Brown & Williamson Funding of Smoking & Health Projects)

BATCO test markets a cigarette called Planet containing the Courtauld's Smoking Material. This generated quite a reaction from the Department of Health and Social Security (DHSS) because very little information was available to the Hunter Committee on this material. CSM contained additives such as sugars, sodium and potassium compounds, urea, iron-containing material and a trace of menthol. This cigarette produced about half the tar of an all tobacco cigarette but 60% more CO. (See Report No. R.D.1099-R, 650011198/1227)

Battelle reports results of PROJECT JANUS hamster inhalation tests conducted for BATCo. In these tests six of forty-three smoke-exposed hamsters developed epidermoid carcinomas, while only two of forty-one control animals developed lesions of this type. (See Report No. B-30)

Battelle reports results of PROJECT JANUS mouse skin painting tests conducted for BATCo which reveal that condensate from 100% PCL cigarettes is less tumorigenic than condensate from standard American blend cigarettes and from 100% CN102 lamina cigarettes. (See Report No. B-31)

Battelle reports results of PROJECT JANUS mouse skin painting tests for BATCo which reveal that condensate from 50% CN 102/50% cut rolled stem ("CRS") cigarettes had comparable tumorigenicity to condensate from 100% processed cigarette leaf ("PCL") cigarettes but less tumorigenicity than condensate from 100% CN 102 lamina cigarettes. (See Report No. B-32)

BATCO studies the effects of growing, harvesting and curing variables on the quality of tobacco and paper reconstituted tobacco ("PRT"). Flue-curing is found to lower most smoke component deliveries. Tobacco converted to PRT produces lower levels of TPM, nicotine and phenols but higher levels of carbon monoxide, acetaldehyde, and acrolein. (See Report No. R.D.1077-R, 650011839/1860)

BATCO develops a method for determining the LD_{50} of cigarette smoke condensate by measuring changes in baby hamster kidney cells. Results showed that only large differences in biological activity could be detected by this test. It was not recommended for routine use. (See Report No. R.D.1978-R, 65001186/1879)

BATCO conducts a literature review of the effects of smoke on alveolar and peritoneal macrophages. There is no consensus on whether macrophage activity is increased or decreased when exposed to smoke. Macrophages are an important part of the immunological system, in that they consume bacteria and foreign cells and remove inhaled particles from the lungs. This study encourages further work to develop an in vitro or in vivo test to quantify smoke toxicity by measuring macrophage response. (See Report No. R.D.1090-R, 650012002/2035)

BATCO initiates a comprehensive literature review of the effects of cigarette smoke and smoke components on cells and tissues in culture. Permanent, non-reversible and hereditary changes in morphology and cell functions which may be invoked by cigarette smoke and its carginogenic components are described. (See Report No. R.D.1091-R, 650011228/1298)

BATCO evaluates chemical tracers in order to study the deposition of smoke particles in the lung. Results show that these tracers are distributed among all sizes of particles and could be used in inhalation studies. No further work is planned. (See Report No. R.D.1092-R, 650011299/1315)

BATCO evaluates a CODEVAC cigarette made from Benson & Hedges blend and cytrel. This cigarette gives a constant delivery of TPM and nicotine per puff

throughout its length. It also delivers significantly less CO than a 100% tobacco cigarette. (See Report No. R.D.1107-R, 650011316/1355)

BATCO studies the smoking behavior of 100 employees. The smoking parameters evaluated include: total smoke volume, average puff volume, average puff duration, ave. puff interval, and butt length. (See Report No. R.D.1109-R, 650011515/15212)

BATCO develops several techniques for the study of inhalation toxicology in small laboratory animals, which will be the main emphasis of the studies to be carried out in the new Life Sciences building which is built this year. A rapid decrease in breathing volume is observed when animals are exposed to smoke, even if heavily anesthetised. (See Report No. R.D.1114-R, 650011474/1514)

BATCO studies the psychomotor performance of smokers and non-smokers. Smokers are found to have lower psychomotor efficiency than non-smokers. (See Report No. R.D.1126-R, 650011443/1473)

BATCO attempts to devise a method for ranking cigarettes in order of irritation. Results show that certain chemical indices are closely related to human evaluation of irritation and that formaldehyde, acetaldehyde, propionaldehyde, acrolein, crotonaldehyde and methyl ketone are highly related to irritation. (See Report No. R.D.1130-R, 650011365/1410)

BATCO establishes the NMFI test at Southhampton after it is decided that there is enough correlation between the NMFI and long-term skin painting results. (See Report No. R.D.1136-R, 6500114111/1442)

BATCO measures the size of smoke particles from various cigarettes using an aerosol analyzer. All samples produce similar particle size distributions. Recommendations are made that further studies should examine particle growth in a humid environment. (See Report No. R.D.1143-R, 650011880)

BATCO studies the effect of changes in the ratio of TPM to nicotine on human smoking patterns. Decreases of 30% of nicotine produce only small compensation in smoking. A reduction in TPM delivery causes a slight amount of compensation in the form of longer puff retention times. (See Report No. R.D.1144-R, 650011543/1563)

BATCO tests a cigarette with machine-printed bands of gelatin on the paper. These cigarettes are found to yield an extra puff with no change in TPM or nicotine delivery. They have reduced sidestream emission but high mainstream yields of carbon monoxide, nitrogen oxide, and hydrogen cyanide. (See Report No. R.D.1429-R, 650011583/1622)

BATCO conducts a study of the uptake of water by cigarette smoke. Major factors influencing the water uptake of smoke are humectants, additives, ventilation, and tobacco types. It was suspected that a lower water uptake in smoke would decrease the deposition of particles in the human lung. R.D.1495 (See Report No. R.D.1495-R, 650011564/1582)

On January 12-18, 1974 BATCO holds the Group R&D Conference at Duck Key, Florida. After a discussion of new smoking materials, it was determined that the frontrunners were N.S.M., Cytrel, CSM and BATFLAKE. (1974 R&D Research Conf.)

1975 On December 12, 1975 Brown & Williamson and BATCo amend their research pooling and cost sharing agreement of July 9, 1969, to limit Brown & Williamson's contribution to $100,000. (680503111)

R. A. Sanford becomes Director of Research and Development, a position he would hold until March 27, 1979. (See K&S memorandum on Brown & Williamson Research Department Heads)

No specific person at Brown & Williamson is assigned the task of keeping abreast of the scientific literature on smoking and health from the time Kennedy left in 1975 until 1980. (Esterle interview of 6/11/87).

Brown & Williamson contracts with Dugan/Farley Communications Associates concerning a marketing approach to reach physicians. (See 501002556/3272)

Battelle reports results of PROJECT JANUS mouse skin painting tests conducted for BATCo to test the reproducibility of its earlier tests. Battelle is able to reproduce only two of three of its prior tests to a degree of statistical significance. (See Report No. B-33)

A. D. Little concludes ciliastasis research for Brown & Williamson. (500007335/7336)

BATCo conducts menthol research for Brown & Williamson.

BATCO conducts a survey of 1500 male smokers of filter tipped cigarettes in PROJECT WHEAT to classify smokers into a number of categories showing patterns of motivation or "inner need" and to investigate if this motivation is related to the smoker's preferred nicotine level. (See Report No. RD. 1229-R; Report No. RD. 1322 650015436, 650020356)

Compensation study conducted by Imperial Tobacco Co., a BATCo affiliate, adjusts his smoking habits when smoking cigarettes with low nicotine and TPM to duplicate his normal cigarette nicotine intake. (Imperial Tobacco Project T-8077)

BIBRA conducts coumarin baboon feeding study. (See Sanford letter of 10/7/75 to Evelyn.)

Felton of BATCo reports on a visit to Battelle Institute on April 22-24, 1975. (650034099)

BATCo investigates the growth of smoke particles in a humid environment. Studies showed that the condensation of water vapor onto smoke particles could cause chemical changes that would increase the total deposition of smoke in the lung. (See R.D.1185-R, 650011900)

On April 2-8, 1975, the BATCO Group R&D Conference is held in Merano, Italy. BATCo policy states that large numbers of lesser animals are preferable to a few higher animals for biological testing. An agreement is made to support a study of the "initiation-promotion hypothesis of risk to smokers" by using mouse skin paintings. It is suggested that the position of the companies not to compete on health grounds if and when new smoking materials are introduced should be discussed at Chewton Glen. Sanford and Hughes are in attendance for Brown & Williamson. Before the meeting Dr. Green sent Dr. Sanford a set of guidelines for BATCo policy on smoking and health. These guidelines include: relations with governments, research, use of additives and substitutes, health claims, etc. (See 1975 R&D Conference minutes, 500006612).

1976 Dr. I. W. Hughes becomes Senior Vice President of Research and Development in January of 1976, a position he would hold until April, 1979. (See K&S memorandum on Brown & Williamson Research Department Heads)

Brown & Williamson conducts research on filtration and paper ventilation. Brown & Williamson also develops the Purite filter, which is shown to filter acrolein and hydrogen cyanide selectively. (500008542/8543)

these components in sidestream smoke. (See Report No. L.508, 650011623)

BATCo investigates the growth of smoke particles in a humid environment using new smoking materials. It is believed that an increase in water uptake by smoke particles increases smoke deposition in the human lung. CSM shows the lowest water uptake while Batflake and Cytrel has the highest. It is recommended that further research should be undertaken to produce a cigarette smoke having reduced water uptake. (See Report No. R.D.1373, 650012182/2208)

On April 5-9, the BATCO Group Research Conference is held in Montreal. The main objectives are to prepare the Tobacco Division of BATCo for the upcoming Hot Springs Conference. It is suggested that "we should study how best to make ethical health claims." It is also proposed to begin a project by the Tobacco Working Group costing $28 million for development of a low delivery cigarette containing extracted tobacco skeletons, additives and flavors. Manufacturers would then compete on the basis of top dressing flavors. (See 1976 BATCo Research Conference)

1977 The Royal College of Physicians released its third report on smoking and health which again concludes that there is a causal relationship between smoking and disease. (Smoking or Health: A Report of the Royal College of Physicians, Pitman medical Publishing Co., Ltd., 1977.)

On February 7, 1977 Brown & Williamson and BATCo rescind their research pooling and cost sharing agreement of July 9, 1969, as modified on December 12, 1975, and enter into a new agreement on November 15, 1977. Under this agreement BATCo would provide its Central Group Research product to Brown & Williamson in exchange for 0.15% of Brown & Williamson's income. (517002801/2802)

Brown & Williamson's Research and Development department is reorganized following Brown & Williamson's purchase of P. Lorillard's export business. (Esterle interview of 6/11/87)

Brown & Williamson collaborates with BATCo (Suisse) to reduce CO delivery. (680072394)

Wilton, Smith, and Binns of BATCo report results from "3-Month Inhalation Toxicity Study of Rats Exposed to Smoke from a Flue-Cured Cigarette." (See Report No. RD. 1477, 3/23/87)

Stewart of BATCo reports results of rat inhalation experiments investigating effect of cigarette smoke on rat lung enzymes and structural proteins. (See Report No. RD. 1525)

BATCo conducts a comparative inhalation toxicity study of smoke from conventional, reconstituted sheet, and BATFLAKE cigarettes which show that BATFLAKE in combination with blended tobacco does not produce increased smoke toxicity. (See Report RD. 1507)

BATCo conducts six week rat inhalation study in an attempt to develop a basis for rapid screening of smoke toxicity. (See RD. 1457, "Combined Scanning Electron Microscopy and Light Microscopy Study on the Rat Larynx," 1/21/77)

Smith of BATCo publishes two articles on examination of the rat larynx following exposure to cigarette smoke. (See Smith, G. "Scanning Electron Microscope Observation of the Rat Larynx," Proceedings of the European Society of Toxicology, 18, p. 272-281, 1977; Smith, G. "Structure of the Normal Rat Larynx," Laboratory Animals, 11, p. 223-228, 1977.)

BATCo reanalyzes the early PROJECT JANUS experiments and concludes that there is no reason to believe that an incorporation of cocoa, sugar, or humectant into the blend of a cigarette leads to an increase in tumorigenic activity of smoke condensate. (See Report No. RD. 1537.)

Battelle reports results from PROJECT JANUS mouse skin painting tests conducted for BATCo which show that condensate from cigarettes made from a Gerlach sheet of ethanol extracted tobacco is less tumorigenic than condensate from cigarettes made from 60% flue cured lamina and 40% CRS. (See Report No. B-42)

Wickham Research Laboratories reports results of mouse skin painting experiments conducted for BATCo comparing tumorigenicity of six cigarettes, including some cigarettes made from reconstituted tobacco. (See Report No. B-43)

Battelle reports mouse skin painting experiments conducted for BATCo comparing the effect of several alternative modes of tobacco manufacture on the tumorigenic activity of condensates produced from cigarettes containing different materials. (See Report No. B-46)

1978 Litzinger of Brown & Williamson proposes research on how people stop smoking so that Brown & Williamson can design products to "intercept" people who are trying to quit. (650510607)

Brown & Williamson conducts research on the FACT duolite filter with ion exchange resin.

Brown & Williamson investigates effect of additive potassium carbonate on smoking characteristics. (650513295)

Brown & Williamson investigates palladium filter and oxygen rich paper in attempt to reduce CO. (650510383)

Smith of BATCo reports interim results on "Pilot Long Term Inhalation Toxicity Study" exposing rats to cigarette smoke for 52 weeks. (See Report No. RD. 1633, 11/14/78.)

BATCo scientists publish results of short term rat inhalation experiments. (See Walker, D., Wilton, Lynda V., Binns, R. "Inhalation Toxicity Studies on Cigarette Smoke (VI) 6-Week Comparative Experiments Using Modified Flue Cured Cigarettes: Histopathology of the Lung," Toxicology, 10, pp. 229-240 (1978); Binns, R., Wilton, Lynda V., "Inhalation Toxicity Studies on Cigarette Smoke (VIII) 6-Week Comparative Experiment Using Modified Flue Cured Cigarettes: General Toxicity," Toxicity, 11, p. 207-218, 1978; Smith, G., Wilton, Lynda V., and Binns, R., "Sequential Changes in the Structure of the Rat Respiratory System During and After Exposure to Cigarette Smoke," Toxicology and Applied Pharmacology, 46, pp. 579-591, 1978.)

As a part of PROJECT JANUS, Battelle conducts two sets of mouse skin painting experiments for BATCo comparing the tumorigenic activity of condensates produced by five types of cigarettes containing different materials, including reconstituted tobacco sheet. Inclusion of BATFLAKE at 25% and 50% levels increased tumorigenicity. (See Report Nos. B-49 and B-50)

BATCo conducts PROJECT IGOR to develop cigarettes meeting Gori's delivery requirements. (500007669)

In March, the BATCo Group R&D Conference is held in Sydney, Australia. At this Conference it is stated that cigarettes of Substantially Reduced Biological Activity (SRBA) could be made and this would present a range of marketing opportunities. SRBA means cigarettes "where epidemiology would show no greater incidence of disease for smokers than non-smokers."

There is also a call for defensive research which may well include social aspects. (See 1978 Research Conference minutes)

1979 The 1979 Surgeon General's Report on smoking and health claims that smoking has been shown to be more dangerous than originally suspected in 1964 and is now the "largest preventable cause of death in the U.S." The report stresses the social costs of smoking, the high risk of smoking in certain occupational settings, the link between smoking and heart disease, and the increased incidence of smoking by children. (U.S. Department of Health, Education, and Welfare. Smoking and Health: A Report of the Surgeon General. U.S. Department of Health, Education, and Welfare, Public Health Service, Office of the Assistant Secretary for Health, Office on Smoking and Health, DHEW Publication No. (PHS) 79-5066, 1979.)

On April 27, 1979 R. A. Sanford becomes Vice President for Research and Development, a position he would hold until July, 1983. (See K&S memorandum on Brown & Williamson's Research Department Heads)

Brown & Williamson funds the "National Public Health Program" at the Franklin Institute. Funding continues until 1983. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Projects)

BATCo conducts menthol testing which shows that menthol has no significant toxicity in animals and that nicotine is rapidly absorbed, metabolized, and excreted in the urine of humans. (See notes from 1979 BATCo Group Research & Development meeting.)

BATCo conducts research on smoking motivation in PROJECT LIBRA, a study of 2000 respondents, to distinguish between nonsmokers, smokers and ex-smokers according to their views on health in general and smoking and health in particular. (See notes from 1979 BATCo Group Research & Development meeting; Report No. RD. 1670; RD. 1743-C.)

BATCo sets up a consumer research facility in Southampton to investigate "interaction process analyses" in which smokers, nonsmokers, and deprived smokers are compared in problem solving situations. (See Notes from 1979 R&D meeting.)

BATCo conducts PROJECT AQUARIUS to identify consonant and dissonant smokers. (See Notes from Group R&D Conference, Part I, February 5-9, 1979.)

BATCo conducts PROJECT VIRGO to identify the perceived benefits and disadvantages of smoking. (See Report No. 1668, "A Qualitative Study on the Perceived Benefits and Disadvantages of Smoking," 4/18/79.)

BATCo conducts rat inhalation studies comparing four different filter types. (6500322802328)

BATCo conducts PROJECT LOCO to examine all possible ways of reducing carbon monoxide. (6503291029127)

Read of BATCo summarizes carcinogenicity tests currently available or under investigation or development by BATCo companies worldwide. (See Report No. RD. 1751, 6500318561880)

Felton of BATCo visits various laboratories in the United States and Canada, including Brown & Williamson, CTR, Philip Morris, as well as TI and Jacob, Mediger, on a fact-finding mission relating to smoking and health. (6500327742836)

In the late 1970's Thornton of BATCo takes over newsletter summarizing smoking and health literature from Felton.

1980 The 1980 Surgeon General's Report to Congress on smoking and health focused on evidence showing smoking results in increased lung cancer risks in women as well as risk of spontaneous abortion, fetal death, and neonatal death. (U.S. Department of Health, Education, and Welfare, The Health Consequences of Smoking for Women: A Report of the Surgeon General, U.S. Department of Health, Education, and Welfare, Public Health Service, Office of the Assistant Secretary for Health, Office on Smoking and Health, 1980.)

BATCUS, Inc. is established to become the parent company of Brown & Williamson.

On December 31, 1980, BATCo and Brown & Williamson cancel research pooling and cost sharing agreement of November 15, 1977, and all prior agreements relating to research pooling. (680503110)

Rosene at Brown & Williamson is assigned the task of keeping abreast of the scientific literature on smoking and health, a task which he performed until 1986. (Esterle interview of 6/11/87)

Brown & Williamson funds research by Dr. Kenneth Greenspan and Dr. Anthony Zito into the development of a model to describe the relationship between cigarette

smoking and health. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson begins funding biomedical research at Harvard Medical School. Funding continues through 1981. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson provides funds for the establishment of a Policy Analysis Center at the Franklin Institute under Gori. Funding continues through 1982. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson begins funding short term basic research at Rockefeller University. Funding continues through 1983. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson begins funding research under Dr. John P. Blass at the Burke Rehabilitation Center entitled, "Nicotine Theory of Metabolic Encephalopathies." Funding continues through 1985. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson begins funding research under Dr. Alton Meister of the Cornell University Medical College on "Glutathione: Its Transport and Function in Detoxification." Funding continues through 1985. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Baker and Greig of BATCo visit the United States and Canada on October 19-31, 1980 to attend the Tobacco Chemists Research Conference and to discuss development in the combustion/tobacco/paper field with other scientists.

In June, 1980 Felton of BATCo visits laboratories in Sweden, Germany, and Switzerland, to become aware of the latest developments in smoking and health. (6500327872789)

On Sept. 15-18, BATCo holds annual Group R&D Conference at Sea Island, Georgia. There is general concern over sidestream smoke and it is agreed that research should be conducted to reduce sidestream smoke. A priority item is research into filters that selectively remove gases from smoke. These minutes include a list of research objectives and their priority. (1980 R&D Conference minutes)

1981 The 1981 Surgeon General's Report to Congress on smoking and health examined the health consequences of smokers who smoke a continually changing, lower tar, lower nicotine cigarette.

Felton and Evelyn of BATCo suggest a procedure for approval of the use of additives for Brown & Williamson which includes the formation of an Additive Guidance Panel, a proposed policy for additive approval, and a program for additive testing. (5210382608262)

Sanford proposes a program for biological testing of Brown & Williamson's additives which would be conducted by BATCo (500003037)

Esterle proposes a program for testing biological activity of Brown & Williamson's cigarette additives to Sanford. (5000039283932)

Brown & Williamson funds biomedical research at the Russek Foundation. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson begins funding research at the University of California at San Diego under Dr. Schrauzer. Funding continues until 1982. (See K&S memorandum on Brown & Williamson Funded Smoking and Health Research Projects)

Brown & Williamson funds a special project at the Franklin Institute on "Cotinine in Plasma of Human Subjects" to investigate using cotinine as a marker of nicotine uptake in humans. Dr. Schrauzer. Funding continues until 1982. (See K&S memorandum on Brown & Williamson Funding of Smoking & Health Projects.)

Brown & Williamson contracts with Peters Technical Transfer Corp. to provide weekly scans and abstracts of the scientific literature in the smoking and health field. (Esterle interview of 6/11/87)

BATCo Additives Guidance Panel approves the use of eugenol-containing natural substances as additives based on data from inhalation tests, Ames testing, and other data. (See 10/25/82 memo from T. G. Mitchell of BATCo to Blackman.)

Hamster inhalation studies are discontinued.

As part of PROJECT IGOR and VIGOR, BATCo studies the prospect of developing and marketing a cigarette along the Gori guidelines. Maximum deliveries of certain critical substances are estimated by examining pre-1960 epidemiology studies in which it is determined that two

cigarettes a day is no more harmful than not smoking at all. The levels of key components of these pre-1960 cigarettes are quantified and new cigarettes are developed that would deliver the same level in 10, 20, or 30 cigarettes. (650020150/0185)

On August 24-28, BATCo holds its Group Research Conference in Pichlarn, Austria. Top priority is given to the development, production, and commercial exploitation of a product with low specific biological activity. Another area of importance is the development of a novel filter useful in producing a marketable low tar cigarette as well as a filter that selectively filters nitrosamines, hydrogen cyanide and aldehydes. Other topics discussed were sidestream smoke, tobacco processing improvements, use of additives, reduction of carbon monoxide, and development of a central computer system for inter-group communications. (526022280/2296)

1982 The 1982 Surgeon General's Report states that cigarette smoking is a major cause of cancers of the lung, larynx, oral cavity, and esophagus and is a contributory factor for the development of cancers of the bladder, pancreas, and kidney. (U.S. Public Health Service, The Health Consequences of Smoking. Cancer. A Report of the Surgeon General: 1982, U.S. Department of Health and Human Services, Public Health Service, Office on Smoking and Health, 1982.)

Brown & Williamson includes chloride analysis in premarket sampling scheme. Brown & Williamson's policy is not to buy tobacco that contains greater than 1% chloride content. (5121005960598)

BATCo conducts mouse inhalation toxicity tests on eugenol and cloves, which result in the BATCo Additive Guidance Panel approving their use in cigarettes during its October 22, 1982 meeting. (512100653)

On August 30, BATCo holds its annual Research Conference in Montebello, Canada. A major issue is the concern about sidestream smoke. It is decided to keep animal results on sidestream activity and thoughts of the biological activity of sidestream within BATCo. (1982 BATCo R&D Conference minutes)

1983 R. A. Sanford becomes Vice President of Science and Technology in July, 1983, a position he would hold until April 1, 1985. (See K&S memorandum on Brown & Williamson Research Department Heads)

Earl E. Kohnhorst becomes Vice President of Research, Development, & Engineering in July of 1983, a position he would hold until March, 1987. (See K&S memorandum on Brown & Williams Research Department Heads)

Brown & Williamson's Additive Guidance Panel revises its policy to cover novel cigarette additives. (5210376417643)

Brown & Williamson funds biomedical research at Washington University. Funding continues until 1985. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

Brown & Williamson begins funding research by Richard Gorlin entitled, "A Clinical Study of the Relationship Between Smoking and Other Activities and Myrocardial Ischemic Events." Funding continues until 1986. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

Brown & Williamson revists PROJECT ARIEL through efforts of Litzinger. (See K&S Memorandum on Project Ariel)

BATCo conducts PROJECT NARINERS to investigate changes in motivation and attitudes on smoking and health and to relate these changes to quitting and switching patterns. (512107561)

On August 22-26, BATCo its holds annual Research Conference in Rio de Janeiro, Brazil. PROJECT RIO is interpreted as having 2 different approaches: (1) Evaluation of national brands according to activity and modification to reduce specific activity; and (2) a systematic evaluation of chemical and physical changes of flue-cured blends to achieve major reductions in specific activity, primarily carcinogenic response. Sidestream and smoker compensation are also major topics. (Minutes of 1983 BATCo R&E Conference, 512106831)

1984 Pepples forwards notes from Gori concerning the safety of the use of cigarette additives; glycerol, oil of mace, and vanillin to Temko of Covington and Burling. (5210377837791)

Union Carbide, Brown & Williamson's supplier of DEG, registers complaint when it mistakenly believes that Brown & Williamson is using DEG in its chewing tobacco. Brown & Williamson informs Union Carbide that it does not use DEG on chewing tobacco or cigarettes but on pipe tobacco. (5121006320633)

Brown & Williamson begins funding biomedical research at Rockefeller University. Funding continues through 1985. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

BATCo conducts tests on transfer of additives to smokes. (512100652)

Massey of BATCo conducts survey of literature on deficiency of vitamin A as a cause of cancer and concludes that addition of vitamin A to cigarettes is not desirable. (6500330553076)

BATCo discontinues mouse skin painting research due to difficulties in obtaining a disease resistant but responsive strain of mouse. (See 3/22/84 notes on visit of Froggatt and Waller to GR&DC on 3/16/84.)

BATCo begins PROJECT SHIP, a smoke harshness improvement project. (512105195, 510001187)

BATCo holds a joint R&D Conference with the marketing department in the United Kingdom. A review of PROJECT RIO was conducted at the 1984 Biological Conference and presented here. Summaries of the other technical exchange meetings are also reviewed. Minutes of the Research Conference includes results of GR & DC's work on sidestream smoke and smoker psychology. A proposal for future biological research includes work on PROJECT RIO and development of short-term bioassay test. (521016789/6865)

1985 Esterle proposes chronic mouse or beagle dog inhalation experiments to prove safety of Brown & Williamson's cigarette additives. (5121005850587)

Brown & Williamson funds biomedical research at the Burke Rehabilitation Center. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

Brown & Williamson funds research at Northwestern Memorial Hospital under Dr. Gruhn. (See K&S memorandum on Brown & Williamson Funded Smoking & Health Research Projects)

1986 BATCo and Brown & Williamson agree in August of 1986 that Brown & Williamson will have access to and royalty free use of BATCo's Central Group Research project for one year for $1,000,000 with amounts for later years to be negotiated annually. (Letter dated August 27, 1986 from E.E. Kohnhorst to the Secretary of BATCo)