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August 17, 1994

James W. Hammond
1010 Townplace
Houston, Texas 77057

Mr. Hans Siegel
Health Services Department
Industrial Hygiene
Exxon Company, U.S.A.
Kellogg Tower, Suite 550
Houston, Texas 77002

Dear Mr. Siegel:

In response to your inquiry, I have set out below my background and experiences before I came to Exxon, the industrial hygiene program I found in place upon my arrival, the engineering controls and technology we used to safeguard workers from dust exposures in the field, the medical surveillance we implemented to double check the effectiveness of our controls, and the interrelation of the medical, industrial hygiene, and safety aspects of protecting workers' occupational health. I have also described our relationship with contractors who also worked on our property, and I explain how the association of mesothelioma with asbestos exposure changed our view of asbestos hazards, while the advent of OSHA regulation in the early 1970's brought few changes to our state-of-the-art program which had been in place for decades.

My educational background primarily consists of basic and applied science: after taking bachelor's degrees in chemistry and physics and chemical engineering from Mississippi State University in 1935, I took a masters of science degree in biological chemistry and toxicology from Louisiana State University with a scholarship.

I worked more than four years for the Chemical Engineering Division of the University of Tennessee, left that job in 1941, and joined the Industrial Hygiene Division of the United States Public Health Service (USPHS) with the rank of Captain. Then through the USPHS, I was assigned to the Massachusetts Division of Occupational Diseases, which was a part of the Department of Labor in Massachusetts and Boston, where I was able to augment my industrial hygiene studies at Harvard. I left Massachusetts in 1942 and was assigned to South Carolina, with the title of Chief Industrial Hygienist for South Carolina's Department of Health. In 1947, I became a member of Exxon Medical Division.

Now I am retired from the School of Public Health, University of Texas in the Medical Center here in Houston. I was an Associate Professor of Industrial Hygiene in that institution for about nine years.

But for most of my career (from 1947 to 1978) I was an industrial hygienist and sanitary engineer for Exxon (or its predecessor companies, including Humble, Esso, and Enjay). I hired on as Industrial Hygienist, and was elevated up to Chief Industrial Hygienist and then became Director of Industrial Hygiene for what would later become Exxon Company, U.S.A. While these promotions affected my salary and title, my professional duties and the goal of a healthful work environment for workers never varied during my 31 years with the Company.

In the first third of this century the control measures with regard to hazardous dusts were that of isolation of the exposure to the material, exhausting the dust away from the breathing atmosphere, capturing the dust by filtration or removal, by wetting the dust-generating material so that the dust wouldn't be generated, housekeeping or housecleaning by using the vacuum hoses or vacuum cleaners, and educating the employees in methods for producing the least amount of dust in their work. I believe that there are many different procedures, and they were all being used in some degree by 1940 in Humble and Esso generally.

In Standard Oil Company of New Jersey (Esso), the Chief of Safety Inspectors, named Mr. Roy S. Bonsib, had developed a particular interest in dust and dust-producing operations from his earlier work with mines; even later in his career he was appointed to some hazardous dust-related committees of the American Petroleum Institute. As early as the mid-1930's he was interested enough in the matter of dust exposure that he got Esso and Affiliates to approve his making measurements of the particular dust-producing operations in Esso refineries and chemical plants. He went into many of the areas where dust could be generated and made observations. Then he made quantitative measurements of the amount of dust that was being produced, and under what conditions they were being produced. And after taking these measurements during 1936, he published his findings and recommendations in July, 1937 as "Dust-Producing Operations in the Production of Petroleum Products and Associated Activities", a Medico-Safety survey by Roy S. Bonsib, M.A., E.M., Chief Safety Inspector of Standard Oil Company of New Jersey. His publication was made available to the petroleum industry world-wide, public libraries, The National Safety Council, schools and foundations.

The first paragraph of Bonsib's book suggests that it is among the first, if not the first, such survey of dust hazards in refineries setting: "Because it is the duty of industry to protect its employees and because no comprehensive survey of the hazards incident to occupational dust problems had yet been made, it was felt that here was an opportunity to render a service to the petroleum industry and its employees by making such a survey."

Bonsib's findings and recommendations were made public to the industry and anyone who was interested; in fact, I saw this publication in the medical department library ten years after it was initially published, and when I asked Mr. N. V. Hendricks, who was the Chief Industrial Hygienist for the Standard Oil Company at that time, to send me a copy, he sent me the copy I still have to this day, my original copy with the buckslip on it. It met fully the "state of the art" for good industrial health practices for 1937 - 1947.

This publication describes safety measures Esso Oil employed at the time, and it also sets out guidelines and standards for safe handling of asbestos materials, based on all available technology and information at the time. So for instance, he describes designing the plant for dust control, providing proper building ventilation, storing potentially dusty materials in dust-tight bins, enclosing material handling equipment, isolating the dusty processes. Furthermore, not have men in the area who were not necessary for that operation, providing wet methods of operation, designing equipment to control dust, providing exhaust systems, establishing maintenance and good housekeeping procedures, and, where these measures are inadequate, providing respirators and other personal protective measures. They included periodic clinical medical examinations, x-ray of chest annually or more often.

Before my arrival at Humble in 1947, industrial hygiene matters had been dealt with in the Company under the umbrella of a safety engineer with the title of Industrial Safety Director for the refinery. Also, during that time the Texas Department of Health made inspections in the Humble plant from time to time at our request.

The best knowledge available at that time concerning unsafe levels of exposure to hazardous dusts was published by the United States Public Health Service in collaboration with the investigating committee for the American Conference of Government Industrial Hygienists. The American Conference of Government Hygienists is a group that is still looked to in setting M.A.C.s or T.L.V.s or T.W.A.s. With regard to potential exposures to dust containing asbestos fibers, the standard recommended by these bodies was to keep prolonged occupational exposures to dust containing asbestos below a concentration of 5 million particles per cubic foot.

This standard and standards for other toxic substances were published mainly, I think, in the journals of the American Industrial Hygiene Association, engineering support groups, and medical societies. It was a very practical standard. These standards were adopted by West Germany, Japan, France and England. They looked to the A.C.G.I.H. for that guidance. The standards were also reported in publication of U. S. Department of Labor, USPHS report, state's labor and health standards.

When I joined the Company in 1947, there was a well-established program for hazardous dust control ongoing for at least 10 years based upon the program outlined by Bonsib. I did not have to be day-to-day involved with evaluating the problem

because of the nature of the program that was already well established and in place in the safety engineering support team, and medical departments. That was fortunate for me because in addition to asbestos exposures I had over 300 potentially hazardous substances to be concerned about in my work throughout the company's operations.

Part of our ongoing industrial hygiene program involved routine air sampling and dust monitoring and special situation monitoring. If some problem appeared or there appeared to be a problem, we would investigate it. And if I had a peculiar problem, for example at the Baytown, Texas Refinery, I could request the assistance of the Texas Department of Health, if it was an issue that they could serve better than I, and they would come take a survey at my request. And I had no hesitation about contacting the State for assistance, because we had no secrets where health hazards were concerned.

Shortly after I reported to work I went to my director and asked him about the question of how much information I would be privileged to present or to give in public papers and other appearances. And we went to the Board of Directors of Humble Oil and Refining Company at that time, and they gave us the policy that there are no secrets in regard to any health or safety matters that I might know or discover that would not be made available to everyone, including our competition.

In 1947, Humble was already well established with the program and knew, based on repeated routine sampling, what the potential levels of dust were in the areas where we could not completely control the dust and all workers would have to use respirators. So we had the knowledge to require workers to wear respirators when there was any potential exposures, and the safety inspectors on the job daily, who would be observing, would make sure they did.

The routine air sampling during that 10-year period between 1937 (Bonsib's report) and 1947 (my arrival) was accomplished with a device called a midget impinger, which had been developed and was being developed and mentioned in the report by Bonsib, and that became available about 1937 or 1938. It was a hand-operated little aluminum pump that didn't have any static electricity sparks to it; and it operated at one-tenth of a cubic foot per minute rather than one cubic foot per minute. And it was operated like an organ grinder and you wore it around your neck and you turned it and you collect your sample in that manner by either having the employee wear the filter up on his lapel or you held it close to his nose, or breathing level.

This monitoring allowed you to evaluate the workers potential exposure and take any precautions that would be necessary, whether it be wet methods of operation or some other procedure, you would also make sure that these people were supervised to stay in line with what practices you recommended. And our safety inspectors did that. They patrolled all units and work areas daily.

We took the attitude that if there was a substantial chance of a hazardous dust potential, then we would not wait until they got above 5 million particles per cubic foot or even 1 million particles before we would require "dust control measures and" respiratory protection. This was on a case by case basis, based on the judgment of the industrial hygienist and the safety people. For example, we had not been requiring men who handled asbestos insulation packages in the warehouse to wear respirators - and respiratory protection unless there were broken sacks because many times those sacks came in on pallets and we removed them out of the boxcars into the room and they never were disturbed and that required nothing more than just care to make sure they didn't break them. But if they broke them, they had to wear respirators because there was no way to take care or clean up that spill without potential dust exposure.

When making mortar, it was a general practice to prevent any dust by injecting water into the sack and wetting it before you opened it then when you dumped it out into the pan or whatever mixture pot you were making up the mortar in it was already wet and generated no dust.

In the early years of my employment with the company, many times we took men right out of the labor pool and made insulators out of them by training them, and part of their training was the safety aspect of it, including the proper use of respirators. In 1947 the respirator program was very organized. It meant that when you were assigned to a position or a job that you may need a respirator, you were supplied a new one in a box; and then, when you used that respirator on the job, - and the safety inspectors made sure you did use it when you should - then you were to put it in the rack, which was picked up daily, returned to the respiratory protection warehouse, and the respirator then was washed, sterilized, dried, and examined for any misfit or any broken parts and a change of filters.

We had a respirator warehouse where all the respirators were brought after they had been used. We issued new ones or reissued only those that had been cleaned. We only used a type that had been approved by the Bureau of Mines tests. After using a respirator, the workers turned in the used respirators daily at the end of their shift or at the end of the work where they had to use them. These respirators were then cleaned, including washing and sterilizing and then dried; and they were examined for any breakage or any need of repair. They were repaired by the operator of the warehouse respiratory section and placed back in the box or placed in the package that would go back to that particular individual's unit. So, the next shift that you came out, there would be a clean sterilized respirator as might be needed for you wherever your work station was.

When we had a potentially continuous exposure, we would swap out employees, since we could not expect them to wear a respirator for hours on end, and we could not let them have any unprotected potential exposures.

Before I came, the technical support group for the Baytown Refinery had purchased sampling equipment such as the midget impinger and laboratory counting operations. They made basic tests throughout the Refinery to find out what the levels were. Moreover, they had gone outside the Refinery fences and studied the air pollution concentrations outside.

We did monitor the air as often as needed to determine if there was exposure at a point we had enough confidence in our results from past experience with certain activities, materials, sites, and work conditions that we were able to anticipate the potential for exposures. In some cases, it was sufficient to periodically monitor to review and confirm our prior experience and findings.

To clean up a spill wherein we had a broken sack of asbestos, we put respirators on the men. Temporarily in cleaning it up we may have had more than the 5 million particles per cubic foot. But this was not of concern to us because the men cleaning up the spill were protected.

In work practices, we always lowered asbestos exposures to the lowest value that we could. If it was in a temporary operation, then we would put respirators on the workers so they would not be exposed to any dust.

The safety inspectors would know when a particular job was going to potentially expose the men, based on past experience, they had the men wear respirators. The men were under constant supervision of the safety inspectors who enforced the use of protective equipment.

In 1930-1940, when we did our dust counts, we were counting the total number of particles that you could see with the microscope of about 450 magnification. Generally, most of the particles we counted were non-asbestos particles.

Mr. Bonsib's counts in the 1930's were similar in that they were done for the total amount of dust particles collected –he did not differentiate between asbestos and other particles.

And since the maximum allowable concentration values that the A.C.G.I.H. published in 1947 spoke to the particles of asbestos per cubic foot of air, at Exxon we were stricter than that standard. Also, we did not use any of the disposable paper-type masks: We used a Comfo M.S.A., filter mask approved by U. S. Bureau of Mines standard.

It is also important to note that we never permitted asbestos dust to create visible concentration in the air. We put respirators on workers before they entered that level. Whenever that possibility could occur, we had respirators on the workers.

I had dealings and conversations with them weekly actually going through the plants themselves. Sometimes we had occasion to be concerned about some operation. For example, if they were bringing in new materials that they had not used before or if they were taking down some particular unit that had not been previously disassembled, industrial hygiene had input into the materials to be used and health protection required.

We had the experience of finding that workers will comply fully with our insistence on using respirators if we first showed them that we did everything reasonable—such as wet methods—to control the dust before we required a respirator. But where they did need respirators, then they were convinced that we had done our job and they needed to cooperate and they were required to do so. We furnished only the most comfortable approved type of protection.

Education of employees began with employees being introduced into operations where asbestos might be. They were educated or were trained in the precautions that were required to work with these materials. The Safety Department made sure that the equipment that might be needed in the way of personal protective equipment was in stock. The operating supervisor understood how to go about controlling the dust from a practical standpoint on the job. And they would strictly enforce those procedures for all employees. And the old employees were already indoctrinated, and they felt a sense of responsibility to the new ones and made sure that they continued to practice all of those features of the program. And they were supervised by the safety inspectors who patrolled constantly and observed and enforced these safety regulations. Jobs could be stopped immediately if not in line with our safety guidelines.

Equally important to our engineering of dust controls was our medical surveillance program with regard to asbestos. Medical monitoring through examinations of employees began before I came to Exxon. New employees as well as those that may be old employees new to a craft involving asbestos were given a thorough physical examination, a clinical examination to make sure they were in good condition so far as it might relate to any occupational disease brought on by dusty conditions or by asbestos. even in 1947 the Humble medical program included pre-employment physicals for the employees; because to apply it to industrial hygiene you would be concerned that you did not let the susceptible employee go to work at the wrong location and be exposed to the wrong materials.

Medical exams included a chest x-ray which was read carefully by a radiologist; and this became part of the permanent record of every employee. Annually or more frequently they were re-examined, including x-rays, to maintain the surveillance of the employee's good health and lung condition.

I saw it 10 years after Mr. Bonsib had recommended it that the x-rays were still being taken at least annually for all of the insulators or other employees who had

potentially dusty exposures and they were being read by a trained radiologist. We had Dr. David Earle, a radiologist, a specialist who also taught this science at Baylor School of Medicine. And he was a consultant and a specialist who read for us on a weekly basis. All x-rays which had been collected at any of the facilities of Humble were read by him and reported back to us.

It was the way that gave us a double insurance that we did have the program in hand. So, for example, I had several conferences a week with Dr. R. W. Pipkin, who was the refinery chief physician at Baytown Refinery during much of my career with the Company. He informed me of any suspicious findings in the clinical examinations or x-ray examinations for any of our employees that might be associated to occupational exposures.

In this connection, I recall that Dr. Kenneth Lynch, whom I had known in South Carolina (1942-1946) before I joined the Company, had autopsied the asbestosis victims cases that had come from the textile mill there in Charleston. He had spoken on that matter; and his associate Dr. Henry Zerbst told me that Dr. Lynch said that he had never seen a case of cancer in these lungs unless the cancer was superimposed on top of the asbestosis. His message was that if you control asbestosis then you will have controlled the cancer problem. Our x-ray program insured that we would be able to detect any asbestos-related changes in workers' lungs.

Also, it continued to be the policy through my tenure at Exxon to pursue follow-up studies, medical studies, on people who have retired from the refinery. Every retiree was followed through until a death certificate is accepted and read. This helped us determine whether we were safeguarding our workers from occupational health hazards.

There was a general safety manual approved by the Director of Safety given to every employee every year or as frequently as it was re-issued. Although I did not take a direct responsibility for writing the safety manual, it reflected the programs that I had implemented, and the Safety Director, who was aware of that, had conferences with me regarding what we were doing. The safety manual had a section on dust control that would include the nuisance dusts as well as the toxic dusts, treated under one section, together with a section on the use of respiratory protective equipment. The manuals were distributed widely and to any who asked for it.

Normally, an employee for a certain unit or craft would be trained specifically for that operation. All of the potential occupational problems associated with that operation are explained fully. In this way, workers could focus on the potential health concerns in the area and materials they were actively working with.

The Company had safety meetings periodically for all its employees at its Refineries, conducted by the Safety Departments, and covering all problems

associated with safety and related health issues. These meetings were typically general in nature, for example, dust disease prevention per se probably would not have come up as such, unless a question was raised. I myself spoke at some of these safety meetings on specific occupational health hazards.

We considered the medical program including industrial hygiene as one. But we have the safety department, and they basically are very strong in the employee relations training field. It was a joint responsibility between the medical department, including industrial hygiene, and the safety department, but ultimately safety was responsible for enforcing safety standards and rules in the plants. The safety inspectors stayed out in the field, were on the job where every unit was, whether it was the cracking coils or cat crackers or the light ends. There was a safety inspector assigned to that area and he patrolled his units throughout the day.

The Company safety manuals were not provided to each of the employees of contractors who worked in the Baytown refinery, but were provided to the supervisors of the contract workers. They were available to the individual if he wanted one, but we seldom required that they study it.

The safety manual was not provided to the contractors just as an attachment to the contract documents and the specifications. It was a separate action of giving it to them before they began work for us by the Operating Manager or his representative of the safety department in the refinery, gas plant or chemical unit.

The Humble company had its own employees as insulators , and did turnarounds generally with its own employees. Brown & Root was the largest contractor firm we dealt with, and often they would furnish the extra help as we might need it for a particular type job. But insofar as pipe cleanup and things of that nature, that was that primarily done by Exxon workers and very seldom did we need any extra help.

In every case our contractors, Brown & Root and other contractors, were required to follow the same guidelines as employees, to follow the same rules as our employees in every regard as far as protection from any exposure to asbestos or other hazardous materials. Brown & Root, for instance, had a very active safety department when I came to Exxon, and later they employed a staff of industrial hygienists. But these specialist seldom visit our operations because they respected our health and safety programs for being superior.

Before they began to work, we drew it to the attention of the contractors that they would be required to maintain and to comply with all of our safety and health regulations in doing the work. And then, we also took on the supervisors as a group - if there were more than one - and taught him or them the principles that we expected to have enforced among employees that he might have under his command.

For example, we required that they also wear the equivalent type of approved respirator wherever our people were wearing respirators or needed to wear respirators or we thought that they might need to wear respirators. They were required to have those; if they didn't have them, we would in a neighborly way lend them the respirators to do the job if it was short term. If they were going to be rather permanently contracted by us in that type operation, we expected them and required them to furnish their own personal protective equipment.

These same supervisors were watched by our safety inspectors; and if they were not keeping in line or keeping up with our requirements, they were informed immediately, even to have them stop work and get adjusted to the right practices or the right equipment that they would need to do the work. Safety inspectors had the authority to close down the job or have the contractors removed from the job.

As a result of all the above, during my 31 years with Exxon the contractors' supervisors who worked in our facilities were educated by our safety personnel of the hazards associated with the jobs they were going to be doing, including any potential exposures to asbestos dust, where that might have occurred. So, for example, to the extent that the job might involve tearing off asbestos insulation, our safety people routinely would advise them of the hazards that would be associated with that and what they needed to do about it.

They would make no exception regardless of what job they were going to do. They'd tell them about all of the problems that were associated with any job they were going to do.

About 1962 we were aware that down in South Africa they had discovered mesothelioma among the asbestos workers. Then we had no mesothelioma. We had never had any cases of mesothelioma. That was because the mesothelioma was being generated or produced by a the mineral crocidolite. Crocidolite is only produced in countries like South Africa, and those are the only ones that had any mesothelioma. We knew that the chrysotile which was 95 percent of the products that the Americans were using, came out of Canada; and there was no evidence of any mesothelioma among their employees or workers even after they knew about the South Africans. They reviewed that. They didn't find any. So, we knew we had some time lapse; but we also did not know how we were going to keep this crocidolite out of our products completely and guarantee it unless we eliminated all of the asbestos.

We decided that if that was a potential mesothelioma problem and mesothelioma was being brought about by unknown quantities of asbestos, we did not have a practical goal to shoot for except zero. This concerned me because of my insistence that I did not want anyone working with any of the products that I would not feel completely safe working with over a 40-year career.

After we were alerted to the theory that mesothelioma may not be associated with any levels of exposure, such as asbestosis would be, we decided that we would start research to develop suitable insulating materials that would permit us to use materials other than asbestos, and we started active research by 1967 with the idea that we would like to get rid of asbestos where and when we could. It took several years to develop that because you have very high temperatures in some refineries where the lines are really red hot; and not many materials will withstand that type of heat over a long period of time. The asbestos was perfect in that respect, and it was a binding agent that was used with magnesium oxide, as you know. About 85 percent was magnesium oxide, which had 15 percent of binder which was asbestos fiber.

I did not believe in 1967 when we began an aggressive search for asbestos-free insulation products that we were putting or allowing carcinogenic fibers to be in the air where the workmen could breathe an abnormal danger to themselves. Nevertheless, through an abundance of caution we tightened up on our safe respiratory program.

But, based on new information, by 1967 we started buying asbestos-free insulation as soon as we could find the material that was available to meet our requirements, and we would substitute it for old product as it was changed out. Our efforts were put in place at Benicia, particularly, where we constructed a new refinery that used a substitute for asbestos insulation suitable for piping less than 450 degrees. I recall that by at least some time in 1968 we had changed our company-wide specifications in line with the earlier decision to seek substitutes for asbestos.

Before about 1967, we had made no concentrated effort to find asbestos substitutes because we thought we could control asbestos exposures, and our experience was suggesting that we could.

The routine medical physical examinations and x-ray examinations made it possible for me to feel as confident as possible that we really didn't need to change our program, that what we were doing was the right thing to do, and we were doing it adequately. We had no indication of anybody getting exposed to any amount of dust; and therefore, we knew that the program was being carried out as it should be. And that was a reassuring fact.

I directed a survey that began back in 1919 and ran all the way through into the early 60's, over 40 years, in which we found that when you worked in our refinery you would have less -- 50 percent -- of the number of cancer of the lungs than you would expect from the normal population or from other workers that were not working in the refinery like salesmen and clerk workers. They had twice as many lung cancers as the refinery workers.

All this time we also continuously looked to see if the medical surveillance program showed evidence of anyone having not been protected or somehow overlooked for an exposure, knowing that all the way from six months or a year would be the longest he would be exposed to hazardous dust before we caught it. In this connection I frequently consulted with our physicians, the internists, that were examining workers, and also with Dr. Earle, radiologist, periodically about these findings. They never found any evidence of exposure to asbestos or other dusts, and never reported to me any findings of pleural plaques or pleural calcification or pleural thickening which are possibly indication to lung contamination.

I should additionally note that we implemented the program described above in the Company's maritime operations. I have ridden on our tankers and barges myself, and in later years my assistants continued to do so, to monitor the potential for shipboard exposures to asbestos and other hazards. Our maritime workers, like our refinery and chemical plant workers, were given physicals at least annually, monitored closely for potential exposures, and regularly trained in safety meetings.

In fact, I am very pleased to relate to you that as of 1978 when I retired, to my knowledge, Exxon had not noted any cases of asbestosis in its present work force or in the people who had retired from the company. We had for long periods 200 or more Exxon insulators at Baytown.

In 1972 the Humble company published safety regulations entitled "Handling Asbestos Guidelines." Although I had no part in the actual writing of those guidelines, they incorporated principles we had practiced. Later that year in September I did write a more lengthy document that went into much more detail about asbestos handling guidelines. Again in October of 1974 another asbestos control program was issued as a continuation of our educational program, and it was widely distributed to make sure everybody in the company was complying with OSHA's regulations.

There were certain requirements concerning the furnishing of workclothes, the wording of signs and warnings, and so on that we were checking our compliance with. In that period of 1970-1975, not all of the facilities adopted all the new standards the same week, but they did over a period of time; while some of the more stringent requirements of OSHA were less strict than practices we had implemented for decades.

All in all, OSHA had little more than a technical impact and an extra layer of authority over the programs of control and monitoring that we had been maintaining and improving upon since the 1930's. You will find, in fact, that Roy S. Bonsib's program from 1937 is one of the primary resource documents referenced by NIOSH, precisely because the program he outlined is based on good industrial hygiene practices and is still valid today, with allowance for improvements in technology and some advances in medical knowledge.

I hope the above is useful to you in your accumulation of information on our past practices and programs concerning asbestos. Please let me know if I can provide you any additional information or elaborate upon anything discussed above.

Yours truly,

James W. Hammond

CURRICULUM VITAE

NAME

James W. Hammond, B.S., Ch.E., M.S., P.E.

BORN

February 2, 1913
Winona, Mississippi

POSITION

Associate Professor of Industrial Hygiene (Retired)
University of Texas
School of Public Health

EDUCATION AND TRAINING

Mississippi State University, 1930-1935, B.S.
Louisiana State University, 1935-1937, M.S.
Massachusetts Institute of Technology, Industrial Chemistry, 1941-1942
University of South Carolina, Post Graduate Work in Chemical Engineering, 1945-1947
Rice, Post Graduate Work in Chemical Engineering, 1948-1949
Mississippi State University, 1952, Ch.E.
Certified American Academy Sanitary Engineers
Diplomate of American Academy of Environmental Engineers
Certified in Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene
Certified in Coal Mining Noise Survey and Control Techniques by the U.S. Bureau of Mines
Certified Safety Professionals of the Americas
Registered Professional Engineers of Texas

EXPERIENCE

1936-1940	University of Tennessee, Chemical Environmental Engineering Research
1940-1942	Industrial Hygiene Engineering USPHS Division of Occupational Diseases, Massachusetts
1942-1946	USPHS and Chemical Industrial Health Engineer, Department of Health, South Carolina
1947-	Associate Director, Division of Occupation Health, Georgia State Department of Health
1947-1959	Industrial Hygienist and Sanitary Engineer, Humble Oil

EXPERIENCE: (continued)

1959- Chief Industrial Hygienist, Headquarters, Humble Oil

1961- Director of Industrial Hygiene, Humble Oil

1965-1978 Director of Industrial Hygiene, Exxon Company, U.S.A.

PROFESSIONAL ASSOCIATIONS

American Industrial Hygiene Association: Board of Directors, 1951-1954;

Chairman, Local Sections Committee, 1953-1955;

Awards Committee, 1953-1955

General Conference Chairman, 1965

American Academy of Industrial Hygiene, President, 1976-1977

American Board of Industrial Hygiene, Director, 1969-1974

Industrial Hygiene Roundtable British Occupational Hygiene Society, 1960-1978

Gulf Coast Section, American Industrial Hygiene Association, Past President Air Pollution Control Association, 1952-1966

Texas Public Health Association, 1947-1955

American Petroleum Institute, Committee on Medicine and Environmental Health, Industrial Hygiene Committee, Past Chairman (Recipient of API Certificate of Appreciation, 1967)

Manufacturing Chemists' Association, Labels and Precautionary Information Committee, and Occupational Health Committee American Water Works Association, 1948-1975

Texas Safety Association, Executive Committee, 1975-1977

Representative of U.S. Department of Labor in Industrial Hygiene Seminar at 1970 Bucharest International Fair, Romania

AWARDS AND HONORS

Gulf Coast Section A.I.H.A. established James W. Hammond Award to Outstanding graduate of both Texas A&M University and U.T. School of Public Health in Field of Occupational Hygiene.

Selected to receive the 1982 Henry F. Smyth Award from the American Academy of Industrial Hygiene

AWARDS AND HONORS (continued)

TLV Committee, A.C.G.I.H., Chairman of Subcommittee on Hydrocarbons and Oxygenated Hydrocarbons

Director, Hygienic Guides Committee, 1965-1966

Past Director, Houston Poison Control Center

"Who's Who In Engineering"

Honorary Membership for Life, American Industrial Hygiene Association

TEACHING EXPERIENCE

Assistant Professor Industrial Hygiene, Georgia Institute of Technology, 1947-48

Instructor, University of Texas, Post Graduate School of Medicine, 1948-1960

Assistant Professor of Industrial Hygiene, Continuing Education, Short Schools, University of Oklahoma, 1960-1974

Clinical Associate Professor, Department of Industrial Hygiene, The School of Public Health, 1967-1978

Clinical Associate Professor, Department of Industrial Hygiene, Wichita State University, 1974-1977

Other Appointments: Houston Board of Health, 1954-1964

San Jacinto Lung Association Air Conservation Committee, 1967-1977
Occupational Health Committee, 1982

PUBLICATIONS

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