Notes on visit to Dewey & Almy Chemical Company, Cambridge, on November 27, 1934 and December 11, 1934 and to the Multibestos Company, Walpole, on November 28, 1934.

By: H. B. Elkins

Officials met:

Mr. Egan (chief chemist)	Mr. McMordie (engineer)
Mr. Fergusson (plant manager)	Mr. Bateson (superintendent, Multibestos)
Mr. Leach	Mr. Slagle
Mr. Edwards	Mr. Martin
Mr. Ross	Mr. Mears
Mr. Jensen	Mr. Stowe
Mr. Taggart	

The more important contacts are underlined.

Note: Due to the nature of its business many of the processes of this company are unique. Items which it is believed may not be general practice are marked with an asterisk and should be treated as confidential until passed upon by an official of the company.

The Dewey and Almy Chemical Company manufactures primarily latex cements and allied products, such as solvent rubber cements, rubberized fabrics, and rubber bonded brake linings. It was because of their developments in this last field that they acquired the Multibestos Company, which manufactures brake linings and clutch facings of all types.

Dewey and Almy Company

Mr. Egan showed me about the plant in Cambridge.

Latex cements:

Rubber latex is obtained in solutions containing 35, 60 or 75 per cent solids. In the dilute solutions there is about three fourths of a per cent of ammonia, which keeps the solution at a pH of 11, and so prevents fermentation and spoilage. In the most concentrated solutions the alkalinity is maintained by a mixture of caustic potash and a potassium cocoanut oil soap. Ammonia is preferable for most purposes because it evaporates off. Its concentration is so low that it is no problem except when the cement or compound is used in very large quantities.

*Various materials such as pigments and fillers are added to the latex solution in making the compound. One such material is a modifying soap made from beeswax and ammonia under high pressure. Sulfur is added whenever it is desirable and possible to cure the rubber in the cement or other product. In the linings for tin cans sulfur can not be used but fortunately an uncured material is more satisfactory.

For many purposes a latex cement is inferior to an artificial rubber emulsion, made by masticating vigorously coagulated rubber and then dispersing it with protective colloids and other suitable chemicals. A cement of this type seemed much finer and more homogeneous than corresponding latex cements, and its cost was said to be the same.

Latex cements are of interest to us because they compete with solvent rubber cements. One of the chief uses of benzol is as a solvent for the latter. For some purposes non-toxic non-inflammable latex cements are better substitutes for toxic, inflammable benzol cements than the slightly toxic but inflammable naptha cements.

Mr. Ferguson said that there had been a swing away from latex sealing compounds toward solvent compounds, but that he felt that its peak had passed and the immediate future would see an increased use of the latex products.

Solvent room:

This company makes both benzol and naphtha solvent cements and compounds. The latter constitute about two thirds of the total, and it was said that probably next year three quarters of the solvent compounds would be made from naphtha. The so-called solvent room is the second floor of an isolated building. It is about 35' x 12' x 8', and contains two mixers, for naphtha and benzol products, respectively. Each mixer holds about a hundred gallons.

Exposure to the solvent may occur chiefly in three places; the pump room, the solvent room, and muddler room, in which the finished cement is loaded into drums for shipment. In the pump room there is some leakage of vapor, or seemed to be, but the pumps are operated from outside, and the room is rarely entered. In filling the drums there is undoubtedly some exposure, but the greatest hazard is certainly in the solvent room.

The solvent is ordinarily pumped through a meter into the mixer. The stirrers are heavy spiral shaped knives which twist and tear the small pieces of rubber which are introduced. Some heat is evolved in this operation, so that the temperature of the mixture is raised, the outside of the mixer being above body temperature when the process was observed. The mixers are closed except for an opening in the top about 18" x 10" which is covered loosely except when materials are being added, when the batch is being inspected, and when it is being emptied. The addition of rubber (cut in small pieces) takes some time, as the several layers are torn apart by hand or they are fed into the machine. Some other materials, such as wax, are usually added. In the operation observed inspections of the batch as it was being mixed were frequent. As the top of the mixer is about five feet from the floor the tendency is for the workman to put his face close to the opening in looking in at the batch.

After two to eight hours, depending chiefly on the kind of rubber used, the mixer is tipped on its side and the batch of finished product is dumped through an opening in the floor into the muddler. The dumping operation observed took four minutes, including the time required to rake out the residual compound. The opening in the mixer through which the substance is poured is about three feet from the floor, and the operator stands three to four feet away except when he is cleaning out the residue. The extremely viscous and elastic mass was said to contain only thirty per cent of solids. Its vapor pressure would presumably be appreciably more than 70 per cent of that of pure benzol, but the viscosity of the mixture should cut down its rate of evaporation considerably.

A blower was operating in the wall opposite the mixer, near the floor, and above it the window was opened. The operator was between the window and the mixer, but a little to one side most of the time. The efficiency of this system of ventilation seems somewhat questionable. Tests on the air in this room (made by the insurance company) showed satisfactory conditions, however, it was said.

The men working on this job are given blood counts every three months and as a rule are transferred after six to nine months. No real cases of benzol poisoning have been encountered.

AR dope:

This impregnating material is a mixture of about five parts coal tar pitch and one part toluol. The components are heated in mixing, and ventilating equipment has been ordered for the process. The fumes did not seem bad at the time a finished batch was observed in the open mixer.

*Rubber bonded brake lining material:

Certain brake linings, especially those for heavy work, are made from asbestos to which carbon black and other substances may be added, and rubber latex. The various materials are mixed in a paper beating machine, spread on a wire screen and the water sucked out, then pressed in a hydraulic press, cured and brought to the proper thickness with a sanding machine. The last operation is well ventilated, but the method of feeding the paper beater was said to be dusty and needs improvement. Probably some such method as was worked out at Walpole will be applied here. None of these processes were in operation.

*Artifical leather:

A soft absorbent paper is passed through a latex solution containing sulfur, coloring matter, etc., and then over a series of heated rolls where the water and ammonia are given off and the rubber is cured. An exhaust system provides for the removal of the ammonia given off (estimated at three pounds, or about sixty cubic feet, per hour).

It is necessary to stop the machine for brief periods in order to attach new rolls of paper. If the stop is for too long the paper in contact with the hot rolls tends to disintegrate. Even the short stops unavoidably made may cause variations in quality in the finished material.

The rubberized sheet is passed through a calender to bring it to the proper thickness. Two or more sheets are often cemented together, sometimes two or three rolls being combined on a machine similar to the impregnating machine, but smaller. No provision for the removal of ammonia is made in this case, but there was no appreciable odor of ammonia around the machine.

If still thicker sheets are to be made, pieces about five feet square are cemented together by hand. In the operation observed a naphtha solvent cement was used.

Other products:

Soda lime, used in gas masks for absorbing phosgene, chlorine and acid gases, is made in some quantity. Zinc chloride solutions and zinc ammonium chloride crystals are also made. Some dermatitis has been caused by these materials.

Chloroform and toluene are used as preservatives. Carbon tetrachloride is also used for some purposes. Apparently these are used in relatively small amounts. Another small use of benzol is in cleaning out drums.

The Multibestos Company

Mr. McMordie, who designed a large part of the ventilating equipment used at the plant, showed me about.

There have been numerous cases of asbestosis developed here, and as a result the methods of manufacture have been greatly modified. The carding process has been dropped, the yarn being bought already spun, and a wet weave substituted for a dry weave process. Mr. Bateson said that more cases of asbestosis were developed in the weave room where the dust count was about seven and a half-million particles per cubic foot, than in the carding room, where the dust count was much higher. The most recent counts ran from half a million to two million, except at a carboloy saw, where it was 6.7 million, and at the paper beater during its feeding (31 million). A new process has been developed for feeding the paper beater the use of the carboloy saw is discouraged pending its removal, and the general ventilation has been greatly improved since these counts were made.

Woven fabrics are used chiefly for brake linings, but for some clutch facings as well. Most of the latter and some brake linings, especially for heavy brakes, are moulded, or made originally as an asbestos paper. For impregnating materials asphelt, chinawood oil, and bakelite resins are used. Rubber bonded linings are not impregnated; the rubber bonding is done in Cambridge, but all cutting, shaping and finishing is done in Belpole.

Weave room:

The yarn consists of cotton and asbestos fibre wound around a small wire. The warp is dry as it leaves the spools but passes over a wet roll before going through the guide so that the dust given off by the vigorous agitation of the dry warp in the weaving process is largely eliminated, since the yarn is wet at this stage. The spindles of weaving yarn are soaked in water before use. The loom spools of dry yarn are shaken somewhat but undoubtedly by far the largest part of the potential dust is prevented from coming off.

*On some of the looms a process of impregnating the yarn as it is woven is being tried. The roll wet with water is replaced with one wet with impregnating solution, in most cases asphalt in kerosene. This is supposed to give a more thorough impregnation and eliminates a process. It has the disadvantage of dirtying up the loom, however, and the fumes of the solution contaminate the air of the weave room. A solution of resin was also being applied in this way: they have succeeded in eliminating toluol from the solvent for these mixtures. On one section of a loom a water emulsion of a resin impregnant was being tried, it being both non-toxic and non-inflammable.

The fumes of kerosene near the looms using the asphaltic impregnant were somewhat obnoxious.

Impregnating room:

The method still used for most of the woven linings is that of impregnating the fabric after it is woven. A long strip is run through a bath of solution, before and after which are placed drying ovens. Conditions in this room seemed satisfactory.

Grinding room:

Here the clutch facings and brake linings are ground down to the proper size, the required holes are drilled, etc., and in this room the most strenuous efforts in ventilation have been made. The removal of visible dust seemed almost perfect in the case of all the grinding operations observed. The chief source of dust seemed to lie in the handling of piles of articles in loading or unloading a machine. In some cases ventilation was even provided for these operations.

One of the men operating an inside grinder (for the inside of clutch facings) wore a respirator, however.

Clutch department:

In the process of making moulded brake linings and especially clutch facings, asbestos is fed into a paper beating machine, where it is mixed with water, pigments, fillers and a little red lead, which helps the impregnant to harden. From here it is pumped to the paper machine where a layer of the mixture is spread continuously on an endless belt, the water drained off, and the resulting sheet of asbestos paper is removed, pressed, and cut up.

Formerly the act of feeding asbestos into this machine was very dusty. Now the bags of asbestos are emptied into a chute (in an enclosed room on the second floor) and the water for the mixture is sprayed in simultaneously, wetting down the asbestos so that it is soaked with water when it enters the beater, and little or no dust is given off. The man handling the bags of asbestos wears a respirator, the operation taking but a few minutes. The room where this was done seemed surprisingly free from visible dust.

This seemed to me a very satisfactory, common sense and economical solution of this particular problem.

Twenty pounds of red lead are sprinkled with a hand scoop into each batch mixed up in the paper beater. This is heavier than many lead compounds and none of it seemed to be dissipated in the form of dust. I understood the workman to say that the maximum output of the machine was five batches a day.

Clutch impregnating room:

Most of the clutch facings are impregnated with AR dope, a solution of a coal tar pitch in toluol, which is made in the Cambridge plant. A rack about 4' x 3' x 6' is filled with clutch facings and then submerged in one of the tanks of dope, of which there are three or four in a room about 28' x 12' x 8'. The solution is kept at 80 degrees F. or higher, and the tanks are covered except when the solution or solvent is being added, when the rack of clutch facings is being introduced, and when the clutch facings have just been removed and the excess solution is allowed to drain back into the tanks.

There is no ventilation in this room and the fumes are said to be bad at times. The foreman said he wouldn't enter the place on a damp day, and that the men often got jags from the fumes. One of the men said he was often made dizzy by the toluol vapor, and that he and his colleague suffered considerable discomfort generally.

It seemed to me that unless these men were exaggerating greatly the conditions should by all means be improved. A determination of the toluol concentration in the air might be worth while. Two or three window blowers, to be operated when the tanks were open, might improve the situation sufficiently for practical purposes.

While the insurance company was said to have investigated these conditions and to be satisfied, and while it is true that toluol is not as insidious a poison as benzol, or asbestos dust, and while there is some doubt about its ever causing chronic poisoning, it is still classified with benzol in Bulletin 582 of the U. S. Dept. of Labor. Certainly conditions such as apparently exist here should not be tolerated if they can be easily remedied.

Drums containing toluol were in some cases labelled as containing alcohol.

General:

Mr. McIlordie said that some dermatitis was caused by the formaldehyde used with tar acid in the manufacture of bakelite resins.

Respirators were worn on many odd jobs, such as sweeping the floor, using the carboloy saw, etc.

In general the firm has been admirably thorough, ingenious, and, I believe, effective in the steps taken to eliminate dusty conditions.