REVIEW OF PRESENTATIONS

J. WILLIAM LLOYD
JOSEPH K. WAGONER
RICHARD A. LEMEN
RONALD YOUNG

DR. LLOYD:
While we are waiting for Dr. Wagoner, I would like to summarize what we have done in the first part of this session.

1. The mortality experience at the B. F. Goodrich Plant at Port Neches indicated a much higher leukemia mortality than you would expect, not only on the basis of the rates for the State of Texas or for the United States, but for that county where there is an excess of leukemia.

2. At an adjacent plant, Texas–U.S. Chemical, an excess of leukemia was also observed.

3. Following that observation, NIOSH looked for other information on the question and, specifically, they wrote to the companies and asked them to come here and present whatever information they had.

4. One of the first sources of information was the University of North Carolina; in particular, their report in the March (1976) issue of the Journal of Occupational Medicine presenting their observations on a six-fold excess of leukemia and lymphoma in people working in synthetic rubber at a styrene-butadiene plant. You heard the three cases of leukemia and lymphoma described and you also were told that some of these people had exposure in their history to agents that might be suspected of being leukemogenic. Nobody has denied that they might have such an exposure — they did cluster people who worked in synthetic rubber plants.

5. Subsequent to that report the North Carolina group, reviewed their study at another styrene-butadiene plant, where they had not noticed any excess of leukemia. They noted in this review of the plant study four cases of leukemia who would have at some time worked in an area where they could have had exposure where styrene-butadiene rubber was made. The relative risk in that area was estimated to be 1.5 and that means that the rate based on some comparison was fifty per cent greater than expected with those small numbers.

6. What we have at this point is two plants in Texas where the leukemia rate is out of line, another plant in the State of Ohio where we have recorded excess amounts of leukemia and lymphomas, and another plant where the rate appears to be in excess.

7. A great deal still has to be worked out on this: We need to know what are the specific chemicals that these people are exposed to and we need much more detail on the process or the processes that are being used and that is why I have invited you people here. We hope you can tell us much more about this problem. I will now turn this back to Dr. Wagoner.

DR. WAGONER:
Before we go to the Mount Sinai group which is going to be discussing its observations in a styrene monomer facility, I would like to go back to Dick and Ron to clarify two points of view.

First, to describe some of the processes and the chemicals that are being used. Basically, one of the problems we face right now is we're not sitting in a unique position of one heavy marker disease, such as angiosarcoma of the liver. Second, we are in a facility which is predominantly of one particular chemical usage, but also uses a variety of chemicals.

Now, as part of the observations on the processes in the Port Neches facilities, I think it's noteworthy that this plant or these plants do not produce styrene, they do not produce butadiene, and the butadiene is piped into the plant and the styrene is trucked by tank cars into the facility. We have had the opportunity of looking at what is available for the butadiene facility which is adjacent to the two SBR plants and I think this might give us some further indication of where we are.

MR. LEMEN:
With Dr. Hanby's assistance, we obtained a listing of the deaths from a company that's adjacent to the B. F. Goodrich and the Texas–U.S. Chemical Plant and we have 122 deaths in which there are no leukemias observed. This is out of a facility that makes the butadiene that is piped into the other facilities.

The total number of deaths that I didn't give you before for B. F. Goodrich where we observed the 5 leukemias was 96 and at Texas–U.S. Chemical, the total was 50. I think it is relevant to note that there were no leukemia deaths or blood disease deaths from the company that makes the butadiene.

MR. YOUNG:
When we were planning the meeting, some questions arose as to whether the process should be described. Obviously, it should; but, I didn't particularly want to try to describe how to make SBR rubber to a group of producers. However, I will make a few general comments. If there are people who would like to correct me as I go along, I realize you're the experts.

As Mr. Lemen has indicated, 15 SBR plants were built by the government in the early 40's. We seem to have a leukemia problem reported in three of these facilities. It is interesting to note that one of the facilities is no longer in operation so you now have 3 out of 14 facilities reporting abnormal findings.

The plants that we visited were primarily emulsion polymerization type plants. They brought in butadiene; they brought in styrene. In various areas of the plants, their soap solutions were made up, their catalysts, their initiators, and their activators; these were charged to their reactor chain.

In the early days of the process it was a batch operation. Later on, it was converted to continuous polymerization and the stream goes from one reactor to another. You saw slides with a series of reactors. At the end of the reactor chain, when the degree of polymerization that is wanted is ascertained, they stop the reaction by an addition of a short-stop. Then, the material goes to a recovery area and the unreacted monomers are recovered.

Basically, you have a blow down tank and a flash tank for the butadiene. The butadiene is a gas and under normal temperature it would flash off. With the butadiene removed, the material goes to a stripping column where it is sparged with steam and the styrene is removed. The styrene-butadiene are recycled and go back to the process.

The material now is a latex that has been removed and the unreacted monomers. We go to latex storage — here is where you would add your antioxidants, antiozonants, oil extenders, carbon black. The mixture is coagulated, filtered, dried, and bailed.

That is a very general overview of how you make SBR rubber. There are a variety of chemicals involved, probably well over 100 chemicals. I will mention a few.

A good description I might add of styrene-butadiene rubber is given in the article by Saltman which appears in Rubber Technology, Chapter Seven. The typical formulation for cold SBR rubber is basically as follows: butadiene, styrene, tert-dodecyl mercaptan (it's interesting to note that this chemical does not appear in NIOSH's extensive book on registry of toxic chemicals), diisopropylbenzene-monohydroperoxide, p-menthane hydroperoxide, ferrous sulfate, potassium pyrophosphate, trisodium phosphate, EDTA, sodium formaldehyde sulfoxylate, and your resin acid soap and water.

Carbon black was added somewhere in the late 50's at these facilities, and also various extender oils are used.

Obviously, you have soaps — it's an emulsion polymerization process. One emulsifier, sodium condensed naphthalene sulphonic acid, appears

in the NIOSH sub-file of suspected carcinogens. Other interesting compounds are diphenylamine and carbon black.

Phenyl-β-naphthylamine aroused my suspicion initially, but further investigation indicated, apparently, this had nothing to do with β-naphthylamine so it is not listed as a suspect carcinogen at this point. (See Table 4, Editor's Note.)

There are various other chemicals that are used as ozonants and oxidants; and there are various other defoamers and drying agents such as talcs and synthetic amorphous silicium.

I've tried to give you a little description of the process and some of the compounds present. We do have extensive lists of compounds, and they are available. We are conducting literature reviews on the substances, but you quite quickly run out of literature on several of the compounds.

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