

Log P-249

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 15, 1984

Forwarded to:

Mr. Henry R. Linden
President
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SAFETY RECOMMENDATION(S)

P-84-15 and -16

At 11:15 a.m., c.d.t., on July 12, 1983, natural gas escaping under 60 pounds pressure from a crack in a butt fusion joint in a 2-inch plastic gas main entered an apartment building in Clear Lake, Iowa, exploded, and then burned. Two Interstate Power Company employees were injured, one apartment building was destroyed, and the adjacent apartment building was damaged heavily. Damage was estimated at more than \$1 million; none of the residents were injured or killed. ^{1/}

According to the Plastic Pipe Institute and plastic pipe manufacturers, such as Dupont, Plexco, and Nipak, a butt fusion between two lengths of plastic pipe when properly made, should be as strong or stronger than the plastic pipe itself. A butt weld between two lengths of steel pipe carries the same strength definition, however, here the similarity ends. In the field, accurate, reliable, repeatable, nondestructive testing of steel butt welds can be readily and practically undertaken by X-ray, radioactive isotopes (gamma rays), and magna flux. The American Petroleum Institutes (API) Standards for Welding Pipelines and Related Facilities, API Std 1104, Section 6.0, Standards of Acceptability, and Section 8.0, Radiographic Procedure, sets the standards of acceptability for size and type of weld defect, the requirements for producing acceptable radiographs, and the qualifications of the radiographers for the work. Over the years, these API standards have been improved to the point where today field radiographic inspection of butt welds on steel pipes, by qualified, motivated technicians, can be classified as a science. However, the field nondestructive tests for plastic pipe butt fusion cannot be classified as a science. The physical appearance of the fusion is the primary nondestructive field test method. The physical appearance test is valid only when all other procedures of squaring the pipe, heating the tool, applying the pressure, and holding the pipe have been rigidly adhered to.

^{1/} For more detailed information, read Pipeline Accident Report—"Interstate Power Company, Natural Gas Explosion and Fire, Clear Lake, Iowa, July 12, 1983" (NTSB-PAR-84/02).

During the annual fusion qualification tests given by Interstate to its pipe-fitters/operators wherein the employee's work was given a physical inspection followed by a destructive test, most of the persons passed both. However, one person's work passed the visual inspection, but failed the destructive test; one person's work failed both the visual inspection and the destructive test; and one person failed the visual inspection and passed the destructive test. Interstate stated that all persons had to pass both aspects (visual inspection and destructive testing) before being allowed to fuse plastic pipe in actual field operation. The Safety Board is concerned that perhaps physical appearance of a butt fusion joint is more of an art than a science and that what looks good to one supervisor may not look good to another and, indeed, upon destructive testing, may fail. As to the July 12, 1983, accident, the report prepared by the testing laboratory stated that the external appearance of the failed butt fusion joint was good, but was a cold weld wherein uniform fusion of the plastic pipe surfaces had not been completed around the pipe. The findings in this accident raise the question about the number of plastic butt fusion joints which may have been installed and have a good external appearance, but which in fact, may be substandard.

At least two other stress possibilities were present in this accident: (1) the fusion joint was placed in a bend in the pipe (the bend was not measured but was photographed when the pipe was excavated) and that subjected the weld to a bending stress; and (2) construction activity was conducted in the vicinity of the pipe after it had been installed (a sidewalk was laid over it, a swimming pool was constructed close to it, and a parking lot was built close to it). All of the construction activity was conducted with trucks loaded with material operating close to the pipe. These stresses may have contributed to the fusion failure, however, if the fusion had been ". . . as strong or stronger than the plastic pipe itself," the bend and construction activity should not have affected it and the accident may have not occurred.

Therefore, the National Transportation Safety Board recommends that the Gas Research Institute:

Conduct research and develop guidelines concerning safe bending radii for plastic pipe containing butt, saddle, and socket fusions. (Class II, Priority Action) (P-84-15)

Support the development of nondestructive testing equipment which can be used practically for plastic pipe fusions in the field. (Class II, Priority Action) (P-84-16)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility ". . . to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (P.L. 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY and GROSE, Members, concurred in these recommendations.

By: 
Chairman