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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:
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President
Pacific Gas and Electric Company
77 Beale Street
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SAFETY RECOMMENDATION(S)

P-82-1 through -3

On August 25, 1981, at 1:33 p.m., P.d.t., in downtown San Francisco, California, a 16-inch natural gas main owned by the Pacific Gas and Electric Company (PG & E) was punctured by a drill that an excavation contractor was using to set tiebacks for anchoring his excavation shoring. Escaping natural gas blew upward and carried into the Embarcadero Complex and other nearby buildings. There was no ignition; however, the gas stream entrained an oil containing polychlorinated biphenyl (PCB). Fall-out affected an eight-square-block area of the city's financial district covering buildings, cars, trees, pedestrians, police, and firemen. Approximately 30,000 persons were safely evacuated from the area in 45 minutes. No one was killed or seriously injured, although many persons were sprayed with the PCB oil mist. 1/

PG & E's preplanning for emergencies and its prompt implementation of the EOR was a positive action which should have been able to control this emergency within a matter of minutes after the accident and long before escaping gas contained significant amounts of PCB's. Rapid isolation of the segment of main containing the break was impaired by several factors. First, company personnel first arriving at the site were not trained or equipped to close valves and valve crews had to be dispatched. The Safety Board believes that with minimal training and access to valve wrenches, the EOR would have been able to direct these employees by radio to the appropriate valves for closure which could have saved 20 minutes in attempting to isolate the section. (At the Board's November 3, 1981, public hearing on this accident, a PG & E official stated that consideration was now being given for training employees other than valve crews to operate isolation valves during emergency situations.)

A second factor preventing prompt isolation of the break was the use by the EOR personnel of an inaccurate Emergency Shutdown Diagram (ESD). According to the principal ESD, the initial actions of the EOR personnel were correct and should have quickly isolated the section of main that included the break; however, valves 297 and 489 were not properly listed on this diagram as emergency isolation valves. What should have been an orderly, preplanned shutdown because of PG & E's preplanning efforts became an impromptu situation and required hurried reviews of ESD's and other company records.

A third factor which diminished the ability of the EOR personnel to isolate the section of main which included the puncture was the result of deficiencies in PG & E's

1/ For more detailed information, read Pipeline Accident Report--"Pacific Gas and Electric Company, Natural Gas Leak, San Francisco, California, August 25, 1981." (NTSB-PAR-82-1)

maintenance operations for emergency isolation valves. Not only was valve 297 not shown on the principal ESD as an isolation valve, it also was not listed on the annual inspection list which is the means PG & E used to assure that emergency valves were inspected, greased, and partially operated at least once each year. This deficiency allowed valve 297 to be paved over in 1978 without PG & E instituting any action to assure that this valve remain accessible. The fact that PG & E was not aware that the valve was inaccessible contributed to the valve crew checking a valve 35 feet from valve 297 and reporting to the EOR personnel that valve 297 was closed when, in fact, valve 297 was open. Had the EOR personnel provided the available location information to the valve crew and directed that a positive identification be made of valve 297 (the valve located by the valve crew as 297 had no valve identification tag to enable positive identification), the inaccessibility of valve 297 would have been known promptly to EOR personnel and they would have recognized earlier that a greater area would have to be isolated to stop the flow of gas to the break. While the EOR personnel soon did expand the area of isolation, this attempt was thwarted because valve 1235 could not be operated. The failure of EOR personnel's actions to isolate the section of main containing the break in combination with the urgency to stop the flow of gas then entraining PCB laden oil apparently influenced PG & E to attempt repair of the break without first isolating the gas main thereby accepting a somewhat higher hazard to its employees.

Shutdown procedures were further complicated by the observation of pressures on a recording chart being sensed between a primary regulator and an upstream monitor regulator. These regulators were located in separate regulator pits which served the low-pressure system and were supplied gas from the 16-inch high-pressure main. The chart showed line pressure on the 16-inch main during normal operations while the monitor regulator remained open; however, when the line pressure dropped below the 15 psig pressure needed to keep the monitor regulator fully open, the regulator began throttling the gas flow until the pressure dropped to 3.5 psig and the regulator closed. The assumed line pressure then fell to zero, and yet the actual pressure at the break was still too high to permit installation of a repair patch.

As a result of its investigation of this accident, the National Transportation Safety Board recommends that the Pacific Gas and Electric Company:

> Train and equip company personnel who respond to emergency conditions in the operation of emergency shutdown valves. (Class II, Priority Action) (P-82-1)
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> Revise procedures for posting distribution system piping changes affected by work orders to assure that valves required for emergency shutdown are properly designated on Emergency Shutdown Diagrams and are included on the listing of valves required to be inspected annually. (Class II, Priority Action) (P-82-2)
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> Include in its written maintenance procedures a requirement that emergency valves be operated during annual inspections and emphasize this requirement to maintenance personnel. (Class II, Priority Action) (P-82-3)

BURNETT, Chairman, GOLDMAN and BURSLEY, Members, concurred in these recommendations. McADAMS, Member, did not participate.

Patricia A. Goldman

By: Jim Burnett for
Chairman