



## National Transportation Safety Board

Washington, D.C. 20594

### Safety Recommendation

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**Date:** January 6, 1998

**In reply refer to:** P-97-11 and -12

Mr. Kenneth L. Lay  
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About 8:30 a.m. on November 21, 1996, because of a propane gas leak, a commercial building in San Juan, Puerto Rico, exploded. Thirty-three people were killed, and more than 80 were injured.

The building was in Río Piedras, a shopping district in San Juan. The structure was a six-story mixture of offices and stores owned by Humberto Vidal, Inc. The company's administrative offices occupied the third, fourth, fifth, and sixth floors, and the first and second floors housed a jewelry store, a record store, and a shoe store.<sup>1</sup>

The National Transportation Safety Board determines that the probable cause of the propane gas explosion, which was fueled by an excavation-caused gas leak, in the basement of the Humberto Vidal, Inc., office building was the failure of San Juan Gas Company, Inc., (SJGC) to oversee its employees' actions to ensure timely identification and correction of unsafe conditions and strict adherence to operating practices and the failure of the SJGC to provide its employees with adequate training.

Also contributing to the explosion was the failure of the Research and Special Programs Administration/Office of Pipeline Safety (OPS) to oversee effectively the pipeline safety program in Puerto Rico, the failure of the Puerto Rico Public Service Commission (PSC) to require the SJGC to correct identified safety deficiencies, and the failure of Enron Corp. to oversee adequately the operation of the SJGC.

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<sup>1</sup> For more information, read Pipeline Accident Report—*San Juan Gas Company, Inc./Enron Corp. Propane Gas Explosion in San Juan, Puerto Rico, on November 21, 1996* (NTSB/PAR-97/01).

Contributing to the loss of life was the failure of the SJGC to adequately inform citizens and businesses of the dangers of propane gas and the safety steps to take when a gas leak is suspected or detected.

People who worked in and around the building that later exploded (the HV building) had noticed the smell of gas for more than a week before the explosion. Several had complained to the SJGC, and the SJGC had sent its employees three times to investigate the complaints.

The manager of the shoe store demonstrated his concern about the propane odor by complaining to the SJGC and to others. However, he apparently did not fully understand the enormity of the threat since he took no action to evacuate the store. His failure to evacuate the store was no doubt influenced by the SJGC employees who visited the building during the week before the explosion and repeatedly told him that there was no gas in the basement.

The HV employees detected the stronger gas odors in the basement during the mornings before the basement air conditioner had been turned on. Apparently during the first several days, operating the air conditioner reduced the odor to the point that it was no longer detectable. However according to witness statements, the odor level and the effects of the gas concentration on employees increased over time to the extent that employees who entered the basement became sick. Given that the SJGC employees knew that people in the shoe store had complained of gas odors in the basement, the SJGC employees should have erred on the side of safety and evacuated the building until the source of the odor had been established and conditions proven safe.

According to the SJGC's emergency plan, if a gas leak is confirmed, the building should be evacuated or other actions should be taken. In the case of the Río Piedras explosion, more than a week passed before SJGC employees confirmed the existence of a significant level of combustible gas in the soil; and at the time of the explosion, they had not confirmed that the CGI indication was due to propane gas. HV employees stated to SJGC employees that the odor dissipated when the basement air conditioner was on; yet no SJGC employee tested the basement atmosphere before the air conditioner was turned on. The first SJGC employee to investigate the complaint was the only one who had an instrument capable of testing the basement atmosphere. He did not start and adjust the instrument when he was outside the building to ensure that it would be accurate inside the building. Starting and adjusting the instrument inside the building meant that it would show only concentrations greater than those in the shoe store. SJGC employees who later entered the basement did not have instruments capable of detecting gas in such large areas as the basement and thus relied only on their senses of smell to detect the presence of gas.

SJGC management, because of the repeated complaints and because the SJGC employees failed to identify the cause of the odor, should have questioned the appropriateness and thoroughness of the SJGC's responses and should have required additional testing of the basement with appropriate instruments and before the basement air conditioner was turned on. SJGC management should also have made certain that the HV management was aware of the potential danger and of the symptoms people may have when they work in environments containing propane. The gas company's management should have told the HV management

about the emergency actions, including evacuation, that should be taken when gas odors continue.

The SJGC's practice of not deciding whether a building should be evacuated until a gas leak has been confirmed is not appropriate: the decision may be made too late, as demonstrated by the Río Piedras explosion. SJGC employees need to consider many factors, with the risk to public safety being paramount, when evaluating the on-site information to assess whether an area should be evacuated before or even during testing. The Safety Board concludes that Enron needs to require the SJGC to revise its emergency plan to include procedures adequate for protecting public safety any time a gas leak is suspected, including the need for building evacuations during leak investigations.

The inadequacy of the training of the SJGC's employees contributed substantially to causing the explosion. Employees cannot do a proper leak survey or pinpoint a gas leak without knowing the lateral location of the gas pipes, the depth of the gas lines, and the depth at which the barholes should be made. For low-pressure propane/air systems, it is imperative that a crew first know the depth of the pipeline and then ensure that the barhole depths reach the pipe depth. The SJGC employees did not know the depth of the gas line and did not sink the barholes deeply enough.

SJGC training was inadequate in other ways. The company did not assess the performance of its trainees after they had been trained or document its training. The personnel files for the incident crew members included certificates for various training courses, but the files did not indicate the content of the courses or whether the courses were part of a training plan.

The Safety Board assessed the development, conduct, and evaluation of training for the SJGC's employees as inadequate, particularly for the people who surveyed, located, and repaired leaks. The major deficiency was the lack of a front-end analysis of the training needed. The SJGC did not do an internal front-end analysis or ask Heath Consultants, Inc., (Heath) to do one. A front-end analysis includes a job analysis, which is necessary to identify the tasks<sup>2</sup> that the holder of the job must be able to do. Doing a job analysis would have identified the individual tasks related to the job, the number of people needed to perform the job, the tools and equipment necessary for performing the work, and any manuals, references, regulations, or company procedures the trainees were required to follow. Once a task is identified, it can be converted to a learning objective,<sup>3</sup> or a goal that the trainee will achieve by taking training.

Learning objectives can be used to measure the effectiveness of the training. After fully describing the learning objectives, the course designer determines the appropriate course presentation options. Options can include computer-based training, on-the-job training,

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<sup>2</sup> A task is an action or function performed as part of a job. Tasks are usually readily observable and should be measurable for determining adequacy of performance.

<sup>3</sup> A statement that describes what knowledge the students will have or what they will be able to do upon completion of training.

interactive video, slides, and other media, as well as the standard platform or lecture format. During this design phase, written testing and/or ways to assess student performance can be designed to reflect the agreed upon learning objectives. In this way, assurance is provided that all critical job tasks are identified and can be taught and tested.

After training, the trainee can be tested or another objective means of assessing training effectiveness can be used to determine whether the learning objectives have been met. The assessment would confirm that the trainee could successfully perform the tasks that have been identified as necessary to do the job. Therefore, the training has been successful, and the trainee is prepared for the job. Not only does the use of learning objectives provide a way of assessing the effectiveness of training, it keeps the training focused on the tasks that the trainee actually has to be able to do in order to perform the job. Thus, a good front-end analysis of a trainee's job can save both time and money.

The SJGC had the same problems with the training for which it had contracted. Heath should have performed a front-end analysis. Had Heath done the analysis, its trainers would have known whether the SJGC employees needed training on the fundamentals or advanced training. The company should have, but did not, require that Heath assess the performance of the employees it trained. Heath, having had years of experience in employee training, should have assessed the SJGC trainees to determine the knowledge they had in the areas being proposed for training.

Therefore, the National Transportation Safety Board issues the following recommendations to Enron Corp.:

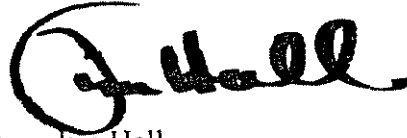
Require San Juan Gas Company, Inc., to include procedures in its emergency plan that its employees can use in determining whether a building or area should be evacuated when a gas leak is suspected. (P-97-11)

Require San Juan Gas Company, Inc., when soliciting a training proposal, to require that the proposal include plans for identifying the tasks for which the trainees must be trained and for assessing the job performance of the trainees and the effectiveness of the training. (P-97-12)

Also, the Safety Board issued Safety Recommendations P-97-5 to the U.S. Secretary of Transportation, P-97-6 through -8 to the Research and Special Programs Administration, P-97-9 and -10 to the Puerto Rico Public Service Commission, and P-97-13 to Heath Consultants, Inc.

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" (Public Law 93-633). The Safety board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendations P-97-11 and -12 in your reply. If you need additional information, you may call (202) 314-6468.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

A handwritten signature in black ink, appearing to read "J. Hall". The signature is written in a cursive style with a large, looping initial "J".

By: Jim Hall  
Chairman