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## 8 Human Factors

By the time Claggett and Linley reached their [lunar] rover and turned it around, they no longer bothered with their dosimeters, because once the reading passed the 1,000-Rem mark, any further data were irrelevant. They were in trouble and they knew it.

—James Michener, *Space*, 1982

On June 4, 1989, a powerful gas line explosion demolished a section of the 1,153-mile Trans-Siberian Railroad, engulfing two passenger trains in flames. Rescue workers worked frantically to aid the passengers, but only 723 could be saved. The rest perished. Many of the 500 victims were children bound for holiday camps by the Black Sea. “My sister and my aunt are somewhere here in these ashes,” said Natalya Khovanska as she stumbled between the remains of the trains, which were still smoldering. The explosion was estimated to have been equal to ten thousand tons of TNT, and it felled all the trees within 3 miles of the blast. By some accounts, a wall of flame nearly 2 miles wide engulfed the valley, hurling twenty-eight railway cars off the tracks. The explosion instantly cut the Soviet Union’s gas supply by 20 percent. A commission was quickly set up to investigate the blast, but several days later they had still not determined why it happened, except that pipeline engineers had increased the pressure in the line rather than investigate the sudden pressure drop caused by the leak. The gas from the leak settled into a valley near the towns of Ufa and Asha and the passing trains detonated the lethal mixture. Mikhail Gorbachev denounced the accident as an