

PHENOMENOLOGY OF LNG ACCIDENTS

A SELECTED BIBLIOGRAPHY

Ines Siscoe

September 1974

P-5295

The Rand Paper Series

Papers are issued by The Rand Corporation as a service to its professional staff. Their purpose is to facilitate the exchange of ideas among those who share the author's research interests; Papers are not reports prepared in fulfillment of Rand's contracts or grants. Views expressed in a Paper are the author's own, and are not necessarily shared by Rand or its research sponsors.

The Rand Corporation
Santa Monica, California 90406

PREFACE

This bibliography is the result of a request by four researchers of The Rand Corporation. It covers the chemical, physical, and environmental aspects of liquified natural gas and its transportation. The references extend from 1965 to date and were culled from a literature search of the following sources:

Applied Science and Technology, 1965-
Engineering Index, 1965-
Energy Abstracts, 1973-
Business Periodicals Index, 1969-
Public Affairs Information Service, 1965-
Rand Library Catalog
Reader's Guide to Periodical Literature, 1965-
Physics Abstracts, 1971-
International Aerospace Abstracts, 1971-
U. S. Coast Guard, Office of Research and Development
Publications, 1972-
Engineering Index, Compendex
Physics Abstracts, Comspec
National Technical Information Service, NTIS

The references are arranged alphabetically by author, or by title if no author is available.

SELECTED BIBLIOGRAPHY

- "Alagasco line has extruded HDPE coating," Pipeline and Gas J., v. 199, pp. 99-102, June 1972.
- Ambler, R. M., "Over-the-road LNG transport," Am. Gas J., v. 194, pp. 28-30, July 1967.
- Andrier, B., "Concrete floating storage for LNG," Pipeline and Gas J., v. 199, pp. 75+, Sept. 1972.
- "Are LNG pipelines practical? yes, but only for short distances, 200 miles or less," Iron Age, v.207, pp. 60+, Mar. 11, 1971.
- Arthur D. Little, "Preliminary system development chemical hazards response information system (CHRIS)," U.S. Coast Guard, Office of research and development, Washington, D.C., May 1972.
- Ashurov, S.A., "Calculation of the combustion temperature of natural gas and liquefied petroleum gases," Energiotechnik, v.22, pp. 558-60, Dec. 1972.
- Balioz, A. B., "Rabota dvukhtaktnogo dizelya s neposredstvennym vpryskom zhidkogo gaza (Operation of two-stroke diesel with direct injection of liquefied gas)," Energomashinostroenie, pp. 18-20, 2 Feb. 1973.
- Ball, W. L., "Current status of national, state and local LNG codes and standards," Pipeline and Gas J., v. 71, p. 33, Feb. 26, 1973.
- Barad, M. L., and D. A. Haugen, "A preliminary evaluation of Sutton's hypothesis for diffusion from a continuous source," J. Meteorol., v. 16, p. 12, 1959.
- Basevich, V. Y., and others, "The methane combustion mechanism question," tr. into English from Izv. Akad. nauk. Sssr., Ser. Khim. (USSR) no.10, pp. 2192-2196, Oct. 1971, NASA rept. no. TT-F-14321.
- Berenson, P. J., "Film-boiling heat transfer from a horizontal surface," J. Heat Transfer, Aug. 1961.
- Biederman, N. P., "LNG barges may solve many problems," Pipeline and Gas J., v. 199, pp. 47-48+, Jun. 1972.
- "Big LNG project planned on West Coast (Pacific Lighting)," Oil and Gas J., v.69, p. 30, Jun. 7, 1971.
- Bowman, C. T., and D. J. Seery, "Investigation of NO formation kinetics in combustion processes - The methane-oxygen-nitrogen reaction," pp. 135-139 in Emissions from continuous combustion systems; Proceedings of the fifteenth symposium, Warren, Michigan, Sep. 27, 28, 1971. New York, Plenum, 1972.

- Burgess, David S., and others, "Hazards associated with the spillage of liquefied natural gas on water," Bureau of Mines rept. no. RI-7448, Nov. 1970.
- Bureau of Mines. "Hazards of LNG spillage in marine transportation," U.S. Coast Guard, Office of research and development, Washington, D.C., Feb. 1970.
- Bureau of Mines. "Hazards of spillage of LNG into water," U.S. Coast Guard, Office of research and development, Washington, D.C., Sep. 1971.
- "Bureau of Mines probes mysterious LNG explosions," Oil and Gas J., v.69, p. 20, Jan. 11, 1971.
- Burgess, D., and M. G. Zabetakis, "Fire and explosion hazards associated with liquefied natural gas," Bureau of Mines rept. no. RI-6099, 1962.
- Caillaud, J. "Invar alloy proves worth for LNG tanker applications," Pipeline and Gas J., v. 197, pp. 45-6+, Oct. 1970.
- "Cause of tragedy keeps experts baffled," Iron Age, v. 211, p.29, Feb. 22, 1973.
- Chatterjee, N., and J. M. Geist, "Effects of stratification on boil-off rates in LNG tanks," Pipeline and Gas J., v. 199, pp. 40-60, Sep. 11, 1972.
- Chohey, N. P., "U. S. beckons LNG tankers," Chem. Eng., v. 79, pp. 76-8+, Nov. 13, 1972.
- Clapp, M. B., and L. F. Litzinger, "Design of marine terminals for LNG, LPG, and ethylene," Pipeline and Gas J., v. 198, p.72+, Jun. 1971.
- Closner, J. J., "Prestressed concrete dike systems for LNG storage containers," Pipeline and Gas J., v. 198, p. 63+, Sep. 1971.
- Columbia LNG Corporation, Docket No. CP72-8, Green Springs Project, Seneca County, Ohio. "Draft Environmental impact statement," Washington, D. C., Federal Power Commission, Apr. 23, 1972.
- "Concrete LNG storage tank uses Mastic gas barrier," Pipeline and Gas J., v. 199, pp.60-1, Oct. 1972.
- Congress. Senate. Committee on commerce. Subcommittee on surface transportation. "Natural gas pipeline safety:hearing, Nov. 9, 1971, on S. 980, to amend the Natural gas pipeline safety act of 1968 (and other bills), 92nd Congress, 1st Session," 1971.

- Crawford, D. B., and C. A. Darr, "LNG receiving terminal design is different," Pipeline and Gas J., v. 200, p. 37+, Dec. 1973.
- Crouch, W. W., and J. C. Hillyer, "What happens when LNG spills?" Chem. Tech., v.2, pp. 210-15, Apr. 1972.
- Crossland, Stuart J. F., "Process liquids to SNG," Hydrocarbon Process, v. 51, no. 4, pp. 89-93, Apr. 1972.
- Davenport, Ian F., and C. Judson King, "Natural convection from time-dependent Profiles at a gas-liquid surface," Int. J. Heat Mass Transfer, v. 17, no. 1, pp. 77-83, Jan. 1974.
- Davis, J. C., "LNG: growth or safety?" Chem. Eng., v.80, pp. 50-2, May 28, 1973.
- De Nevers, N., "Liquid natural gas," Sci. Am., v. 217, pp. 30-7, Oct. 1967.
- Diller, D. E., and L. A. Sarkes, "Data for LNG; progress report, 1970-1973," American Gas Association mon., v. 55, no. 9, pp. 27-28, Sep. 1973.
- Di Napoli, R. N., "Design needs for base-load LNG storage, regasification," Oil and Gas J., v. 71, pp.67-70, Oct. 22, 1973.
- "Distrigas seeks FPC approval of LNG project," Oil and Gas J., v. 71, pp. 31, Dec. 3, 1973.
- Drake, E. M., "Prevent LNG 'rollover'," Hydrocarbon Process, v. 52, no. 3, pp. 87-90, Mar. 3, 1973.
- Drake, E. M., and A. A. Putnam, "Vapor dispersion from spills on LNG on land," Cryogenic Engineering Conference, Aug. 1973.
- Dutkiewicz, B., "Methanol competitive with LNG on long haul," Oil and Gas J., v. 71, pp. 166-7+, Apr. 30, 1973.
- Dyer, A. F., "LNG from Alaska to Japan," Chem. Eng. Progress, v. 65, no. 4, pp. 53-7, Apr. 4, 1969.
- "Dynamic loading and fatigue testing on LNG carriers," Shipbldg. Shipping Rec., v. 117, no. 5-6, pp. 40-1, 3, Jan. 29-Feb. 5, 1971.
- "Easogas LNG, Inc., and Distrigas Corporation Dockets Nos. CP73-47, CP73-78, CP73-88, CP73-132, CP73-148, Cp73-205, CP73-230," Sep. 6, 1973.
- Elliott, H. H., and T. J. Joyce, "Kilowatt-hours from LNG: the potential for using liquefied natural gas for power generation: abstract," Combustion, v. 40, pp. 30-1, Feb. 1969. ASME Paper 68-PWR-9 for meeting Sep. 16-19, 1968.
- "Engineering/construction/service firms listed for SNG, LNG, gas processing, etc." Pipeline and Gas J., v. 200, p. 48+, May 1973.

- ✓ Faridany, Edward, "LNG: 1974-1990. Marine operations and market prospects for liquefied natural gas," Quarterly Economic Review special no. 17, Jun. 1974.
- Fawcett, H. H., "Conference on hazardous cargoes (7th) held at the U.S. Coast guard academy, New London, Conn., 8-9 July 1970." National Academy of Sciences, Washington, D. C., Committee on hazardous materials, 31 Aug. 1970.
- Fawcett, H. H., "Conference on LNG importation and terminal safety, Proceedings, Held in Boston, Mass., 13-14 Jun. 1972." National Academy of Sciences, Washington, D. C., Committee on hazardous materials, 1972.
- Fay, James A., "Unusual fire hazard of LNG tanker spills," Combust. Sci. Technol., v. 7, no. 2, pp. 47-49, 1973.
- Federal Power Commission, "Final environmental impact statement for the construction of an LNG import terminal at Staten Island, N. Y.," 1974.
- Federal Power Commission, "Construction and operation of an LNG import terminal at Providence, Rhode Island, Eascogas LNG, Inc., Algonquin LNG, Inc., Algonquin Gas Transmission Company, and New England LNG, Inc., Docket Nos. CP73-47, CP73-88, CP73-139, CP73-197, CP73-199," Draft Environmental impact statement, 8 Nov. 1973.
- "Federal Power Commission will hear requests to build new LNG facilities," Oil and Gas J., v. 71, p. 49, Oct. 8, 1973.
- Field, S., "SNG and the 1985 U. S. Energy picture," paper presented to the American Institute of Chemical Engineers, New York, N. Y., 28 Nov. 1972.
- Filin, N. V., and B. A. Kuranov, "Thermal stresses in a spherical vessel filled with liquefied gas (Temperaturnye napriazheniia v sfericheskom rezervuare pri zapolnenii szhizhennym gazom)" Problemy Prochnosti, vol. 4, pp. 34-38, Nov. 1972.
- "The first rumblings of a worldboom: more than \$3.5 billion has been earmarked to boost world-wide shipments of LNG (Cryogenic tankers for shipping liquefied natural gas)," Bus. Week, p. 32+, Apr. 3, 1971.
- "Floating LNG plant," Gas, v. 46, p. 45, Dec. 1970.
- Foster, W. G., and D. O. Murraray, "Development program for a liquid methane heat pipe," Cryogenic Engineering Conference, proceedings, Boulder, Colo., Aug. 9-11, 1972. New York, Plenum Press, 1973, pp. 96-102.

- Friswell, N. J., "Emissions from gas-turbine-type combustors," In, Emissions from continuous combustion systems, proceedings of the 15th symposium, Warren, Mich., Sep. 27-28, 1971. New York, Plenum Press, 1972, pp. 161-175; Discussion, pp. 175-182.
- Frost, Jack, "The financial considerations behind liquid natural gas carrier construction," Dock and Harbour Authority, v. 53, pp. 12-13, May 1972.
- Garland, F., and G. Atkinson, "The interaction of liquid hydrocarbons with water," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Oct. 1971
- Gardenier, J. S., II, "Concepts for analysis of massive spill accident risk in maritime bulk liquid transportation," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Jun. 1972.
- Gardner, F. J., "Vast worldwide trade blooming in LNG," Oil and Gas J., v. 70, pp. 52-5, Sep. 11. 1972.
- "Gaz-transport's membrane system," Marine Eng/Log, v. 76, pp. 42-3, Apr. 1971.
- Geneshan, R., "Methanol as fuel - cheaper than LNG," Oil Gas J., v. 70, no. 3, pp. 61-2, 30 Jul. 1972.
- Gibson, G. H., "Consider safety, reliability, cost in selecting type of LNG storage," Oil and Gas J., v. 69, pp. 65-9, Feb. 8, 1971.
- Goldberg, E., and E. K. Saltz, "LNG terminal is designed for safety (Distrigas of New York, Staten Island)" Pipeline and Gas J., v. 200, no. 3, pp. 42+, Mar. 1973,
- Goldfeder, L. B., "Control valves for LNG facilities," Pipeline and Gas J., v. 199, p. 58+, Jan. 1972.
- Gondouin, M., and F. Murat, "Transportation and storage of LNG," Chem. Eng. Prog., v. 68, no. 9, Sep. 1972.
- Goodwin, R. D., and R. Prydz, "Densities of compressed liquid methane, and the equation of state," J. of Research, Section A. Physics and Chemistry, v. 76A, pp. 81-101, Mar. - Apr. 1972.
- Grumer, Joseph, and others, "Fundamental flashback, blowoff, and yellow-tip limits of fuel gas-air mixtures," Bureau of Mines, Washington, D. C. Rept. of investigations, Jul. 1956.
- Hagiwara, Y., "Here are features of Japan's 1969 LNG -receiving system," Oil and Gas J., v. 66, p. 101+, Apr. 29, 1968.
- Hague, Brian C., "LNG stored safely within densely populated Stuttgart: recently completed, above-the-ground storage facility, the first of its type in West Germany, holds 17 million cubic meters, its design incorporating all the latest safety technology needed for its location inside a large city,"

- World Petroleum, v. 43, pp. 32-3, Feb. 1972.
- Hale, D., "LNG tanker developments," Pipeline and Gas J., v.199, pp. 52-3, Sep. 1972.
- "History of LNG transport; from Methane Pioneer until now," Marine Eng/Log, v. 76, p. 41, Apr. 1971.
- Hottel, H. C., "Review of certain laws governing diffusion burning of liquids," Fire research abstracts and reviews, v. 1, p. 41, Nov. 1959.
- "Hottest item on the shelf: LNG carriers," Fortune, v. 87, pp. 60-1, Apr. 1973.
- "How to calculate density of LNG at cryogenic temperatures," Oil and Gas J., v. 69, no. 3, pp. 56-7, Jan. 18, 1970.
- "Import/receiving terminals," Pipeline and Gas J.,v. 200, p. 30, Dec. 1973.
- Ingram, Timothy H., "Peril of the month: gas supertankers," Washington Mo., v. 4, pp. 7-13, Feb. 1973.
- "International Conference on LNG, 1st, proceedings, Institute of Gas Technology, Chicago, Ill., Apr. 7-12, 1968. "
- "International Conference on LNG, 2nd, proceedings, Paris, Oct. 19-23, 1970."
- "International Conference on LNG, 3rd, proceedings, Washington, D. C., Sep. 24-28, 1972."
- "International LNG facilities," Pipeline and Gas J., v. 200, p. 30, Dec. 1973.
- "Is there an economical way to store liquefied natural gas?" Power, v. 113, p. 77, Jan. 1969.
- Katz, D. L., and C. M. Sliepcevich, "LNG/water explosions; cause and effect," Hydrocarbon Process, v. 50, pp. 240-4, Nov. 1971.
- Katz, D. L., and H. T. Hashemi, "Pipelining LNG in dense phase," Oil and Gas J., v. 69, pp. 55-60, Jun. 7, 1971.
- Katzin, Jerome S.,and Patrick Siegler Lathrop, "Funding LNG systems facilities," Public Utilities Fortnightly, v. 91, pp. 17-22, Mar, 15, 1973.
- Kidnay, Arthur J., "Liquefied natural gas," Colo. Sch. Mines, Miner. Ind. Bull., v. 15, no. 2, Mar. 1972.

- Kime, J. W., "LNG carriers; USCG role in LNG systems," Marine Eng/Log, v. 77, p. 128+, Sep. 1972.
- Kniel, L., "LNG cold potential could cut ethylene-production costs," Oil and Gas J., v. 67, pp.96-9, Sep. 15, 1969.
- Kuemper, E., and Heinrich Koppers, "Sicherheitstechnik fuer LNG-speicher (Safety devices for LNG-storage tanks)" Gas Waerme Int., v. 22, no. 6, pp. 220-224, Jun. 1973.
- Laney, William M., "Identification of codes, standards and safety regulations for proposed LNG development testing laboratories at NMRC-Galveston," National maritime research center, Galveston, Texas, Technical report, Oct. 1972-May 1973, Aug. 1973.
- Lehrer, Peter, "Experimental investigation of LNG fires on storage-tank models," Gas Wasserfach, Gas Erdgas, v. 114, pp. 340-344, Jul. 1973.
- Levin, Donald, and David M. Danger, "Fire protection of railroad tank cars carrying hazardous materials - analytical calculations and laboratory screening of thermal insulation candidates," Naval Ordnance Lab., White Oak, Md., Jul. 21, 1972.
- Levy, M. E., and others, "Ignition of subatmospheric gaseous fuel-oxidant mixtures by ultraviolet irradiation," AIAA Aerospace sciences meetings, 7th, proceedings, New York, N. Y., Jan. 20-22, 1969, AIAA Paper No. 69-88.
- "LNG by rail," Gas J., v. 341, no. 5548, p. 232, Mar. 11, 1970.
- "LNG carrier; boil-off, to burn or not to burn?" Marine Eng/Log, v. 77, p. 52+, Sep. 1972.
- "LNG carrier; Gazocean's new ship hauls gas to Boston," Marine Eng/Log, v. 77, pp. 44-5, Sep. 1972.
- "LNG carrier: many cargo containment systems are available," Marine Eng/Log, v. 77, pp. 40-3, Sep. 1972.
- "LNG carrier: special report," Marine Eng/Log, v. 77, pp. 37-52+, Sep. 1972.
- "LNG from Indonesia eyed by U. S. and Japan," Chem. Mktg. Rep., v. 203, p. 7+, Apr. 30. 1973.
- "LNG report," Oil and Gas J., v. 70, pp. 82-100, Oct. 9, 1972.
- "LNG report: storage dynamics," Pipeline and Gas J., v. 199, pp. 37-48, Sep. 1972.
- "LNG-ship operation holds no added risk, API group told," Oil and Gas J., v. 69, p. 236, May 17, 1971.

- "LNG; status of the cryogenic tanker," *Marine Eng/Log*, v. 76, p. 39, Apr. 1971.
- "Liquefied natural gas tank; four-layer sandwich wall," *Civil Eng.*, v. 39, p. 39, Jul. 1969.
- "LNG-tank support, insulation is developed," *Oil and Gas J.*, v. 69, p. 85, Dec. 6, 1971.
- "LNG tankers inflate shipbuilders' hopes: U. S. yards could get a big share of perhaps 100 ships that will be needed," *Bus. Week*, p. 46+, Aug. 19, 1972.
- "LNG used to power tankers," *Cryogenics*, v. 12, p. 151, Apr. 1972.
- McDermott, John, "Liquefied natural gas technology," *Chemical Technology*, no. 10, Park Ridge, N. J., Noyes Data Corp., 1973,
- Malte, P. C., and G. A. Wooldridge, "Low pollution characteristics of urban transit buses fueled with liquefied natural gas," *SAE Prepr.* no. 720685 for meeting Aug. 21-24, 1972
- Martin, A. R., "Physical behaviour of some biowaste gases in an ion age," *Electric Propulsion Conference*, 10th, American Institute of Aeronautics and Astronautics, Lake Tahoe, Nev., Oct. 31-Nov. 2, 1973. Paper 73-1113.
- May, W. G., "Dispersion of LNG spills," *Hydrocarbon Process*, v. 52, no. 5, pp. 105-109, May 1973.
- May, W. G., and W. McQueen, "Radiation from large liquefied natural gas fires," *Combust. Sci. Technol.*, v. 7, no. 2, pp. 51-56, 1973.
- "Membrane tank system for methane tankers," *Cryogenics*, v. 8, p. 259, Aug. 1968.
- Miller, R. T., "Liquid natural gas storage," *J. Metals*, v. 23, no. 10, pp. 34-37, Oct. 10, 1971.
- Murphy, J. N., and others, "Hazards of marine transportation of liquid chlorine," Bureau of Mines, Pittsburgh, Pa., Pittsburgh mining and and safety research center, Report No. PMSRC-S-4158, Mar. 1970.
- Nakanishi, E., and R. C. Reid, "Liquid natural gas-water reactions," *Chem. Eng. Prog.*, v. 67, pp. 36-41, Dec. 1971.
- National maritime research center, Galveston, Tex., Liquefied natural gas program, "LNG tank designs," Report No. NMRC 272-23000-R1, Dec. 1972.
- "Natural gas: to foresee is to forstall," *Chemistry*, v. 46, p. 17, Apr. 1973.

- Naval Ship Research and Development Center; Publication of Lifetime Extreme Accelerations for Design of LNG Cargo Tanks, "Development and demonstration of a vulnerability model of deaths, injuries, and damage from potential hazardous materials spills," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Mar. 1974.
- Naval Weapons Center, "Explosion hazards associated with spills of large quantities of hazardous materials," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Mar. 1974.
- Obrzut, J. J., "LNG tanks gain big margin of safety from wire girdle," Iron Age, v. 210, pp. 48-9, Aug. 17, 1972.
- Olien, N. A., and L. A. Sarkes, "Keeping up with LNG; a new literary Awareness Service helps to do the job," Am. Gas Assn. Mo., v. 55, v. 29+, Jul.-Aug. 1973.
- Olien, Neil A., and others, "Survey of current information on LNG and methane, the thermophysical properties methane, and metrology," National Bureau of Standards, Boulder, Colo., Cryogenics Div., Annual progress rept. no. 3, Feb. 1973.
- Operations Research, Inc., "Spill risk analysis program, Phase II: Methodology development and demonstration," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Aug. 1974.
- "Pacific signs for big slug of Indonesian LNG," Oil and Gas J., v. 70, p. 80, Sep. 25, 1972.
- Parikh, P. G., "Pollutants from thetane fueled gas turbine combustion," J. Eng. Power, v. 95, p. 97-104, Apr. 1973.
- Park, R. R., "Ocean transport of LNG," Gas, v. 47, pp.48-51, Aug. 1971.
- Parker, R. O., J. K. Spata, "Downwind travel of vapors from large pools of cryogenic liquids," International Conference on LNG, 1st, proceedings, Apr. 1968.
- Parker, R. O., "A study of downwind vapor travel from LNG spills," paper presented at A. G. A. Distribution Conference, Operating Section, May 1970.
- Pastuhov, A., "Overview of LNG worldwide," Gas, v. 48, pp. 26-9, Dec. 1972.
- Pastuhov, A., and F. Ruccia, "Why not transport LNG and electricity at the same time," Pipe Line Ind., v. 32, no. 5, pp. 44-8, May 1970.
- "Polluting incidents in and around U. S. waters, calendar year 1972," Commandant (G-WEP), U. S. Coast Guard, Washington, D. C.

- Post, Thomas R., "Private compensation for injuries sustained by the discharge of oil from vessels on the navigable waters of the United States: a survey (methods by which private persons may seek compensation for the damage)," *J. Maritime Law and Commer.*, v. 4, pp. 25-65, Oct. 1972.
- "Prestressed-concrete LNG tanks tested, in operation (Barcelona, Spain)," *Oil and Gas J.*, v. 68, pp. 95-6, Jan. 5, 1970.
- Puklavec, V., "Boil-off liquefaction on large capacity LNG tankers," *Erdoel-Erdgas-Z.*, v. 89, no. 8, pp. 293-297, Aug. 1973.
- Putnam, A. A., "A model study of wind-blown free-burning fires," *Symposium (International) on combustion, 10th, The Combustion Institute*, p. 1039, 1965.
- Pratt, D. T., and others, "Comparison of four simple models of steady flow combustion of pyrolyzed methane and air," *Combustion Science and Technology*, v. 6, pp. 187-190, Nov. 1972.
- Rausch, A. H., and A. D. Levine, "Rapid phase transformations caused by thermodynamic instability in cryogenics," *Cryogenics*, v. 13, pp. 224-9, Apr. 1973.
- Rhodes, H. L., and others, "Vapor-liquid equilibria data for two helium-nitrogen-methane mixtures from 76.5//0 to 164//OK and pressures to 1,200," *U. S. Bureau of Mines, Rep. Invest. 7598*, 1972.
- Riggins, W. M., "How Delmarva P & L meters LNG storage and usage," *Pipeline and Gas J.*, v. 200, p. 74+, Jun. 1973.
- Rodosevich, J. B., and R. C. Miller, "Experimental liquid mixture densities for testing and improving correlations for liquefied natural gas," *AICHE J.*, v. 19, pp. 729-35, Jul. 1973.
- Royal, M. J., and N. M. Nimmo, "Big methanol plants offer cheaper LNG alternatives," *Oil and Gas J.*, v. 71, pp. 52-5, Feb. 5, 1973.
- Ruppert, Karl, "LNG drive systems for road vehicles," *Linde Rep. Sci. Technol.*, pp. 29-31, Nov. 19, 1973.
- "Safety standards for LNG set out by DOT and NFPA," *Oil and Gas J.*, v. 70, p. 45, Oct. 23, 1972.
- "San Diego Gas and Electric Co. turns on first LNG-supplied distribution system," *Gas Age*, v. 134, no. 10, pp. 30-1, Oct. 1967.
- Sarsten, J. A., "LNG stratification and rollover," *Pipeline and Gas J.*, v. 199, pp. 37-9, Sep. 1972.
- Smith, H. F., "Gas turbine propulsion for LNG tankers," *ASME-Paper 69-GT-47* for meeting Mar. 9-13, 1969.

- Soedjanto, P., and Fred W. Schaffert, "Transporting Gas - LNG vs. methanol," Oil and Gas J., v. 71, no. 24, pp. 88-92, Jun. 11, 1973.
- Stannard, J. H., "New NFPA 59A-1971 LNG code," Pipeline and Gas J., v. 198, p. 39, Aug. 1971.
- Starling, K. E., and others, "Thermodynamic property predictions for LNG," Cryogenic Technol. v. 7, no. 2, pp43-7, 51, Mar.-Apr. 1971.
- "Study finds no danger of LNG exploding if spilled on water," Oil and Gas J., v. 70, p. 24, Feb. 28, 1972.
- "Submerged combustion units revaporise LNG," Process Eng. p. 13, Jul. 1973.
- Thompson, G. E., "Kenai (Alaska) LNG plant design," ASME-Paper 69-Pet-19 for meeting Sep. 21-25, 1969.
- "Three systems provide for economic and safe operation of LNG carriers," Marine Eng/Log, v. 77, p. 98, Sep. 1972.
- "To fuel U. S. in the future, supertankers and superports," U. S. News, v. 73, p. 77, Dec. 11, 1972.
- "Tomorrow's transport; Daimler-Benz LNG fuel systems," Cryogenics, v. 12, p. 479, Dec. 1972.
- TRW, "Thermal radiation and overpressures from instantaneous LNG release into the atmosphere," First Quarterly Progress Report, 08072-1, May 29, 1967
- TRW, "Thermal radiation and overpressures from instantaneous LNG release into the atmosphere," Final Report to American Gas Association, No. 08072-4, Apr. 26, 1968.
- TRW, "Thermal radiation and overpressure from instantaneous LNG release into the atmosphere - Phase II" Final Report to American Gas Association, No. 08072-9, May, 1969.
- Uhl, A. E., "Kenai-Tokyo trade is start of Pacific LNG boom," Oil and Gas J., v. 68, no. 29, pp. 82-87, Jul. 20, 1970.
- Uhl, Arthur E., and Lawrence A. Amoroso, "Safety and reliability of LNG facilities," ASME Paper 72-Pet-53 for meeting Sep. 17-21, 1972.
- Uhl, A. E., and others, "Safety and reliability of LNG facilities," Gas, v. 48, pp. 48-50, Nov., pp. 34-6, Dec. 1972, v. 49, pp. 43-5, Jan., pp. 36-38, Feb. 1973.
- "United States and Canadian LNG peakshaving facilities," Pipeline and Gas J., v. 199, pp. 44-6, Jun. 1972.
- "United States and Canadian LNG peakshaving facilities," Pipeline and Gas J., v. 200, pp. 22-4, Jun. 1973.

- "United States boom coming in ships to haul gas, oil; demand for oil natural gas is outrunning U. S. supply; to ship them in requires hundreds of new tankers; for shipyards, it means big business, U. S. News, v. 73, pp. 56-8, Sep. 4, 1972.
- "U. S. Coast Guard research and development contract DOT-CG-42, 356-A with C. R. Cushing: Intermodal container safety; in progress.
- "United States hikes underground storage for light gas liquids by 47.9%," Oil and Gas J., v. 71, p. 62, Aug. 13, 1973.
- U. S. Steel, "Evaluation of tanker structure in collision," U. S. Coast Guard, Office of Research and Development, Washington, D. C., Aug. 1974.
- Walls, W. L., "Fire protection for LNG plants," Hydrocarbon Process, v. 50, pp. 205-8, Sep. 1971.
- Walls, Wilbur L., "LNG: a fire service appraisal - 2," Fire J., v. 66, no. 2, pp. 30-33, Mar. 1972.
- Welker, J. R., and H. R. Wesson, "Control of LNG spill fires with high expansion foams," ASME Paper 72-Pet-46 for meeting Sep. 17-21, 1972.
- Welker, J. R., and others, "LNG spills: to burn or not to burn," paper presented at A. G. A. Distribution Conference, Operating Section, May 1969.
- Werthenbach, H. G., "Propagation of flames on cylindrical, liquid hydrocarbons tanks," Gas Wasserfach, Gas Erdgas, v. 112, no. 8, pp. 383-6, Aug. 1971.
- Wesson, H. R., "Control LNG-spill fires," Hydrocarbon Process, v. 51, pp. 61-4, Dec. 1972.
- "Where natural gas behaves like a genie," Bus. Week, pp. 144-6+ Jan. 21, 1967.
- "Williams, John D., "Cold cargo: liquefied natural gas could fuel resurgence of shipbuilding firms; U. S. yards prepare to join LNG tanker competition as energy demand grows," Wall St. J., v. 180, p. 1+, Jul. 10, 1972.
- Wilson, R., "Natural gas is a beautiful thing?" Bull. Atom. Sci., v. 29, pp. 35-40, Sep. 1973.
- Wissmiller and E. O. Mattocks, "How to use LNG safely," Pipeline and Gas J., v. 199, pp. 28-32, Mar. 1972.
- Witte, L. C., and J. E. Cox, "Non-chemical explosive interaction of LNG and water," ASME Paper 71-wa/HT-31 for meeting Nov. 28-Dec. 2, 1971.

"World natural gas: 1972" Bureau of Mines, Div. of Fossil Fuels, Apr. 29, 1974.

Yu, P., "Liquid-liquid - vapor equilibria in the nitrogen - methane - ethane system," Can. J. Chem. Eng., v. 47, no. 5, pp. 495-8, Oct. 1969.

Zraket, Charles A., "Energy, resources and the environment," Mitre Corp. Rept. No. 72-180-Rev-2, Oct. 24, 1972.

Zuber, N., and M. Tribus, "Further remarks on the stability of boiling heat transfer," AECU 3631, USAEC Tech. Info. Service, 1959.

Siscoe

PHENOMENOLOGY OF LNG ACCIDENTS
A SELECTED BIBLIOGRAPHY

P-5295