Shri Jayant Saraiya ENGINEER

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At 9:30 P.M. on a cold, windy night in January, 1966, the telephone rang at the Sixth Street home of Mr. and Mrs. Jayant Saraiya in Sinclair, Wyoming. Jay, who was watching TV, got up and answered. "Jay? This is Sam at the plant. The temperature on the regenerator has been slowly dropping all evening. Thought I better tell you." "Thanks," said Jay. "I'll be right over." He hung up, walked over to the kitchen window where he could see an outside thermometer which indicated a cool seven below zero, and proceeded to don a ski parka, boots, and leather cap with ear flaps. "I'll be at the plant for awhile; don't wait up for me," he called to his wife. He stepped into his 1963 Falcon, and drove the four blocks to the plant. The plant is Sinclair Refining Company's refinery at Sinclair, near Rawlings, Wyoming.

Going directly to the control house, Jay talked with Sam Watkins, the shift supervisor. He studied the temperature, pressure, and throughput logs of the refinery that the recording instruments spewed out steadily. "Sam," Jay said finally, "Let's go down to the blower house and look around." Donning their heavy parkas and caps, they went out into the icy wind and across the refinery yard to a small galvanized iron building which housed the blower for the regenerator. This machine gulps in the enormous quantities of air required to burn the carbon off the catalyst and forces it into the burning vessel, called the regenerator. The blower was screaming at a high pitched roar in its usual manner and at its designed speed. Jay had noted in the control room a reduced air flow from the blower. Now by inspecting the blower equipment carefully, he finally noted that the air intake duct above the roof had built up a ring of ice which was restricting the flow of air to the blower. Pointing this out to Sam, he suggested that Sam call the maintenance foreman and ask him to chip off the ice. "I'm sure that will correct the trouble and I'm going home," he told Sam. "If the temperature doesn't start back up after they finish knocking off the ice, call me."

Just another common incident in the working life of an industrial chemical engineer, with this difference. Jay Saraiya is an Indian national trained as a chemical engineer in the United States who plans to spend his professional career in the U.S. A lack of interest in chemical engineering on the part of U.S. youth and a burgeoning demand has created an opportunity that foreigners are taking advantage of. Some educators have estimated that we may soon reach the point where one fifth of all chemical engineers being graduated by U.S. engineering schools will be non-citizens.

Jay's experience is typical. Born and raised in Bombay as the son of a moderately wealthy importer, Jay went to the University of Bombay and majored in chemistry and physics. In 1959, by straining the family's financial resources almost to the breaking point, he went to the United States and enrolled as a freshman in chemical engineering at Montana State University. Technical education in India is conducted in English, so language was no handicap. Four years later he was graduated as a B.S. in Chemical Engineering. Immediately upon graduation he was hired by Sinclair. Desperately short of chemical engineers and located in what many Americans consider "Nowheresville," Sinclair and Rawlins welcomed Jay with open arms. Company employees found Jay a comfortable apartment in Rawlins for $35 per month and the local newspaper ran a feature article on Jay and his history.

Feeling that he would be a happier and more stable employee if he were married, Sinclair encouraged him to take his vacation ahead of schedule to go to India to get his bride. Accordingly, in January Jay married Jayshee Asher, a Bombay girl selected with his family's approval according to the Indian tradition.

Jay and Jayshee returned to the high, barren, wind-swept plains of Wyoming in February. After having spent her entire life in steaming, teeming, tropical Bombay, Rawlins seemed like another planet to Jayshee. But there were compensations. The apartment was warm, comfortable, and convenient—and then there were the stores, particularly the supermarket with its abundance and cleanliness like nothing she had ever experienced in India.

Spring comes late at 6500 feet altitute but it does come eventually. In summer there were trips to the nearby Wind River and Teton mountain ranges and to Yellowstone Park.

In November, their son Monal was born. Now the difference between India and America really became apparent to Jayshee. What with the washer and drier, the canned milk and baby food, the abundance of shots, pills and vitamins, the baby was never sick. A major crisis was narrowly

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NOMENCLATURE

Dimensions are given in terms of mass **(M)**, length **(L)**, time **t**, and temperature **(T.)** Vectors have a single underline and tensors have a double underline. Force is not considered a fundamental dimension, but is assigned instead the dimensions of mass-acceleration instead the dimensions of mass-acceleration product **(ML/t²)**. This "absolute" system of dimensions is commonly used by physicists, much less commonly by engineers.

- A = thermodynamic work function, ML^2/t^2.
- C_p = heat capacity at constant pressure per unit mass, L^2/t^2T.
- D_{AB} = binary diffusivity for system of species A-B, L^2t.
- d = molecular diameter, **L.**
- E_v = total rate of viscous dissipation of mechanical energy, ML^2/t^3.
- G = Gibbs free-energy per unit mass, ML^2/t^2.
- g = gravitational acceleration, L/t^2.
- h_1, h_2 = elevation, **L.**
- j_{A_y} = mass flux of species A in the y-direction, M/tL^2.
- K = kinetic energy, ML^2/t^2.
- $\mathbf{K}$ = Boltzmann constant, ML^2/t^2T.
- k = thermal conductivity, ML/t^3T.
- m = mass of molecule, **M.**
- p = fluid pressure, M/Lt^2.
- q_y = y-component of the heat flux vector, M/t^3.
- T = absolute temperature, **T.**
- t = time, **t.**
- u = mean molecular speed, **L/t.**
- $\underline{v}$ = mass average velocity, **L/t.**
- $<\underline{v}>$ = space average value of velocity, **L/t.**
- W = rate of doing work on system, ML^2/t^3.
- w = mass flow rate, **M/t.**
- α = thermal diffusivity, L^2/t.
- β = velocity function (defined in Equation 18), dimensionless.
- μ = viscosity, **M/Lt.**
- ν = kinematic viscosity, L^2/t.
- ρ = density, M/L^3.
- $\underline{\underline{\tau}}$ = shear stress tensor, M/t^2L.
- Φ = potential energy, ML^2/t^2.

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averted the following spring. Jay's parents insisted that he bring his son home for a family inspection. Jay and Jayshee realized that a six-month old child from antiseptic America would have an extremely difficult time in India, possibly even dying of dysentery. They finally persuaded Jay's family to come to Wyoming instead.

Jay has moved steadily ahead with Sinclair. Shortly after his son was born, they asked him to move out to the company town of Sinclair so that he would be more readily available whenever technical difficulties arose. For $50 per month, he rents a two-bedroom, one-floor company-owned house. At his present salary rate of $700 per month, he has been able to live well and still help his family. Until his brother completed college last summer, he contributed $100 per month towards his expenses. Financial help to his family in India has been accomplished with the aid of a favorable exchange rate which converts one dollar into four rupees.

This true story points to one way that the continued shortage of U.S. chemical engineers is being met. Not an isolated example by any means, Jay Saraiya is only one of sixteen non-citizen chemical engineers graduated and placed in permanent positions in the U.S. by one educational institution, Montana State University, in the past six years. The employers of these men include some of the U.S.'s leading companies at some of their most attractive locations. Just as nature abhors a vacuum, so good jobs are going to be filled whether or not American boys want them.