



AUTHOR Richard D. Reger

AFFILIATION Alaska Division of Geological & Geophysical
Surveys

ADDRESS 794 University Avenue (Basement)
Fairbanks, Alaska 99709

TELEPHONE (907) 474-7147

TITLE: SLUSHFLOWS OF ATIGUN PASS, DALTON HIGHWAY
CENTRAL BROOKS RANGE, ALASKA

ABSTRACT

Slushflows are turbulently flowing tongues of saturated snow (slush) and debris typically produced in arctic alpine areas during brief spring breakups. They were first recognized in the Atigun Pass area during pre-construction geotechnical studies for the Trans-Alaska Pipeline System (TAPS) and their hazard potential was accommodated during design, construction, and maintenance stages of the TAPS project. They continue to influence traffic flow and maintenance on the Dalton Highway.

The slushflow season begins about the third week of May and lasts through the first week of June in the Atigun Pass area, where Larry Onesti and his students measured meteorological conditions that produced this distinctive type of wet-snow avalanche in 1979, 1980, and 1981. Prior to spring breakup, persistent subfreezing air and snowpack temperatures prevent significant meltwater production, but during late May day-time temperatures abruptly rise to 5 to 12°C as warm air masses move from the Interior north into the central Brooks Range and solar radiation peaks. Rapid meltwater production starts after the snowpack becomes isothermal (0°C). If warm temperatures continue for 48 to 96 hr, slushflow activity begins in chutes and on floodplains where drainage of meltwater from the seasonal snowpack is exceeded by the production of meltwater in the snow.

Observations of 30 flows in the Atigun Pass area document that masses moving down steep (12-18°), confined chutes attain velocities of several tens of meters per second and transport considerable debris. On gentle (2°) floodplains, these flows travel a few meters per second and carry much less debris.

Slushflows build distinctive debris fans at the mouths of chutes. Studies of fan morphologies and plant covers indicate that foci of debris deposition shift as rounded humps grow on upper fan surfaces and deflect stream channels. Deposition occurred on most fan surfaces several thousand years ago, but most modern deposition is limited to lower chutes and proximal fan surfaces. Some chutes produce one or more slushflows most years, but most produce flows at irregular intervals. Willow-ring counts indicate at least one flow occurred in an average chute every 3 to 11 yr during the past 50 yr.

Experiences in Spitsbergen, northern Scandinavia, and arctic Canada demonstrate that this natural process is capable of causing great damage, disruption of services, injury, and loss of life. However, brevity of the slushflow season, limited distribution of slushflows, and the distinctive landforms associated with them make avoidance of this hazard fairly easy, provided that consideration is given to infrequent, large-magnitude events that can reach far beyond normal limits.

