TECHNICAL NOTES

SUBJECT: ENG – Simplified procedure for determining the required pressure rating of PVC and HDPE pipe.

Purpose. To transmit a method for determining the pressure rating of PVC or HDPE pipe based upon potential surge pressures.

Effective Date. Upon receipt.

Contents of Technical Note.

Utah Conservation Practice Standard (CSP) 430, Irrigation Pipeline and 516, Pipeline, states when operating at design capacity, the full-pipe flow "should not exceed 5 feet per second, and the working pressure at any point should not exceed 72 percent of the pressure rating of the pipe." If either of these limits is exceeded, special design considerations must be given to the flow conditions, and measures must be taken to adequately protect the pipeline against transient pressures (surge). Furthermore, 430 states, "Flexible conduits such as plastic pipe, aluminum pipe, corrugated metal pipe, or ductile iron pipe, shall be designed using NRCS National Engineering Handbook (NEH), Part 636 Chapter 52, Structural Design of Flexible Conduits."

This bulletin sets forth applicable design requirements to be used for the planning, design, and installation of plastic pipe.

If a planned pipeline will exceed the requirements set forth in CSP 430, current NEH Part 636, Chapter 52, Structural Design of Flexible Conduits shall be used within the scope and purpose intended for the design of plastic pipe. An adequate design of any pipeline includes surge pressure analysis to account for sudden changes in velocity. For HDPE pipe a modulus of elasticity of pipe material (E) shall be 150,000 psi for short duration dynamic loading such as surge and temporary live loading deflection. Simplification of NEH 636, Ch 52 equation 52-9 yields a surge pressure multiplier based on dimension ratio, (see Table 1 and 2 for PVC and HDPE pipe).

Inherent properties of PE and HDPE Plastic Pipe provides for higher short-term hoop strength for occasional or recurring surge pressures, referred to as quick-burst pressure or short-term strength (STS). However, due to unknown surge

frequencies, installation variations of typical pipeline systems, and localized negative pressures caused by surge, STS shall not be used, and the sum of maximum operating and cyclic surge pressures shall not exceed the pressure class (rating) of the pipe as certified by the manufacturer. Pipeline appurtenances shall also be considered when designing pipelines for surge pressures.

Table 1 PVC Pipe Pressure Surge Multiplier			Table 2 HDPE Pressure Surge Multiplier		
Dimension Ratio	Pressure Surge, psi		Dimension Ratio	Pressure Surge, psi	
	(ΔV = 1 fps)	(ΔV = 2 fps)		(ΔV = 1 fps)	(ΔV = 2 fps)
13.5	20.2	40.4	7.3	18.9	37.8
14	19.8	39.6	9	16.5	33
17	17.9	35.8	11	14.6	29.2
18	17.4	34.8	13.5	13.0	26
21	16.0	32.0	15.5	12.0	24
25	14.7	29.4	17	11.4	22.8
26	14.4	28.8	21	10.2	20.4
32.5	12.8	25.6	26	9.1	18.2
41	11.4	22.8	32.5	8.1	16.2

Example: A planned irrigation pipeline using HDPE SDR 11 (pressure rating of 160 psi) plastic pipe conveying water at 6 ft/sec and a maximum operating pressure of 45 psi. Surge analysis: Possible velocity change of 6 ft/sec multiplied the surge multiplier for SDR 11 pipe (14.6) produces 87.6 psi surge pressure. Minimum pipe pressure rating is equal to the sum of maximum operating pressure and surge, 132.6 psi, therefore, SDR of 11 is adequate.

For situations where the pipeline is single line with water flowing to a single outlet, the surge pressure is added to the static pressure not the operating pressure as in the example above. The water will stop flowing in the pipeline, the pressure goes to static, and then the surge pressure is generated.

Filing Instructions. File in the Technical Notes notebook under ENG-210

Contacts: Brent Draper, State Irrigation Engineer, 801-524-4582
         Aimee Rohner, State Design Engineer, 801-524-4263

DAVID C. BROWN
State Conservationist