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Date: **OCT 08 2015**
Symbol: ENV-DO-15-0274
LA-UR: 15-27555
Locates Action No.: NA

Ms. Michelle Hunter, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: Request for Additional Information, Class V Underground Injection Control Wells, Discharge Permit Application DP-1835

On September 24, 2015, Mr. Steve Huddleson, New Mexico Environment Department (NMED) Ground Water Quality Bureau, requested additional information (verbal communication) from the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) on discharge permit application DP-1835, submitted by DOE/LANS in April 2015. Discharge permit application DP-1835 is for the operation of the Chromium Project's proposed Class V underground injection controls (UIC) wells. Mr. Huddleson asked for additional information on the following subject:

- ✓ **Additional information on injection well design and operation.** The injection well design schematic provided in Appendix B of the April 2015 discharge permit application (ENV-DO-15-0085) should be modified to include the following additional information: (a) the normal and maximum operating pressures, (b) the possible degrees from vertical of injection wells drilled at an angle, and (c) identification of the Baski, Inc. flow control valve (FCV™). In addition, a more detailed description of how the injection wells will be operated is needed.

Enclosures 1, 2, and 3 provide the additional information requested.



Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this information.

Sincerely,



Alison M. Dorries
Division Leader
Environmental Protection Division
Los Alamos National Security, LLC

Sincerely,



Gene E. Turner
Environmental Permitting Manager
National Security Missions
Los Alamos Field Office
U.S. Department of Energy

AMD:GET:MTS:RSB/lm

Enclosures:

1. Injection well operation schematic
2. Injection well operation description
3. Baski Flow Control Valve description

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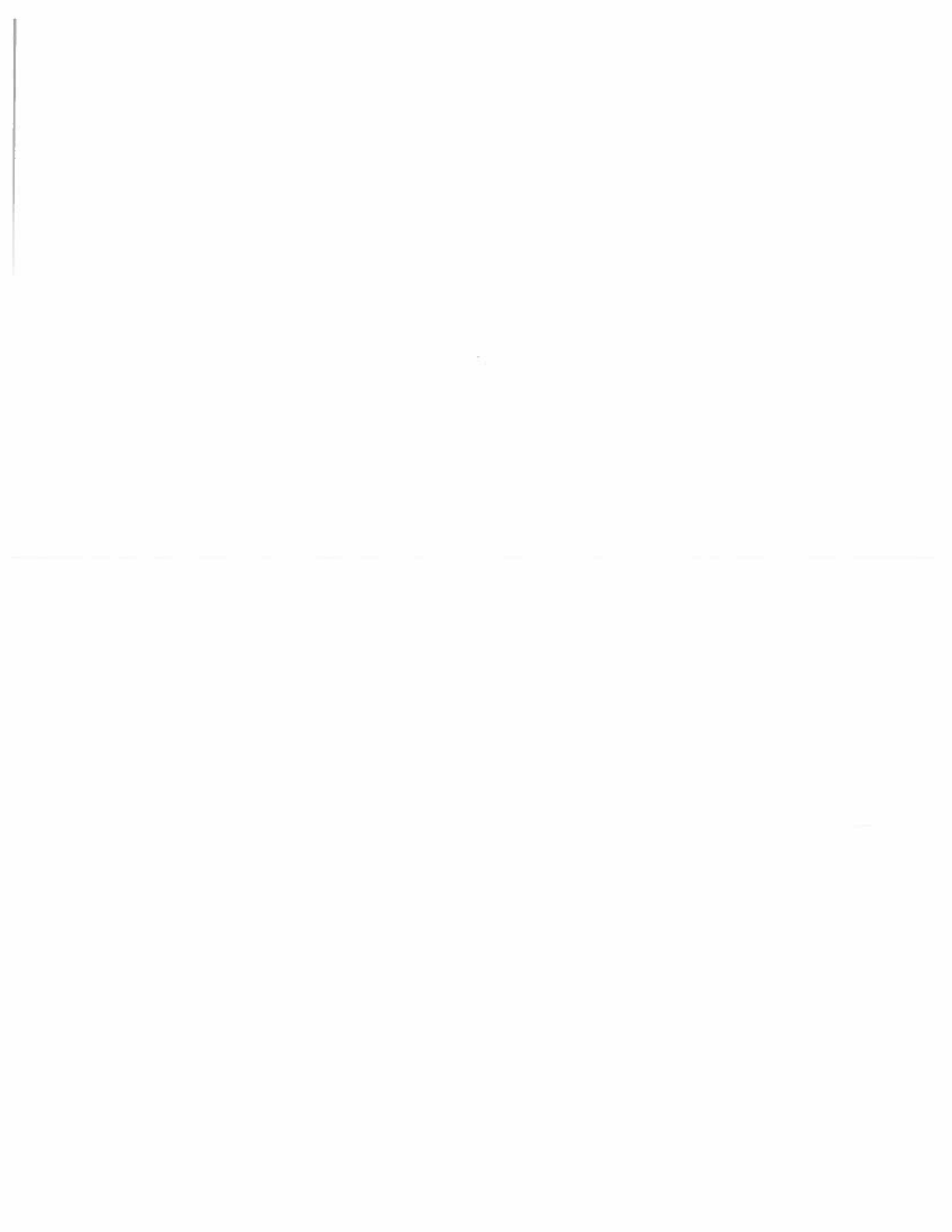
ENCLOSURE 1

Injection well operation schematic

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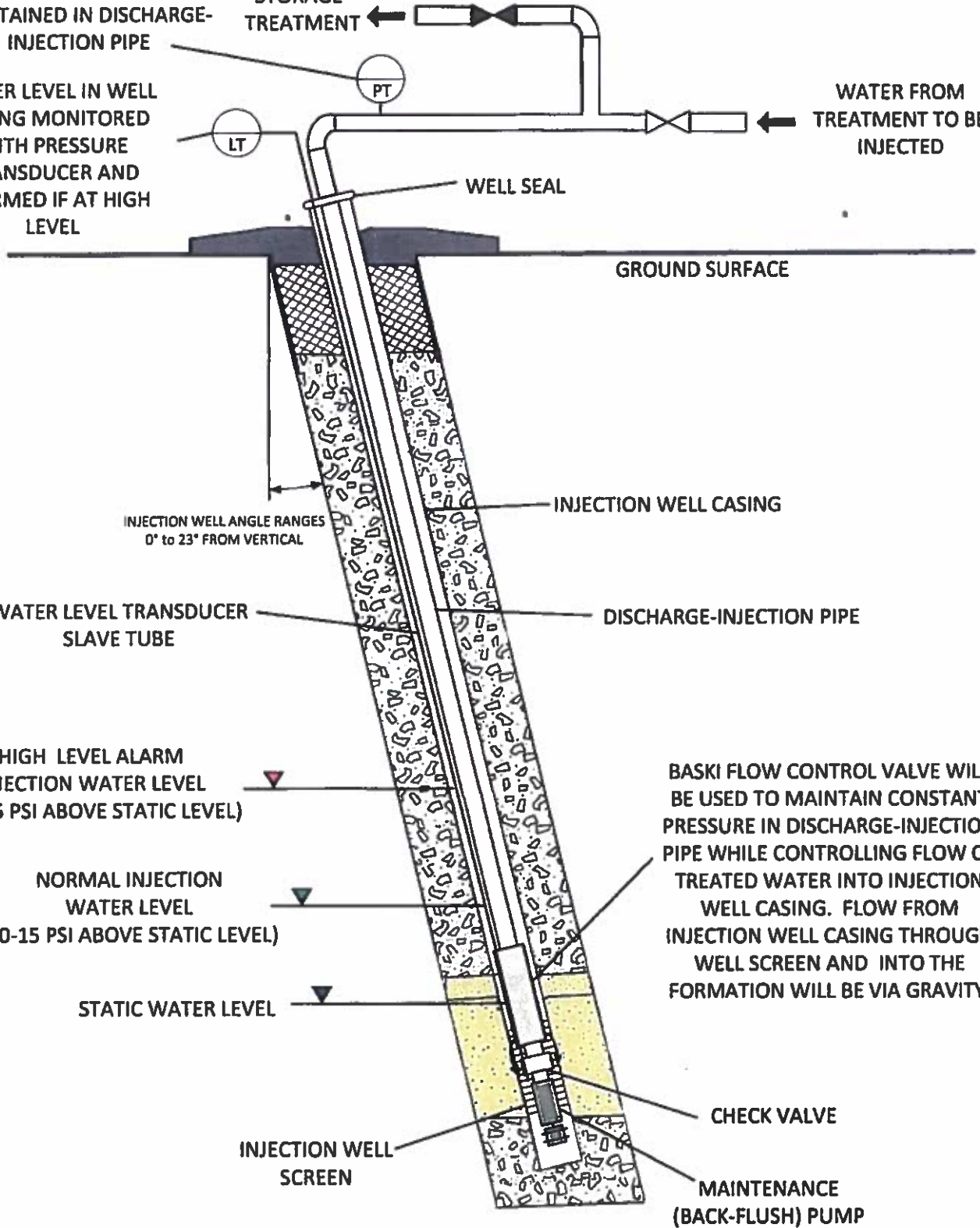
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PRESSURE MONITORED AND
MAINTAINED IN DISCHARGE-
INJECTION PIPE

WATER LEVEL IN WELL
CASING MONITORED
WITH PRESSURE
TRANSDUCER AND
ALARMED IF AT HIGH
LEVEL

WATER FROM
TREATMENT TO BE
INJECTED



INJECTION WELL OPERATION SCHEMATIC

NOT TO SCALE

ENCLOSURE 2

Injection well operation description

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Injection Well Operation Description

Chromium-containing groundwater extracted from the regional aquifer in Mortandad Canyon will be treated with ion exchange to remove chromium prior to injection into the regional aquifer. The injection wells to be used will be similar in design to the extraction wells and will inject the treated effluent into the same vertical interval of the regional aquifer from which it was removed (0-100 ft below the top of the regional aquifer). The flow of treated water that is pumped into the injection wells will be controlled with a Baski flow control valve (FCV™). The FCV™ will keep the discharge-injection pipe filled and under pressure to prevent cascading of the water into the well. Once discharged from the FCV™ the water will enter the injection well casing, and flow through the well screen and into the formation via gravity. Pressure in the piping at the surface will be monitored with a control system which will then adjust the FCV™ operation to maintain the pipeline pressure set point.

The water level in the injection well casing will be monitored by the control system through the use of a down-hole pressure transducer. Static water level within the injection wells is expected to be 1,000 to 1,100 feet below the ground surface. During injection it is expected that the water pressure within the injection well casing will rise 10-15 psi above the static water level. Reduced injection capacity within the well is anticipated during on-going operation. Thus the control system will be programmed to alarm the operator and shut down one or more extraction wells, if necessary, in the event that water levels within the injection well casing reached the high level set point (35-45 psi above static water level).

The discharge-injection pipe will also be equipped with a check valve and a submersible pump. This pump will be used to maintain well performance by back flushing the well as part of a regular maintenance program. Back flushing is anticipated once the water pressure within the injection well increases 10-12 psi above the levels observed initially. Backflush water will be stored and treated, if needed, prior to injection or land application in accordance with the approved Discharge Permit.

Schematics of the injection well operation and the Baski FCV™ are provided as Enclosures 1 and 3, respectively. The schematic in Enclosure 1 depicts an angled injection well; the angle from vertical is not anticipated to be greater than 23 degrees.

ENCLOSURE 3

Baski Flow Control Valve description

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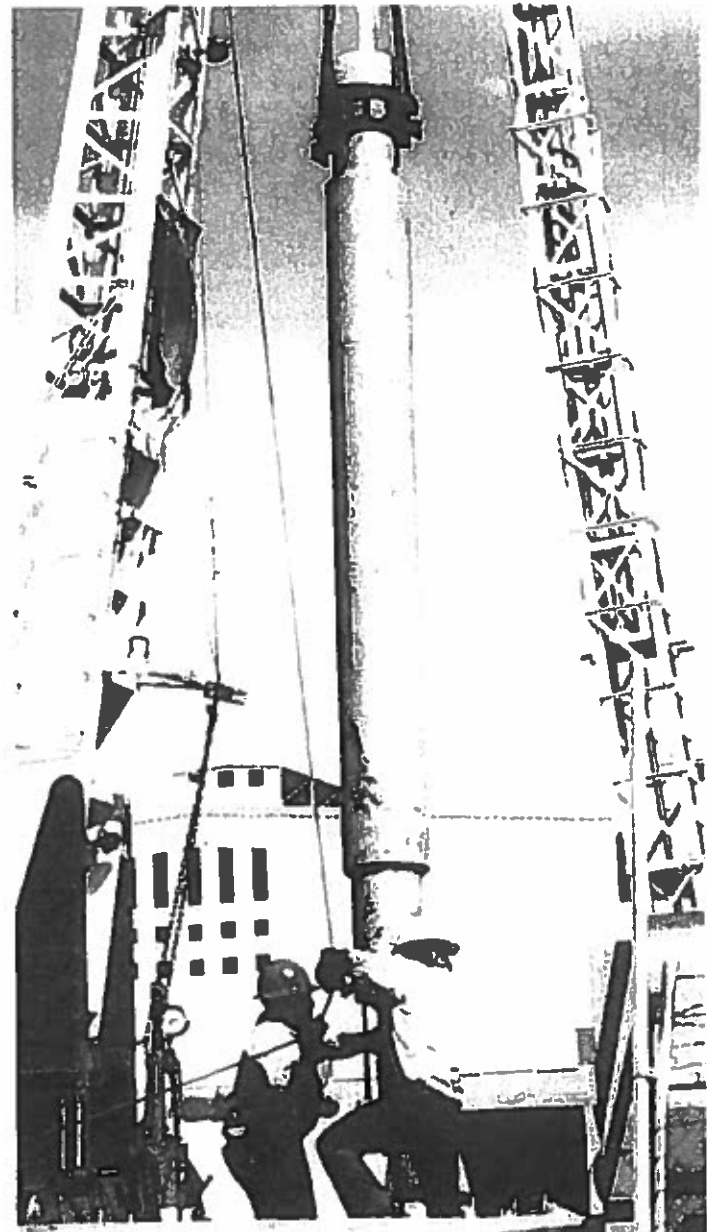
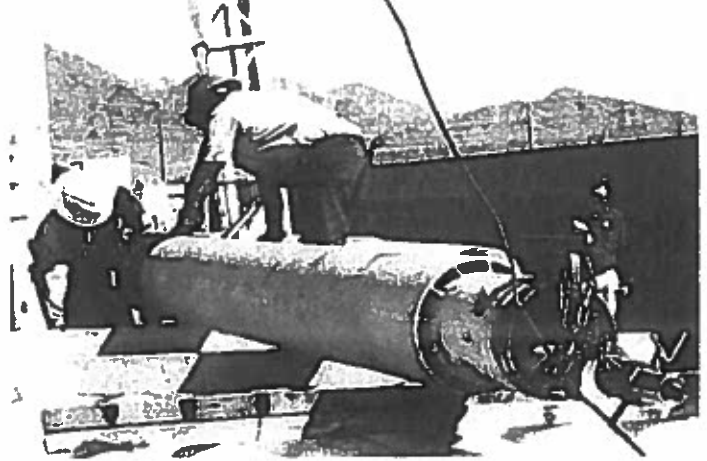
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*Above:
Cort Baski with the inner control section of a
FCV™ Flow Control Valve (16-inch OD, all
stainless steel), with the channels and annular
orifices visible.*

*Right:
After fabrication this unit was installed
at 645 feet below ground level,
just above a vertical turbine bowl assembly.*



Catalog 6
Copyright by
BASKI Inc.
Denver, Colorado (USA)

InFlex™ Flow Control Valve (FCV™)

U.S. Patents 5,318,081 and 5,273,155

The InFlex™ Flow Control Valve (FCV™) is a fluid-actuated valve that permits pumping water to the surface or regulating the flow of water from the surface into the well, while using the same column pipe and maintaining a column of water in it at all times. The InFlex™ FCV™ may be used in conjunction with a submersible pump or a vertical turbine pump for Aquifer Storage and Recovery (ASR) and Aquifer Thermal Energy Storage (ATES) applications. Advantages of the InFlex™ FCV™ include:

- **Impressive Performance**

Testing at the factory and field use of the InFlex™ FCV™ confirm that it effectively adjusts and holds desired injection rates. Because of its unique design features, including no sliding seals to fail, it is the most durable and versatile valve on the market.

- **Cavitation-Free Design**

The key to the successful control of the injection water through this valve is its long, adjustable, annular-gap flow path through a series of circular annular orifices. This flow path provides non-cavitating head loss that is easily controlled by changing the gap between the annular orifices and the rubber element. Stainless steel channels are a part of the adjustable flow system and stabilize the rubber element as it is pushed down and stretched by the inflation liquid.

- **Impossible to Sand-lock**

By design, there is no place for sand to collect; therefore, the InFlex™ FCV™ cannot sand lock. It is impossible for the rubber element to "stick" at any time during pumping or injection, as there are no sliding surfaces to become "stuck" due to corrosion or sand-locking.

- **Wear-resistant**

The InFlex™ FCV™ is extremely wear-resistant due to its rubber control element, similar to slurry pumps which are rubber lined to reduce wear. Due to its low-velocity, cavitation-free flow, the InFlex™ FCV™ resists sand and silt far better than conventional valve designs. Conventional valves have all of their pressure loss (at high velocities) across only one orifice stage, leading to wear from suspended solids and erosion with cavitation.

- **Ask about our 5-year limited warranty**

The InFlex™ FCV™ utilizes a reinforced rubber element, the only "moving" part. This element is an adaptation of the element that has been successfully used in our inflatable downhole packers in demanding open-hole conditions for over two decades. All metal parts of the valve are constructed of stainless steel. Other more corrosion-resistant alloys are optional for aggressive environments.

- **Wide Range of Injection Capacities**

Our InFlex™ FCV™ offers injection capacities of 10,000 gpm and higher with driving heads of 20 to 3,000 feet. All of the valves are infinitely adjustable from drip-tight shut-off to maximum flow. Furthermore, their maximum flow rate can be limited by using two control lines.

Casing Size nominal [Inch]	Valve OD maximum [Inch]	Column Pipe nominal [Inch]	Flow Rate	
			typical [gpm]	min - max [gpm]
5	4	2	100	0 - 300
6	5	3	200	0 - 600
8	6-5/8	4 or 5	400	0 - 1,200
10	8-5/8	6	800	0 - 2,000
12	10-3/4	8	1,400	0 - 3,000
16	12-3/4	10	2,000	0 - 4,000
20	16	12	3,000	0 - 6,000
22	18	14	3,500	0 - 7,000
24	20	16	4,000	0 - 8,000
28	24	18 or 20	5,000	0 - 10,000

Flow Rate Discussion:

$$\text{Flow Rate [gpm]} = C_v \sqrt{\text{Head [feet]}}$$

The flow rate through a given valve is proportional to the square root of the driving head. The driving head is the sum of the injection pipeline pressure in feet of water plus the distance down to the injection water level in the well minus the head loss in the column pipe.

Baski customizes the flow coefficient (C_v) range of each valve to the intended application (its column pipe size and driving head). Flow control results from changing this C_v between 0 (closed) and the valve's maximum (open).

For more information on aquifer storage and recovery (ASR), please refer to *Groundwater Recharge and Wells - A Guide to Aquifer Storage Recovery* by R. David G. Pyne

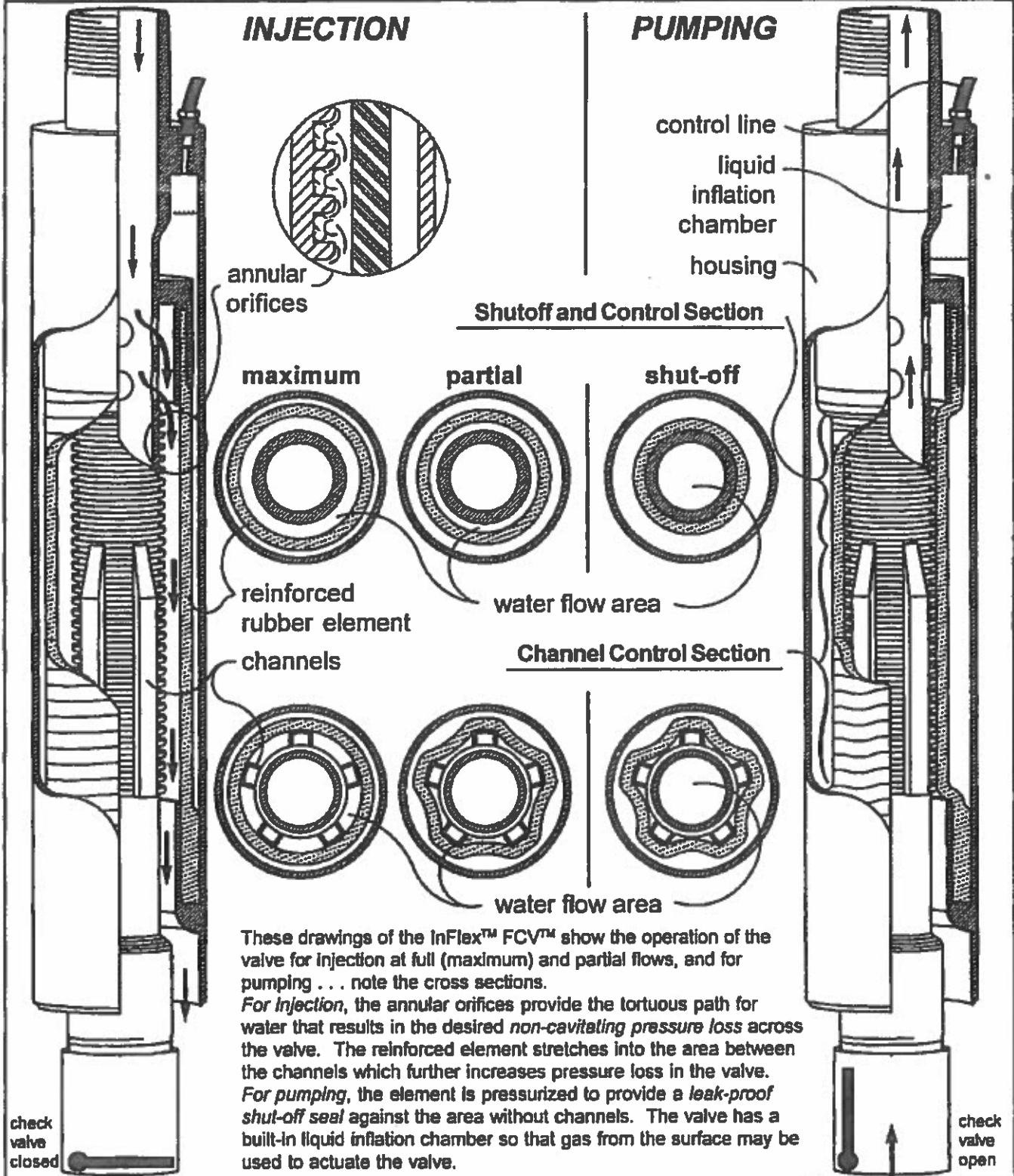
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InFlex™ Flow Control Valve (FCV™)

U.S. Patents 5,316,081 and 5,373,195



These drawings of the InFlex™ FCV™ show the operation of the valve for injection at full (maximum) and partial flows, and for pumping . . . note the cross sections.

For injection, the annular orifices provide the tortuous path for water that results in the desired *non-cavitating pressure loss* across the valve. The reinforced element stretches into the area between the channels which further increases pressure loss in the valve.

For pumping, the element is pressurized to provide a *leak-proof shut-off seal* against the area without channels. The valve has a built-in liquid inflation chamber so that gas from the surface may be used to actuate the valve.

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