

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
Underground Injection Control Program
FACT SHEET
(Pursuant to NAC 445A.874)

Project Name: **Dixie Valley Geothermal Project**
 Permittee Name: **Terra-Gen Dixie Valley, LLC**
 Permit Number: **UNEV87063**
 Address/Location: **North end of Dixie Valley East of Fallon, Churchill Co.**
 Permit Action: **UIC Draft Permit Issuance**
 Type of Project: **Geothermal Power Production**
 Injection Wells (#): **Sixteen (16)**

A. Description of Discharge

Location: Total of sixteen (16) permitted injection wells (IWs): Two IWs: 25-5, and 45-5 in Section 5, T24N, R37E; two IWs: 38-32, & 38A-32 in Section 32, T25N, R37E; and six IWs: 32-18, 52-18, 65-18, SWL-1, SWL-3, & 41-18 in Section 18, T24N, R37E; SWL-2 in Section 13, T24N R36E; Dixie Valley Geothermal Unit, Churchill County, Nevada. Other wells may be proposed within these sections may be used for injection after written approval is issued and the total number of wells does not exceed sixteen (16).

Well	DOM #	Completed	Loc	Elev aml	Depth	Injection Interval	Max Press psig
25-5 Sidetrack		Jan 2009	Sec 5		6700'	4498' – 6700', below 5440'	See Permit
25-5 orig		9/09/1989	-		6215'	4498' – 6215'	
45-5		6/24/1981	Sec 5	3481'	8261'	Perfs 5850' - 6165', 6198'-8261'	
41-18		12/14/1990	Sec 18	3493'	10739'	7135' – 7137' & below 7586'	
52-18		5/08/1980	Sec 18	3465'	9860'	8543' - 9860'	
65-18		1/21/1981	Sec 18	3467'	9466'	8383' - 9466'	
32-18		3/31/1986	Sec 18	3499'	7461'	6938' - 7461'	
SWL-1		11/29/1978	Sec 18	3496'	7255'	5630' - 7255'	
SWL-2 sidetrack		8/24/1979	Sec 13	3499'	8588'	7994' - 8588'	
SWL-3		11/25/1979	Sec 18	3498'	9126'	Perfs 7325' - 7350', 7420' - 9126'	
38-32	477	12/20/2000	Sec 32	3465'	3832'	Perfs 1030' – 1055' & below 1499'	
38A-32	788	1/09/2009	Sec 32	3460'	4000'	860' – 4000'	
27-32 (converted to observation well in 2009)		9/30/1997	Sec 32	3484'	970'	260' – 970'	

Characteristics: The injectate is geothermal fluid that has been passed through a dual-flash geothermal power plant. There are two injectate pipelines; one goes to the northern wells and the other to the southern wells from the manifold near the plant. Cooling water overflow is injected into the northern pipeline with geothermal fluid (north and south injectate differ slightly chemically because of this). The injectate has an average TDS of 2,050 mg/l. The primary chemical species are; SiO₂ - 630 mg/l, Na - 485 mg/l, Cl - 500 mg/l, HCO₃ - 1207 mg/l and SO₄ - 215 mg/l. A fluoride level of 14.7 mg/l exceeds the maximum contaminant level for drinking water and a boron level of 11.7 mg/l. The permittee started to inject supplemental ground water from an existing Navy groundwater (shallow, non-geothermal)

well for reservoir pressure maintenance. The TDS of this shallow water is approximately 980 mg/l.

B. Synopsis

Jan 2009 – Completed new well 38A-32; and reworked/sidetrack/tested casing on well 25-5; also cleaned 25-5 cellar and repaired wellhead/casing due to moderate corrosion.

Dec 20, 2007 – Permit transferred from Caithness Dixie Valley to Terra-Gen

July 14, 2005 - NPDES Permit NV0021407 cancelled on – no longer discharging to Spring Creek.

Feb 4, 2003 – Temporary UIC permit issued for additional injection wells

Dec 21, 2000 – permit transferred from Oxbow to Caithness Dixie Valley LLC

June 3, 1998 – permit renewed

March 18, 1988 – original UIC permit issued to Oxbow Geothermal

2009 Renewal: The permit expired in 2003, with a renewal application received in Dec. 2002. Caithness was the owner/operator at that time. Since, Terra-Gen acquired the project, and has been making some changes over the last few years. A goal has been to reinject as much water as possible, including shallow ground water via wells in Section 32 (27-32, 38-32) from the Navy well by the power plant. Though these wells have a shallow casing shoe, they are located in an area below the Senator Fumaroles and intersect a shallow geothermal outflow zone (300 degF) at shallow depths, in addition to fractures at deeper depths that allow injected water to return to the main reservoir at deeper depths. This has been shown to be occurring through tracer tests, and the water level in these wells are quite deep even during injection. Changes have been made to the surface discharge practices, mainly discontinuing discharge into the channel of Spring Creek and directing flows to surface basins and minor overflow to the desert floor. Surface discharges have been kept to a minimum, over the last five years plus, due to the significant reduction in water within the geothermal reservoir.

The O&M manual shall be updated in 2009 to the new 2008 UIC guidance.

December 2001 modification: The only change to the UIC permit was for increasing the number of permitted wells. The permittee reworked (deepened and cased) an existing observation well (#38-32) on the alluvial fan down slope from the Senator fumaroles, near injection well #27-32. Both of these wells will be used to inject shallow ground water (from a Navy well) in an attempt to augment injection to replenish water that has been depleted from the geothermal aquifer over time due to the cooling tower and other maintenance and emergency losses. The number of permitted wells will be increased from nine (9) to ten (10). The permittee may want to consider increasing this number again when the permit is up for renewal in 2003. Well #27-32 has been permitted as the ninth permitted well under the existing permit and has been in operation. Well #38-32 will be given temporary approval is needed and permitted as the tenth well when the modification is completed.

1997 Renewal: The Dixie Valley geothermal unit is the highest temperature geothermal resource in the State. Bottom hole temperatures of up to 480°F have been observed in production wells. The production and injection well depths range from approximately 6,000 to 10,000 feet. There is 3000 to 6000 feet of valley fill material containing groundwater in the area. This groundwater varies in quality: very poor quality under the salt marsh, approximately 10 miles to the south (~280,000 mg/l TDS); reduced quality near fault zone discharging geothermal fluid; and of good quality in other areas (ranges from 500-2000 mg/l TDS). The applicant was issued injection permit NEV60037 on December 12, 1986 that allowed injection in three wells (#32-18, #52-18 and #65-18) located in Section 18. The applicant was issued injection permit NEV87063 on March 18, 1988 that allowed injection in two wells (#45-5 and #25-5) located in Section 5. Two additional wells (#SWL-1 and #SWL-3) were added to the second permit in 1990. Injection well 41-18 was approved per letter on September 11, 1991. These permits were combined into one permit - NEV87063, now UNEV87063.

The 62-megawatt (gross) plant will require disposal of an estimated 9,500 gpm. The plant has operated in the mid 50's net megawatts range. The permittee is asking to have the injection rate limit increased to 12,000 gpm, including injection augmentation, which shall be granted in this renewed permit.

In 1997, the permittee initiated a program to locate a water source to use to augment injection to help increase the declining reservoir pressure, which has been decreasing over the years due to water losses at the cooling tower and during surface discharges. A priority was to find water with very low Ca and Mg concentrations to prevent

scaling/precipitation in the wellbores and fractures within the reservoir. Some test holes were drilled to find warm water of the desired quality, however various reasons prevented Oxbow from using these wells (e.g. low flow). The permittee signed an agreement with the Navy to pump shallow ground water from the Goerenger well to the southern injection field. The permittee is currently pumping 730 gpm of Goerenger well water into well SWL-1. Goerenger and other sources of water may be injected into other wells in the future. (no geothermal fluid is going into this well as of late 1997).

The O&M manual submitted on February 8, 1994 shall be revised by Oxbow Geothermal in early 1998 to better describe current discharges and practices. The original O&M manual was submitted to describe how discharges are handled, which allows the Division to reduce the amount of reporting and pre-approval process required of the permittee. The permittee will still be responsible for notifying the Division within 24 hours of all emergency situations related to fluid discharge when there are possible health and environmental impacts.

C. Receiving Water Characteristics

The injection wells are completed into the geothermal resource/reservoir and have water quality similar to the production wells/discharged fluid. Both the production and injection wells have multiple casing and cementing completions that should protect upper aquifers, provided integrity of the casing is maintained.

D. Procedures for Public Comment

Notice of the Department's intent to reissue a permit authorizing the facility to discharge to the ground water of the State of Nevada subject to the conditions contained within the permit, is being sent to the *Reno Gazette-Journal* and the *Lahonton Valley News* for publication. The notice is being mailed to interested persons on our mailing list (see Attachment A). Anyone wishing to comment on the proposed permit can do so in writing for a period of 30 days following the date of the public notice. The comment period can be extended at the discretion of the Administrator.

A public hearing on the proposed determination can be requested by the applicant, any affected state, any affected interstate agency, the regional administrator or any interested agency, person or group of persons.

Any public hearing determination by the Administrator to be held must be conducted in the geographical area of the proposed discharge or any other area the Administrator determines to be appropriate. All public hearings will be conducted in accordance with NAC 445A.238.

The final determination of the Administrator may be appealed to the State Environmental Commission pursuant to NRS 445A.605.

E. Proposed Determination

The Department has made the tentative determination to modify and reissue the proposed permit for a 5-year period.

F. Proposed Effluent Limitations and Special Conditions

See Part I.A of the permit.

G. Rationale for Permit Requirements

Verification that the quality of fluid discharged to the injection well remains constant. Confirmation that fluids disposal does not adversely affect the existing hydrologic regime.

Prepared by: Russ Land
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