

# **Quality Criteria for Deepwell Disposal of Industrial Fluids**

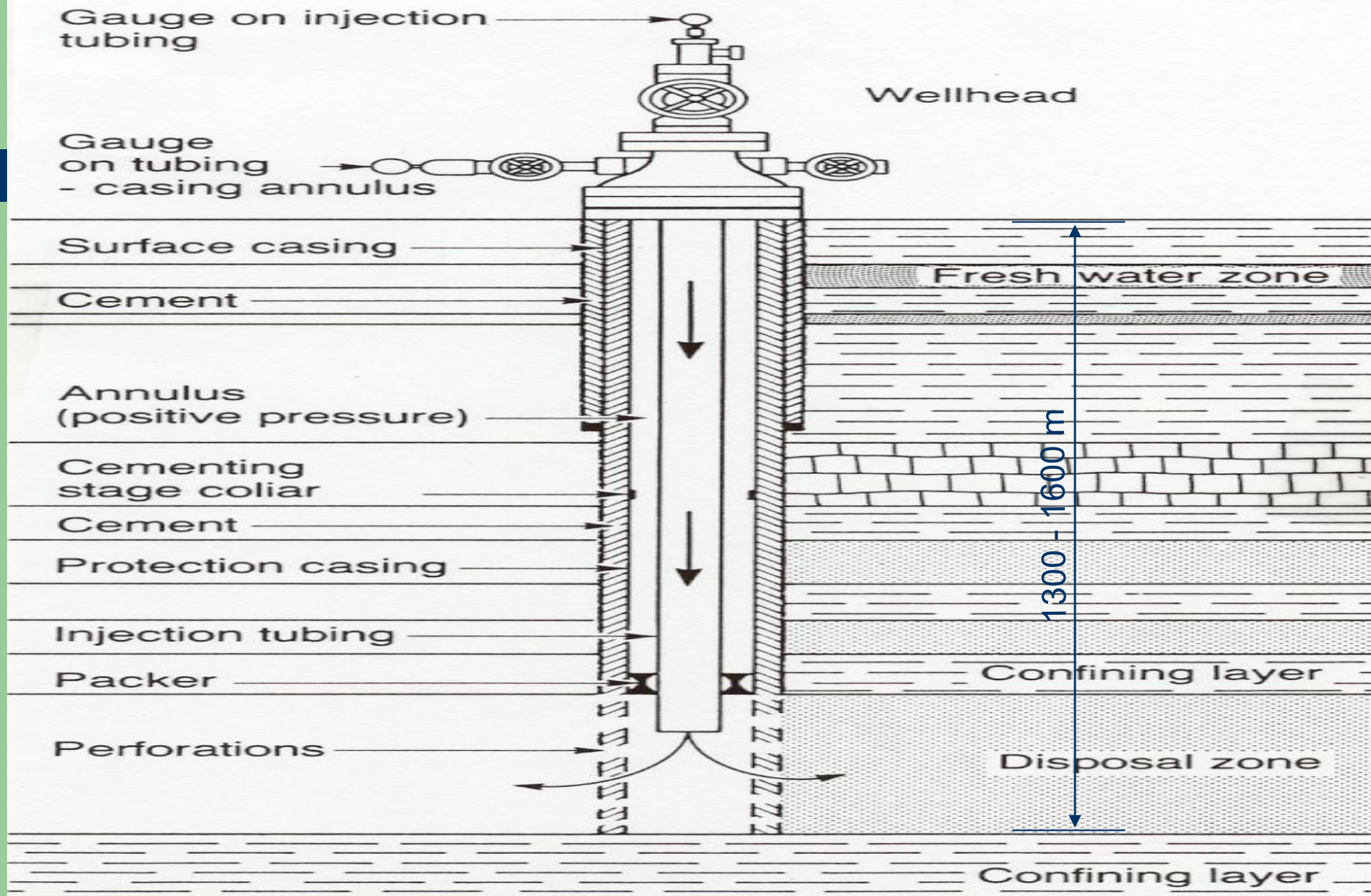
**Tony Fernandes, P.Eng.**

**Alberta Environment and Water**

# Injection Well vs. Disposal Well

- *Injection well* means a well into which “fluids” are being injected (for EHR, storage, disposal, coal gasification, or ore exploration)
- *Disposal well* means a well used for the disposal of waste into a subsurface stratum (for CCS, long term storage, or disposal)

# TYPICAL INDUSTRIAL WASTE DISPOSAL WELL



# Legislation

- The ERCB regulates all subsurface injection under the OGCA.
- As per section 39 of the OGCA all schemes for subsurface storage or disposal of industrial fluids or other substances have to be approved by the ERCB
- Directive 051: Injection and Disposal Wells - Well Classifications, Completions, Logging, and Testing Requirements (1994)

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AB legislation: <http://www.qp.alberta.ca/>  
ERCB directives: <http://www.ercb.ca/portal/server.pt?>

# Legislation

- **ERCB approval under s 39 (1), OGCA**
  - (c) the gathering, storage and disposal of water produced in conjunction with oil or gas,
  - (d) the storage or disposal of any fluid or other substance to an underground formation through a well,

# Legislation – Role of AEW

- **Role of the Minister of the Environment**  
(defined in the OGCA)
  - Protection of non-saline groundwater
  - Determine waste suitability for deepwell injection

# Legislation – Role of AEW

- **OGCA, section 39**

- (2) ERCB shall refer the application to the Minister of Environment
- (3) Minister of Environment may impose conditions
- (4) Minister of Environment has discretion re referral
- (5) Minister of Environment delegation of power
- (6) Variance re (3) subject to Lieutenant Governor direction agreement

# Status Quo

- **Currently, the ERCB refers to the Minister of Environment applications for Class 1a wells/caverns, only**
  - AEW has delegated to the ERCB the administration of subsurface related environmental issues
  - Referral detail in Bulletin 2010-17 (clarifies Bulletin 2007-06)
  - Applications for CCS injection wells for CCS with or without EHR not captured by current ERCB referral process to AEW.



# AEW Policy

- **POLICY NO. ES-99-PP1**

- Deepwell injection is an acceptable industry practice for aqueous industrial and hazardous waste with limited recycling potential
- Off-site Class Ia wells receiving third party HW require a PIN from AEW (EPEA, s 188).
- A PIN for receivers is issued upon application to operators of off-site Class Ia wells
- HW deemed suitable for deepwell injection is as per D051, except for the pH (range: 4.5-14.0)

# Deepwell Disposal of Industrial Fluids

- Resource conservation/pollution prevention
- Prohibitions (ww, run-off, spent oils/solvents, diesel inverts, BATEA)
- Ww quality must meet 2.3 and 2.4 of D051
- Waste classification as per WCR (if disposed off-site)
- Fluids injected as per class of well (D051)
- Surface storage facilities (OGCA or EPEA)

# Deepwell Disposal of Industrial Fluids

- Information Required
  - Location of the proposed well
  - Estimated daily and annual injection volumes
  - Depth to usable groundwater
  - Identification of each ww stream, sources, volumes
  - Ww characteristics
  - Rationale for deepwell injection

# Deepwell Disposal of Industrial Fluids

- Specific Well Class Criteria
  - Class Ia: specific fluids & criteria
  - Class Ib: specific aqueous fluids & criteria
  - Class II: brines or brine equivalent fluids
  - Class III: CO<sub>2</sub>, acid gases, solvents, inert gases  
(storage or EHR)
  - Class IV: H<sub>2</sub>O, steam for HC recovery

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Detail in D051 at <http://www.ercb.ca/portal/server.pt?>

# Deepwell Disposal of Industrial Fluids

- General Criteria
  - pH between 4.5 and 12.5
  - Does NOT meet surface discharge criteria
  - Non-halogenated organic fraction or less than 10% by mass except if
    - it is untreatable sand or crude/oil water emulsion, or
    - it is an antifreeze or dehydration fluid with  $> 60\%$   $\text{H}_2\text{O}$
  - Halogenated organic compounds in a total combined concentration less than 1000 mg/kg, and
  - PCB concentration of less than 50 mg/kg.

# Deepwell Disposal of Industrial Fluids

- Class Ia wells: specific fluids & criteria (~25)
  - General criteria plus
  - Heavy metals > Schedule 1 or s 13(2)(d) WCR)
  - PIN as per WCR for wells receiving 3<sup>rd</sup> party hazardous fluids

# Deepwell Disposal of Industrial Fluids

- Class Ib wells: specific fluids & criteria (~167)
  - pH between 6.0 and 9.0
  - Flash point > 61° C, except
    - Untreatable sand or oil/H<sub>2</sub>O emulsion
    - Antifreeze/dehydration fluid
  - Heavy metals ≤ levels schedule 1 or s.13(2)(d), WCR
  - XOC < 100 mg/kg

# Deepwell Disposal of Industrial Fluids

- Class II wells: produced water or brine (~1261) equivalent fluids
  - Produced water
  - Brine from salt caverns or solution mining operations
  - Water-based pigging fluids
  - Brine reject or backwash
  - Water containing polymers or other chemicals (EHR)
  - Waste fluids from circulation during cementing
  - $\text{CaCl}_2$  water



# Deepwell Disposal of Industrial Fluids

- Class III wells: HC and specific gases (storage/EHR)
  - Solvent or HC for EHR
  - Sweet gas for storage
  - CO, N<sub>2</sub>, O<sub>2</sub>, air or other gases (storage/EHR)
  - Acid gases (disposal/storage/well cycling operations)
- Class IV wells:
  - Fresh water (potable water)
  - Water vapor/steam

# Deepwell Disposal of Industrial Fluids-SHTC

- “The deepwell shall be used as approved by the ERCB for disposal of the following:
  - (a) on-site produced liquid effluent from:
    - (i) the stabilization-size reduction facility; or
    - (ii) the physical-chemical treatment facility; or
    - (iii) the water treatment facility; or
  - (b) the industrial runoff from the water treatment facility which is excess to the facility’s requirements; or
  - (c) any waste received from off-site sources that may be disposed of into a Class 1a well, according to ERCB Directive 51, March 1994, as amended from time to time.”

# Deepwell Disposal of Industrial Fluids-SHTC

- **SHTC (HW Treatment Plant – EPEA approval)**

For each waste stream injected (Class Ia)-daily, monthly, and annually, as applicable

- Total volume
- Flow rate pH
- TSS
- TOC
- PCB
- TCB

# Deepwell Disposal of Industrial Fluids – Example

- **Chemical Plant (process ww – EPEA approval)**
  - Parameters identified in previous slide per general criteria
  - For each waste stream injected (Class Ia)
  - Total volume and daily flow rate (monthly and annual reports)
  - BOD, COD, TOC
  - O&G
  - Phenols
  - $\text{PO}_4^{3-}$ ,  $\text{NH}_3^+$ ,  $\text{NO}_3^-$

# Deepwell Disposal of Industrial Fluids – Example

- Pipeline Waste (pigging sludge)
  - Liquid (fails the liquid paint filter test)
  - $^{210}\text{Pb} < 100 \text{ Bq/g}$
  - Radiation dose:  $\ll 0.3 \text{ mSv/year}$
  - $2 < \text{PCB} < 50 \text{ mg/kg}$

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Question: **How to manage this waste?**

<http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/norm-mrn/index-eng.php>

# Deepwell Disposal of Industrial Fluids – Example

- **Pipeline Waste (pigging sludge)**

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Question: **How to manage this waste?**

- Liquid low PCB NORM waste with activity below UDRL.
- Low activity NORM waste that can be deepwell injected into a Class Ia or Class Ib well or, once stabilized, disposed of as solid waste into a Class I landfill.
- Can be solidified by stabilization.
- Class I Landfills are not part of the EC “environment”.

# Deepwell Disposal of Industrial Fluids

- **What to test for?**

- Formation fluid (metals, TDS, TSS, routine H<sub>2</sub>O cations & anions, m-AHC, VHC-F1, EHC-F2/F3)
- Each waste stream (raw materials, chemical process and technology, reactions, products, and by-products)
- General criteria (class 1a wells: listed waste)
  - pH, TDS, TSS (surface water quality criteria)
  - Non-halogenated organic fraction < 10%
  - Halogenated organic compounds < 1000mg/kg
- Flash point

# Deepwell Disposal of Industrial Fluids

## Recommendations:

- Water resource conservation
- Protect non-saline groundwater
- Update quality criteria for fluids going for disposal
- Monitor injected fluids, injection well, and receiving formation
- Use subsurface injection as a sustainable BATEA technology



# Questions?

***Tony Fernandes, P. Eng.***

*Alberta Environment and Water*

*Email: [Antonio.Fernandes@gov.ab.ca](mailto:Antonio.Fernandes@gov.ab.ca)*

*Phone: 780 427 0636*