

FREYTECH INC. EBD TECHNOLOGY FOR CRUDE OIL AND GAS WELLS

SUSTAINABLE SOLUTIONS TO INCREASE OIL PRODUCTION AND DECREASE EXPENSES

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Remediation: Air, Water and Soil

1) EBD TECHNOLOGY BENEFITS IN ONSHORE AND OFFSHORE OIL & GAS WELLS.

- A) Reduction in paraffin wax and asphaltene in oil tubes
- B) Reduces emulsification caused by asphaltene in crude oil.
- C) Reduction in sulfur & hydrogen sulfide
- D) Reduction in oil viscosity
- E) Reduction in iron eating bacteria colonies
- F) Reduction in corrosion
- G) Removal in Greenhouse Gas (GHG), Flue Gas Emissions and foul odors around wells.
- H) Reduction in electric power consumption to run the motor pumps given less friction and lower viscosity.
- I) Increase in oil production.
- J) Prolongs tube and oil rig equipment service life
- K) Effectively remediates oil produced water and oil wastewater.
- L) Reduction in required maintenance and wastewater treatment expenditure.
- M) Decreases capital investment and increases profits
- N) Remediates organic & inorganic pollutants including chemicals, heavy metals & benefits the environment.

2. EBD TECHNICAL SUMMARY FOR OIL WELL FACILITIES (SHORT VERSION)

HOW EBD WORKS: During EBD technology development, we focused in part on Reactive Oxygen Species (ROS) which are a collection of highly unstable, oxidizing oxygen-containing molecules that originate from industrial activities (i.e. O&G), combustion processes, pollution, as well as biological and environmental generators. ROS concentration in underground crude oil reservoirs is minimal due to the absence of oxygen but increases drastically during oil production and surface handling. High levels of ROS are known to damage microbial DNA, proteins, and lipids, significantly inhibiting their metabolic functions essential for effective bioremediation. Elevated levels of reactive oxygen species (ROS) surpass the capacity of microorganisms to degrade pollutants and **operational waste** such as scale, sludge, biofilm, asphaltene, paraffin wax, and other challenging materials that precipitate from suspension.

EBD units are engineered systems designed to interact with ambient environmental fields, influencing local electrochemical conditions and energy balance within air, water/fluids, and soil environments. These interactions are proposed to modulate local electrochemical balance, contributing to more stable molecular and ionic conditions that influence redox behavior and microbial energy exchange. Our proprietary, science-driven approach manages disorder and energy dispersal in a nature-positive manner. EBD systems contain proprietary mineral compositions, including high-entropy metal oxides, that support electrochemical stabilization and facilitate more favorable electron-transfer conditions within the surrounding environment. This process reduces the persistence of unstable ROS, contributing to a shift toward more stable oxygen species within air, water, oil and soil environments. This unique process reduces microbial stress, promoting optimal conditions for their metabolism and ion regulation. These small yet cumulative, stabilizing effects are greatly amplified and sustained over time via biological feedback loops, leading to significant, verifiable and continuous, long-term improvements in remediation and **treatment efficiency** without adding external energy.

REMOVING PRECIPITATES: EBD systems influence local energy distribution and electrochemical interactions in ways that support native microbial activity and enzymatic function, which contribute to sustained reductions in

paraffin wax, asphaltene and inorganic scales. These observed reductions result from a combination of enhanced biological processing and altered chemical stability, with downstream transformation pathways remaining an active area of investigation.

ENERGY SAVINGS & INCREASED PRODUCTION: EBD systems are designed to control and remove material buildup inside piping and related Oil and Gas infrastructure, preserving pipe diameter and improving production efficiency. This also reduces electricity use since pumps do not need extra pressure to compensate for restricted flow, supporting efficient and sustainable operations.

3. EBD TECHNOLOGY SUMMARY FOR OIL WELL FACILITIES (LONG VERSION)

EBD Technology is based on the presence of certain concentrations of positively and negatively charged particles in the air/atmosphere (+) and in the earth's crust (-). Cosmic ray air showers contain a mixture of positively charged, negatively charged, and electrically neutral particles. As the shower cascades down through the atmosphere, it creates billions of subatomic particles.

For purposes of this summary, we term these (-) charged particles as “the forces pushing upwards and the (+) charged particles as “the forces pushing downwards”.

By producing a balanced energy state using the EBD systems, the frequency of the crude oil molecules will be excited by the concentration balance between the force pushing downward (+) and the force pushing upward (-). Once both sets of positive and negative forces are balanced, the molecular frequency will increase. This results in less friction being generated and oil viscosity being reduced.

By installing the appropriate type and number of EBD units around the crude oil pipes, high oil viscosity and sludge accumulation caused by streaming electrification and changes in the rate of viscosity will be reduced. The degree of friction present in the oil well will also vary according to the molecular differences present in the individual properties of the crude oil. This is due to the fluctuating flow direction of the crude oil molecules not being in parallel with the same direction as the oil liquid flow being exerted by the oil pump.

By installing EBD systems and thus causing an increase in crude oil molecular frequency, the volume of sludge will be reduced. This is because the ROS which is present in and around the crude oil will not be able to easily bond with the sludge components. In addition, oil pipeline corrosion is caused in part by hydrogen embrittlement through hydrogen sulfide that causes hydrogen-induced cracking. Rust build-up caused by the combination of the metallic piping materials and ions will also be reduced. High oil viscosity and reduction in streaming electrification caused by friction will significantly decrease regardless of the type of crude oil involved.

By increasing and optimizing the frequency of the crude oil and sludge molecules, crude oil will flow far less impeded and oil production will increase. In addition, asphaltene and sludge accumulation will be decreased, as will the incidence of rust thus significantly prolonging oil well equipment and piping service life. This in turn will also conserve electric power and CO2 emissions will be dramatically reduced during the crude oil production process.

4. OIL-IMPREGNATED SLUDGE AND ENTROPY ENERGY

Energy concentration described above is always in a constant state of change. When crude oil is extracted from the deep Earth's crust, the negatively charged particles (-) are very high. Entropy energy will increase, after crude oil is mixed with air, sea water or fresh water, whose energy contains positively charged particles (+). During the refining process, entropy energy will decrease and the negatively charged particles (-) will increase, due to the artificial processes carried out such as heating, cooling and pressurizing. These low entropy states lead to producing an environment where metallic ions mingle in the crude oil. One of nature's functions is to stabilize the concentration of energy in the natural environment. Nature's self-cleaning functions however, require a high concentration of entropy energy. Microorganisms cannot adequately propagate under a low entropy concentration such as is present at oil refineries. That is why artificial sludge treatment methods such as chemical treatment or distillation are required instead.

A single electron state on the outermost orbit is known as an 'unpaired electron' and is also called a 'free radical'. A free radical tries to stabilize itself by taking one electron away from other atoms. This is called a "radical chain reaction" through highly activated strong atoms. The presence of free radicals, including super oxidant and hydroxyl radicals in the Reactive Oxygen Species (ROS) results in significant decrease in nature's bioremediation and biotransformation processes.

Areas of the crude oil rock layer where crude oil is located, contain high concentrations of negatively charged particles (-). With hydraulic fracturing technology, fracturing fluid, which contains acids, sand grains, antiseptic agents, gel agents, and surfactants, is injected under high pressure into the crude oil well which contains a high concentration of negatively charged particles (-). Chemical substances, which are added into the fracturing fluid, also contain high concentrations of negatively charged particles (-). Both the crude oil and the fracturing fluid are composed of negatively charged particles (-) and they are attracted to each other forming strong bonds. This becomes a significant obstacle in separating gases and fluids and in addition, negatively charged particles (-) cause sludge and asphaltene accumulation in the wellbore and pipeline. Hydraulic fracturing creates cracks in deep-rock formations through hydraulically pressurized fluid injection which is also a factor in the increase of the negatively charged particles (-).

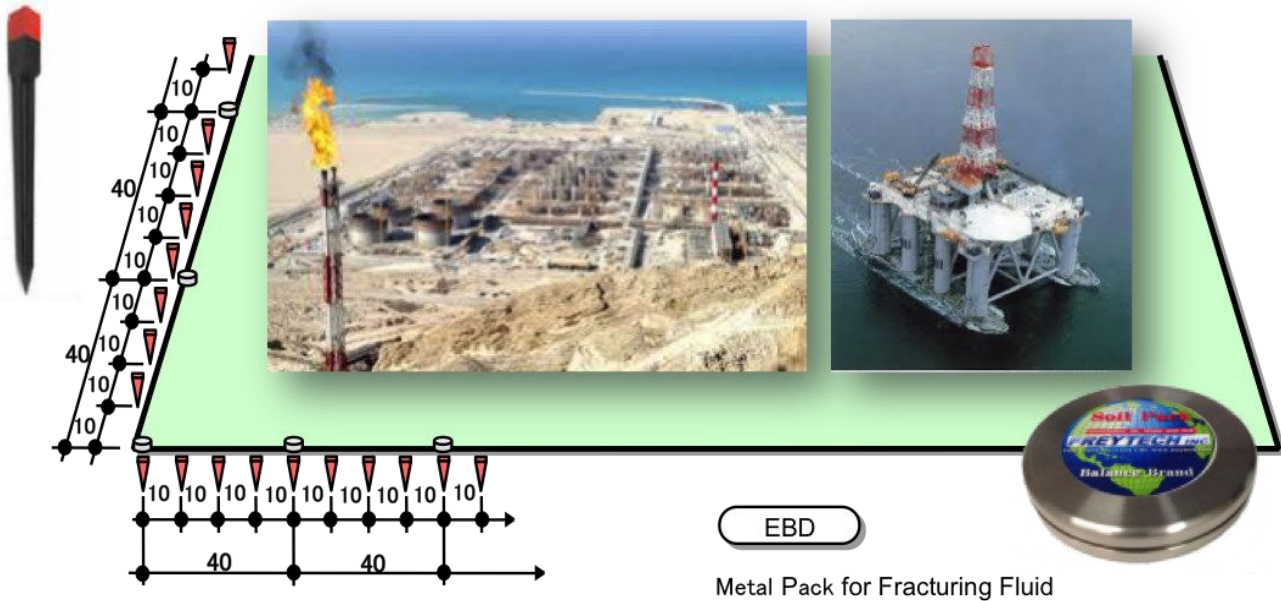
5. ESTABLISHING THE NECESSARY (+) & (-) ENERGY BALANCE AT OIL & GAS FIELD FACILITIES: EBD SYSTEMS FOR OIL WELL AREAS

EBD Radical Stakes need to be buried underground, around the perimeter of each oil well, in order to restore the balance between the positive (+) and negative (-) energy particle concentrations present within said perimeter. Bury one EBD Radical Stakes at 45 cm in depth in each of the 4 corners of the oil well perimeter as well as one EBD Radical Stake at each 10-meter equidistant interval in between each of the 4 corners of the perimeter. The concentration balance between (+) and (-), will be restored and maintained usually within one year of EBD system installation. The EBD Radical Stake units restore the balance in all matter located above and below ground within the perimeter. This includes the energy concentration balance of the areas where the crude oil is located below ground.

Device Installation for the Crude Oil Plant

EBD

Radical Stake For Radioactive Substances



Metal Pack for Fracturing Fluid

When the two sets of energy particles reach equilibrium, the composition of minerals which make up the shale rock layer will change. That is to say, the direction of the crude oil molecules will become unified and will flow smoothly in the same parallel position as that of the pumped oil flow and this greatly facilitates fluid transportation.

As already mentioned in the above segment, hydraulically pressurized liquid is composed of water, sand grains, and chemicals (fracturing fluid) and it is injected into the crude oil reservoir. Large amounts of these chemicals remain in the underground layer however, and not only cause soil and ground water contamination, but also increase (-) concentrations which limits oil production at the well. Therefore, an additional type of EBD system needs to be buried around the perimeter of the oil field and/or refinery. EBD Metal Packs are for soil remediation and will remediate chemical substances such as acids, antiseptic agents, gel agents, and surfactants, along with the heavy metals present in the soil. EBD Metal Packs are effective regardless of the size of the perimeter and regardless of the underground depth of the pollutants. Bury one EBD Metal Pack at 45 cm in depth in each of the 4 corners of the oil field and/or refinery perimeter as well as one EBD Metal Pack at each 30-meter equidistant interval in between each of the 4 corners. The concentration balance between (+) and (-), will be restored and maintained within one year or less of EBD system installation.

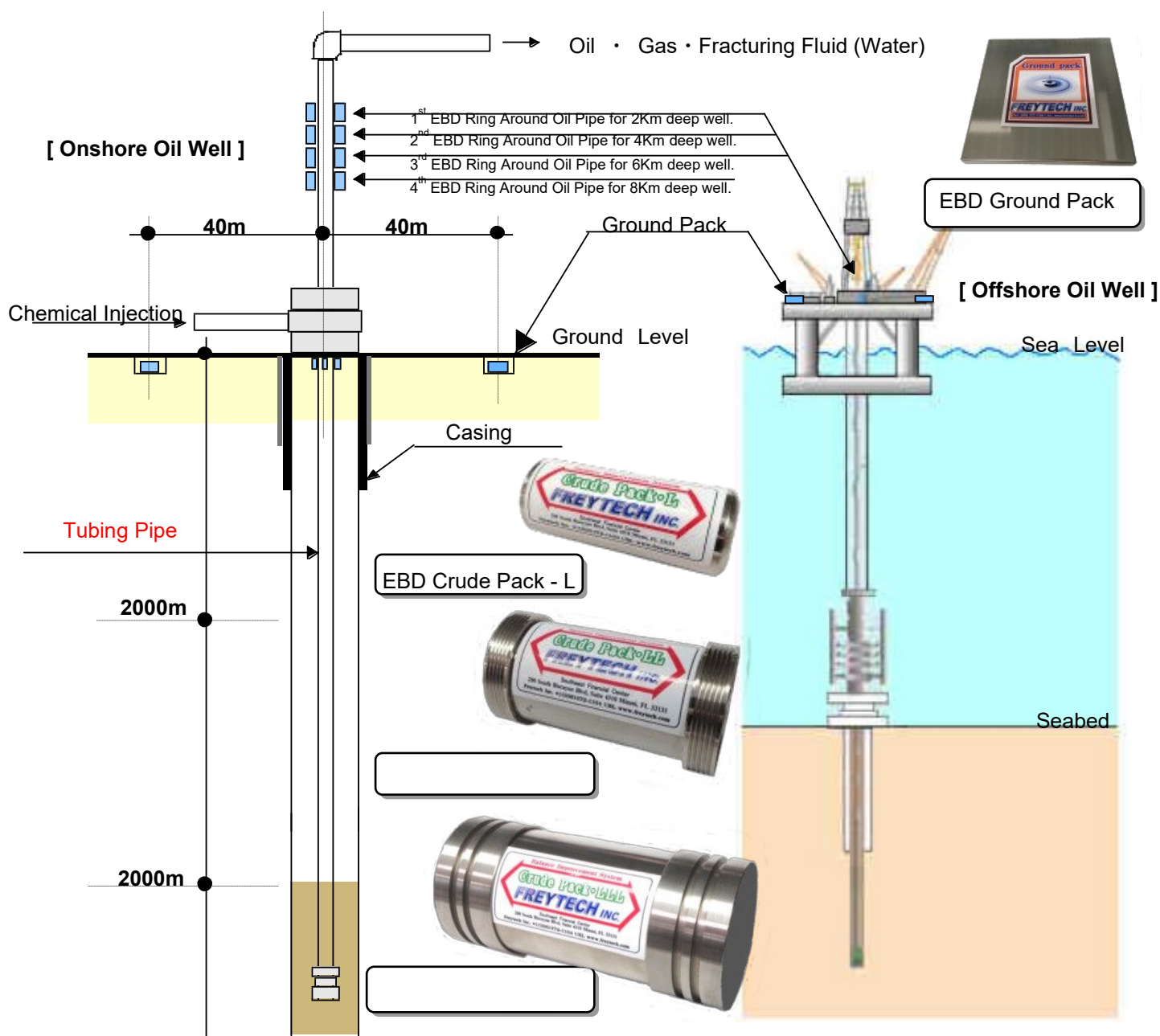
The EBD Systems working in unison, produce an environment where indigenous microorganisms can decompose the chemical substances and the heavy metals. Even in the case of radioactive substances, extremophiles (a type of microbe) present in nature, can decompose the organic compounds that radioactive waste is bound to, which helps isolate the nuclear material.

6. EBD SYSTEMS FOR EACH INDIVIDUAL OIL WELL

Regarding the EBD Systems required for liquids, solids, and gases, **EBD Crude Packs** will be required to achieve the required energy particle balance. They should be installed vertically (in series) in ring formation at equidistant spacing around the oil pipe. If the well is less than 2,000 m in depth, then only one set of EBD

Crude Packs is required to be attached above ground to the outer surface of the vertical line of the oil well casing. The number and type of EBD Crude Packs required at each oil well, are calculated according to the outer diameter of the oil tube inside the casing. If the distance of the wellbore pipe is 4,000m, a double set of EBD Crude Packs need to be installed along the vertical line of the casing. If the distance is 6,000m, a triple set of EBD Crude Packs will be required and finally, if the distance is 8,000m, four sets of EBD Crude Pack systems will be required. Please see following diagram below.

EBD Installation Diagrams Onshore & Offshore Platforms



【EBD Selection for Crude Pack】

mm (A)	Inch (B)	Device (80°C - Under)	Device (80°C - or Over)
40	1 × 3/4	2(L)	4(L)
50	2	2(L)	4(L)
65	2 × 1/2	2(L)	4(L)
80	3	3(L)	6(L)
90	3 × 1/2	3(L)	6(L)
100	4	4(L)	8(L)
125	5	4(L)	8(L)
150	6	5(L)	10(L)
175	7	5(L)	10(L)
200	8	6(L)	12(L)
225	9	6(L)	12(L)
250	10	7(L)	14(L)
300	12	7(L)	14(L)
350	14	8(L)	16(L)
400	16	9(L)	18(L)
450	18	10(L)	20(L)
500	20	12(L)	24(L)
600	24	14(L)	28(L)
650	26	16(L)	32(L)
700	28	18(L)	36(L)
750	30	20(L)	40(L)
800	32	22(L)	44(L)
850	34	24(L)	48(L)
900	36	26(L)	52(L)
1000	38	28(L)	56(L)
1100	40	30(L)	60(L)
1200	48	32(L)	64(L)
1350	54	34(L)	68(L)
1500	60	36(L)	72(L)
1600	64	38(L)	76(L)
1800	72	40(L)	80(L)
2000	80	42(L)	84(L)

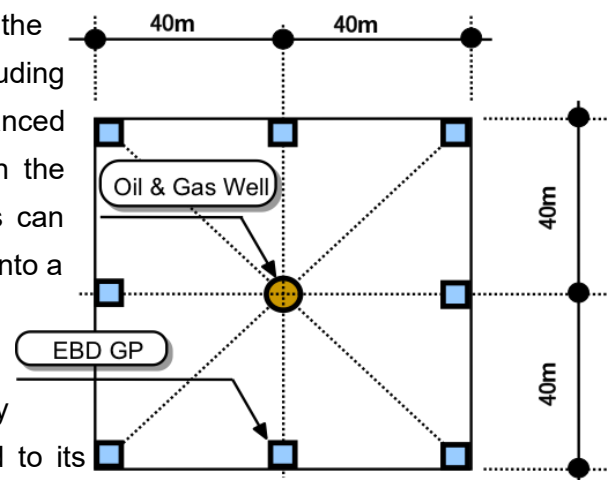


Crude Pack • L

In addition, eight (8) **EBD Ground Pack (GP)** units need to be buried at 45 cm in depth around each crude oil well. In offshore applications, place them around the perimeter of the platform. Each GP unit should be buried at a 40m distance from the oil well as shown in the diagram below to the right . EBD GP systems function to improve the balance state below ground in order to enhance smooth microbial activation.

Massive amounts of Reactive Oxygen Species (ROS) are now present in our global environment. ROS is caused by ultra-violet rays, electric magnetic waves and chemicals. As previously explained, these conditions cause electrons in oxygen atoms to spin off from their outermost orbits. ROS kills massive amounts of beneficial microorganisms present in water, soil and in nature. This dangerous phenomenon contributes greatly to breaking the natural chain resulting in a marked decrease in the absolute amount of microorganisms present on Earth which remediate environmental contamination.

By burying the EBD Systems at 45 cm in depth around the perimeter of the oil well, all matter within said perimeter, including the below ground oil will be beneficially influenced. Once a balanced state is reached, a suitable environment is created in which the unpaired electrons on the outermost orbits of oxygen atoms can recover their missing electrons. When ROS is converted back into a stable form of oxygen, indigenous microorganisms are then able to propagate exponentially. As indigenous microbial reproduction grows exponentially, contaminated soil is naturally remediated in the process and the soil condition is returned to its original pristine condition over time. Extremophiles existing in nature will be activated for this specific type of soil remediation. Extremophiles which exist in the oil produced water and in the soils below ground can only propagate under a balanced environment and they will, therefore, not propagate even if they are artificially cultivated to remediate contamination.



7. EBD SYSTEMS FOR PRODUCED WATER TREATMENT. (Oil Produced Water & Oil Wastewater Derived from Oil Produced Water)

Water which is recovered together with crude oil after the hydraulic fracturing process, is separated into crude oil, methane gas, and oil produced water. This oil produced water is commonly treated using oil-water separation, distillation, flocculation, reverse osmotic membrane filtration and porous coordination polymers. However, capital investment, consumables, and maintenance costs associated with the installation and operation of on-site wastewater facilities and infrastructure, has become a heavy burden to bear for oil companies.

In addition, there are numerous technical problems involved to effectively treat oil produced water, which contains untreatable substances such as oils, toxic substances, and heavy metals.

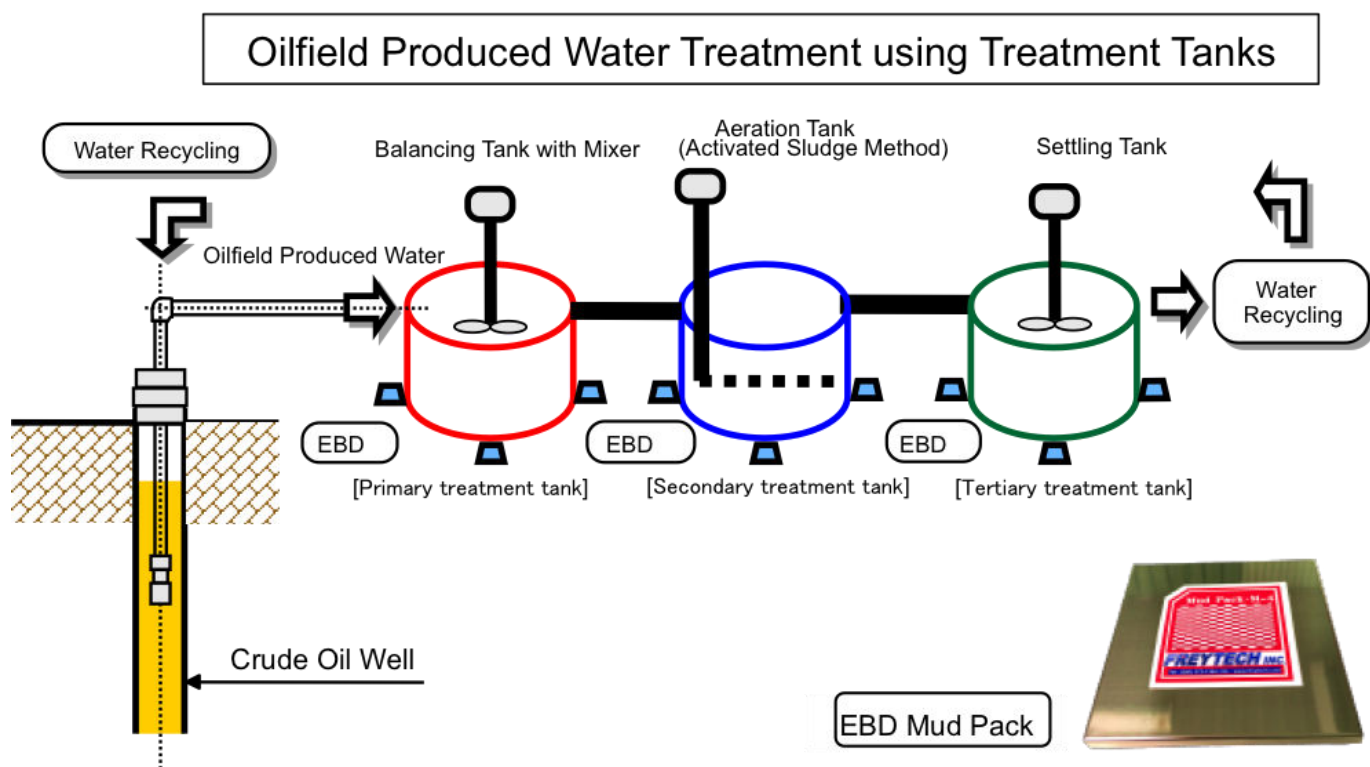
After primary treatment, the oil produced water is usually transported to temporary storage ponds/pits and/or tanks. After costly treatment processes, it is thereafter, injected into deep underground wells in order to permeate the contaminated wastewater around the layers of soils.

FREYTECH EBD Technology is effective in treating oil produced water and oil wastewater derived from oil produced water in much more affordable and sustainable ways.

a) EBD SYSTEMS FOR WATER TREATMENT IN STORAGE TANKS

By burying **EBD Mud Pack** (Model MP3) units at 30 cm in depth, at 2m equidistant intervals around the entire perimeter of each water treatment tank, detrimental and oxidizing Reactive Oxygen Species (ROS) which exists in the wastewater in each of the tanks, will be converted into a stable form of ROS. The amount of ROS will be significantly reduced and as a result, indigenous microorganisms will effectively replicate and decompose the contaminants after being enabled to consume a much healthier type of oxygen introduced naturally by the beneficial effects of EBD technology.

Each primary treatment tank should include a functioning mechanized mixer / stirring machine in order to accelerate EBD wastewater treatment. If the wastewater depth of the primary treatment tanks is below 3 m, mixers are not absolutely required but are still recommended. The EBD treatment target levels at this primary stage are at 50% reduction in contaminants. By the time the EBD treated wastewater from the primary treatment tanks flows into the secondary treatment tank, the BOD level will be between 500~1000mg/l.



The secondary treatment stage requires aerator units, which include an air intake and injection pipe in the tank together with the **EBD Mud Pack (Model MP4)** units buried underground or secured above ground, around the base of each secondary treatment tank. The number of EBD Mud Packs required is determined according to the size of the tank(s). During the secondary process, the contaminant reduction rate will be decreased by 98%. The BOD target value will be 10~30mg/l. This part of the wastewater process, normally employs activated sludge methods. However, one of the important advantages of EBD technology is that sludge build up will be significantly reduced as compared to employing conventional wastewater treatment methods. Consequently, the greatly reduced natural ecosystem and environmentally required amount of sludge will

accumulate, thus making frequent and costly sludge suction processes, unnecessary.

An additional EBD System advantage is that the aerators do not need to be functioning 24 hours a day, seven days a week. EBD Mud Packs enable operators to only run their aerators only 8 hours a day, thus providing for substantial electrical power savings. Furthermore, it is estimated that if the wastewater in the secondary treatment tanks is less than 3 meters in depth, aerators are not even necessary. When aerators are employed, EBD Air Packs are also recommended to be secured to the outer surface of the air compressor outlet pipe.

For the third treatment stage, the EBD Mud Pack (Model MP4) units will also need to be installed around the tank(s). This will be the final treatment process in which the water quality will be remediated to a point in which it can be properly recycled. The EBD target value of the BOD will be 0.5 mg/l. This process also employs the activated sludge method. The contaminants, including inorganic substances, will be transformed by enzymes which are secreted from the microorganisms already existing in the EBD treated tank area. The transformation can be confirmed using an **Electron Probe Micro Analyzer (EPMA)**. Thus, element compositions before and after the EBD system installation, can be confirmed in soil and water using at EPMA.

Producing an energy particle concentration balance between the negative (-) and positive (+) particles, is very important for the decomposition of inorganic substances in the contaminated water in the tanks. This balanced state will assist with the smooth transportation of electrons and the enhancement of the microbial energy metabolism processes. The microorganisms present in the newly balanced environment, will have the important function to decompose inorganic substances. As mentioned above, the microorganisms will secrete the biotransformation enzymes responsible for the decomposition of inorganic substances. This vital process can only be activated, however, in an environment where the two sets of energy particles (+ & -), are balanced equal or close to becoming balanced.

Although the biotransformation enzymes secreted by the EBD treated microorganisms, contain only minute, small quantities of metal ions, they can however, absorb the (+). An increase in (+), leads to an increase or decrease in the quantities of the protons and neutrons in atoms which form the very matter of inorganic substances.

An amplification of the (+), will occur not only in the enzymes, but also in the surrounding environment. This will also lead to an increase in the (-) in order to produce a balanced state. As a result, entropy energy will increase above and below ground around the EBD treated area where the positive (+) and negative (-) particles are mixed.

b) EBD SYSTEMS FOR WATER TREATMENT IN WASTEWATER PITS AND EFFLUENT WELLS

If the oil well site does not have a full-scale wastewater treatment plant, oil produced water once partially treated on site is temporarily stored in pits.

The treated water in the temporary storage pits evaporates through exposure to sunlight and contaminated substances are continually diffused into the atmosphere. This has a negative impact on public health for those residing nearby. This practice also contributes to global warming as the evaporated substances reach the

ozone layers. EBD technology solves these problems.

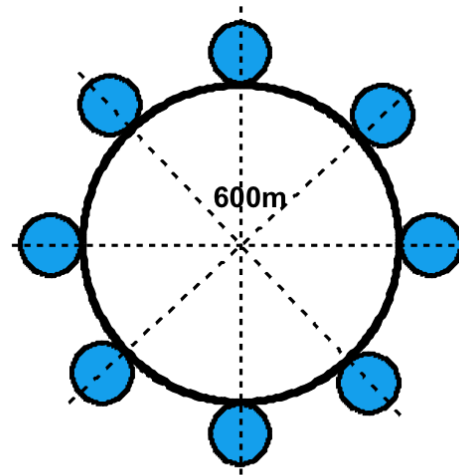
EBD Mud Packs need to be buried at 30 cm in depth at each of the four corners of the tank and at 40 m equidistant intervals in between each corner. In addition, the **EBD Soil Packs** need to also be buried at 30 cm in depth at 20-meter equidistant intervals in between the location of each EBD Mud Pack.

Over time, the EBD systems will produce and maintain a balanced energy state in the pit and this will cause a marked reduction of ROS produced by the contaminated wastewater. When ROS are converted into stable forms, extremophiles which exist in nature will be significantly activated. The contaminated water in the pit will be remediated through exponential indigenous microbial propagation.

Since wastewater is continually produced and flows into the treatment tanks on an ongoing basis, it will also be necessary to install **EBD Water Pack** units on the outer surface of the wastewater pump discharge pipe. EBD Water Packs will produce and maintain a balanced state running from the treated water storage pit to the water injection well. The number of EBD Water Pack units required will be determined according to the outer diameter of wastewater pump's discharge pipe. In addition, **EBD Ground Pack (GP)** units will be required to be buried around the treated water injection pump. Eight (8) EBD Ground Pack units are required for each treated water injection pump. Each EBD Ground Pack should be buried at 30 cm in depth, each at 40m in distance to the 8 cardinal points where the pump is located. GP units will contribute towards the creation of a balanced state below ground, and this will enhance smooth microbial activation.

Producing a balanced state in the soil is very important for maintaining the stable oxygen form for microbial activation. The stabilization of the soil quality decreases the accumulation of contaminated substances on the inner wall of the well and it also decreases the (-) around the oil well. The accumulation of contaminated substances has occurred due to highly contaminated water being injected deep into the ground under very high pressure.

Water Pump Discharge Pipe Diameter in mm	Water Pump Discharge Pipe Diameter in inches	Number and Type of EBD Water Pack Units Required for Treated Wastewater Below 80°C	Number and Type of EBD Water Pack Units Required for Treated Wastewater Above 80°C
65	2×1/2	1	2
80	3	1	2
90	3×1/2	1	2
100	4	2	4
125	5	2	4
150	6	3	6
175	7	3	6
200	8	4	8
225	9	4	8
250	10	4	8
300	12	5	10
350	14	5	10
400	16	6	12
450	18	6	12
500	20	7	14
600	24	8	16
Contact Freytech Inc. for EBD calculation corresponding to smaller or larger OD pipes.			



Note: Piping may be made out of any type of material

8. ADDITIONAL EBD SYSTEM CONSIDERATIONS

- ☐ A balanced state between will be produced within 6 – 12 months after EBD systems are installed.
- ☐ Indigenous microbial activation will become significant once a balanced environment in the entire area surrounding the crude oil wells, storage pits and wastewater discharge wells is produced.
- ☐ Soil analysis is recommended every two months after EBD system installation.
- ☐ The required period of EBD treatment can be calculated based on the age of the oil well facility. For example, if 10 years represents one unit of ongoing operation, three months will be required for the improvement of soil and water quality by achieving the maximum microbial propagation. Therefore, if the oil well facility is 30 years old, it will take $3 \text{ months} \times 3 = 9 \text{ months}$ for the required balance to be achieved. Once the Balance is reached, microbes will begin to replicate exponentially. Allow for additional time in low precipitation areas.
- ☐ The following environmental factors greatly affect indigenous microbial activity: temperature, oxygen density, ROS density, nutritive salt concentrations, moisture levels, and pH levels.
- ☐ Active oxygen which is present in the environment of the well will begin bonding with free electrons which are also present in the surrounding atmosphere. The value of the parameters will fluctuate depending on the amount of precipitation until the soil and water quality can be improved. Long-term observation will be required.
- ☐ EBD systems are effective even with highly concentrated substances as well as multiple kinds of contamination.
- ☐ EBD systems are effective for onshore as well as offshore Oil & Gas applications.
- ☐ Please see additional EBD brochures for other applications such as soil remediation, oil transportation, etc.
- ☐ All materials contained in EBD units comply with OSHA 29 CFR XVII-1910.1200 Section (i). EBD systems do NOT contain hazardous components under current OSHA definitions, or EPA listing. The EBD materials do NOT contain any ingredients that are on the NPT list or registered with IARC for carcinogens and the material mixture tested as a whole has been found to be: • Nontoxic • Non- corrosive • Not an irritant • Not a sensitizer in oral, dermal and ocular tests (see US Federal Hazardous Substance Act 16 CFR 1500) Section 3. Physical & Chemical Characteristics. EBD systems do not contain any flammable materials, are explosion proof and do not cause any electromagnetic interaction.