Iraqi Journal of Science

An Overview of General Regulations to Minimize Environmental Affects from Petroleum Drilling and Production Activities

Ayad A.Al-Haleem, Faleh H.Al-Mahdawi*
Department of Petroleum, College of Engineering University of Baghdad, Baghdad, Iraq.

Abstract:

Improved environmental protection requires better education and training of regulations which manage different available activities in petroleum operations.

Data from industry is very important to ensure that the existing or suggested regulations are based on accurate scientific information and that they contribute to best environmental protection without adding useless restrictions to this industry.

This research deals with an overview of major environmental regulations and issues facing the petroleum industry.

Many issues which regulate drilling and production activities that may pollute surface water, clean up of existing hazardous waste sites, storage and management of various chemicals and other important aspects are listed and discussed to know how to protect our petroleum environment by minimize or eliminate the adverse impacts through the understanding and implementation of proper regulations management.

Keywords: environmental protection**,** General Regulations, oil wells drilling, drilling fluids. drilling and production activities**.**

نظرة شاملة للقوانين العامة لتقليل التاثيرات البيئية من فعاليات الحفر والانتاج النفطي

أياد عبد الحليم عبد الرزاق، فالح حسن محمد*
قسم هندسة النفط، كلية الهندسة، جامعة بغداد، بغداد، العراق

الخلاصة:

ان تحسين الحماية البيئية يتطلب دراسة افضل وتدريب على التعليمات التي تنظم مختلف النشاطات الموجودة في العمليات النفطيه. ان البيانات المتوفرة من الصناعة مهمة جدا للتاكد من ان التعليمات الحالية والمقترحة قد بنيت على معلومات علمية صحيحة وانها ستساهم في حماية بيئية افضل من دون اضافة محددات غير هامة لهذة الصناعه.

يتعلق هذا البحث بدراسة شاملة للتعليمات البيئية الاساسية والمفاهيم التي تواجة الصناعة النفطيه.العديد من المفاهيم التي تنظم فعاليات الحفر والانتاج والتي قد تلوث المياه السطحية وتنظيف المواقع الحالية للمخلفات الضارة وخزن مختلف المواد الكيميائية ومفاهيم مهمة اخرى قد ادرجت ونوقشت لمعرفة كيفية حماية بيئتنا النفطية عن طريق تقليل او تحديد التاثيرات المعاكسة من خلال فهم وتطبيق التعليمات التنظيمية المناسبه.

Introduction:

Waste generated from various activities associated with the oil industry. The waste includes waste from drilling process for example cutting rocks and various chemicals that are added to the drilling

*Email:Fhmetr@yahoo.com

fluid to improve the specifications.Water associated with a large proportion of the total volume of waste. That water may be a product about 98% of the total waste in the United States, while drilling fluids, cuttings and associated waste represent the remaining 2% [1].

The produced water volumes vary considerably both with the type of production (oil or gas), and throughout the lifetime of a field. Typical values for North Sea fields range from 2400-40000 m^3/day for oil installation and 2-30 m^3/day for gas production [2].

The acids used in the wells activation and other fluids used in hydraulic fracture and natural gas resulting from the separator operation represent other sources of waste and environmental pollution at the oil sites. .There are many wastes for various jobs associated with the process of oil and gas production, these waste include: waste water from cooling tower, water softening wastes, contaminated sediments, scrubber wastes, various lubrication oils, site construction wastes, and air pollutants including exhaust from internal combustion engines, fugitive emissions and boiler emissions.

The wastes above vary in their effects on the environment and human, but the most important step before starting to study their harmful effects is to try to separate its components according to the solid and liquid (water and hydrocarbon). The regulatory framework that exists under international (regional and global) regimes must satisfy the exploration and production forum guidelines for the development and application of health, safety and environmental management systems (HSE-MS) [3].

Planning for emergency events should properly examine risk, size, nature and potential consequences of a variety of scenarios including combination incidents. A variety of documents is available to describe risk and hazard assessment, contingency planning and effects of emergency events [4 - 14].

An Overview of Issues and Management Approaches

Awareness of the importance of environmental issues has become more and more central to the thinking of the oil industry and regulates in the last decades.

The environmental and protection agency (EPA) has established five criteria to determine whether a waste is hazardous or not under this act. there are four generic criteria that are based on the waste properties.

These criteria are ignitability, corrosivity, reactivity, and toxicity. A list of materials and the level above which they would be considered toxic under the resource conservation and recovery act (RCRA) is mentioned [15]. if the waste is considered to be hazardous under RCRA , management and tracking of the waste is then required, including waste generation, transportation, treatment, storage and disposal [16].

After an extensive review of wastes generated by the upstream petroleum industry, it was found that those wastes were not intrinsically hazardous [17-18].

Because of this, most of those wastes have been exempted from RCRA: subtitle C, table-1.

Generally, not all wastes generated during drilling and production activities are exempt from RCRA, table -2. Nonexempt wastes include those that are generated from the maintenance of equipment, i.e. those that are not unique to exploration and production operations.

Nonexempt wastes are not necessarily hazardous and don't necessarily require management under RCRA: subtitle C . They are hazardous only if they meet one of the hazardous criteria [19].

The safe drinking water act regulates underground injection wells through the underground injection control (UIC) program.

This program presented five classes of injection wells for different types of wastes [20]. Among of these classes, class II represent wells for injecting oil field fluids, whether for disposal or for enhanced recovery operations.

Many acts were passed to protect the environment of any an expected impacts from petroleum activities. Among of them the federal water pollution act amendment (CWA) were passed in 1972 to protect surface water by preventing or minimizing discharges of materials like oil, produced water, or drilling mud. Also the comprehensive environmental response, compensation, and liability act (CERCLA) was passed in 1980 identifies sites from which releases of hazardous materials might occur or have already occurred.

In general, most countries regulate oil and gas activities to minimize their environmental impact. These regulations may be different from country to country. Although many of these regulations have

increased the protection of the environment, they have also increased the cost of oil production. The cost of environmental compliance has been reported to be as high as 10% of the annual expenditures of an oil field [21].

These high environmental costs have encouraged the development of new technologies for waste management that can make waste treatment and recycling more cost effective than simple disposal [22].

Strategy was developed the concept of zero waste discharges from drilling operations to new levels to get zero contaminant discharge policy through implementing waste management principles consist of the three golden rules : Reduce, Reuse & Recycle

Table 1-RCRA subtitle C Exempt waste

Produced water
Drilling fluids
Drill cuttings
Rig wash
Drilling fluids and cuttings from offshore operations disposed of onshore.
Well completion, treatment, and stimulation fluids.
Basic sediment and water and other tank bottoms from storage facilities that hold product and exempt waste.
Accumulated materials like hydrocarbons, solids, sand, and emulsions from production separators, fluid treating vessels, and production impoundments.
Pit sludges and contaminated bottoms from storage or disposal of exempt wastes.
Workover wastes.
Gas plant dehydration wastes, including glycol – based compounds, glycol filters, filter media, backwash, precipitated amine sludge, iron sponge, hydrogen sulfide, scrubber liquids and sludge's.
Cooling tower blow down.
Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue in it is from an exempt waste stream).
Packing fluids.
Produced sand.
Pipe scale, hydrocarbon solids, and other deposits removed from piping and equipment prior to transportation, scale formed in boilers is nonexempt, however.
Hydrocarbon – bearing soil.
Pigging wastes from gathering lines.
Wastes from subsurface gas storage and retrieval, except for the listed noexemot wastes.
Constituents removed from the produced water before it is injection or otherwise disposed of.
Liquid hydrocarbons removed from the production stream but not from oil refining.
Gases removed from the production stream, such as hydrogen sulfide and carbon dioxide, and volatilized hydrocarbons.
Materials ejected from a producing well during the process known as blowdown.
Waste crude from primary field operations and production.
Light organics volatilized from exemp wastes in reserves pits or impoundments or production equipment.
Geothermal production fluids.
Hydrogen sulfide abatement wastes from geothermal energy production.

Table 2- RCRA Nonexempt Wastes.

Unused fracturing fluids or acids.
Gas plant cooling tower cleaning wastes.
Painting wastes.
Oil and gas service company wastes, such as empty drums, drum reinstate, vacuum truck reinstate, sandblast media, painting wastes, spent solvents, spilled chemicals, and waste acids.
Refinery wastes.
Liquid and solid wastes generated by crude oil and tank bottom declaimers.
Used equipment lubrication oils.
Waste compressor oil, filters, and blowdown.
Used hydraulic fluids.
Waste solvents.
Waste in transportation pipeline – related pits.

Caustic or acid cleaners.
Boiler cleaning wastes.
Boiler refractory bricks.
Boiler scrubber fluids, sludges, and ash.
Incinerator ash.
Laboratory wastes.
Sanitary wastes.
Pesticide wastes.
Radioactive tracer wastes.
Drums, insulation, and miscellaneous solids.

Field Observations:

The most important observations that resulted from the visit of many drill, production, and oil refineries sites are listed below.These observations varied in the economic and environmental sides

1. There are many air pollutants generated during drilling and production operations, Such as emission output of internal combustion engines in drilling towers, generators, pumps and units of production and separation.But the combustion of associated gas is the main polluter of the air in a lot of our oil sites,which representsa significant economic loss and influential environmental risk.
2. The amount of associated water which increasing with reservoir age as a result of resorting to artificial left to keep the reservoir pressure is a problem to be taken care and try to convert these quantities to improve the need for water in oil fields .
3. the absence of environmental controls and limitations that govern the various activities in the oil sites.
4. The lack of an effective strategy for the management and organization of the various wastes for the purpose of reducing their environmental impacts.
5. The presence of seepage and leakage from the various equipment, as well as exposure to pipeline failures from time to time as a result of obsolescence age.
6. Use of some non-studied chemicals that improve the performing in the oil sites.
7. The discharge of large quantities of associated water to the water sources nearby without studying their geochemical specifications. Where the properties of this water, for example, in our South fields we find high salinity water is dominated by chloride ion and the total concentration of dissolved substances (190,000 to 290,000 mg/ l) (North and South Rumaila fields). While the water in theAllhis field is salt water dominated by sulfate ion.
8. Water is injected into the oil field to maintain pressure or sometimes injected water with chemical additives, such as Injection in the Dammam formation, although this is not rewarding.
9. Most of the refineries disposal of waste liquid by pipeline to nearby water sources (rivers or drainage). For example Basra refinery put its waste to the Khor -Abdullah, and because of pipeline corrosion formed lake Subtraction result of oil seeps in the areas around Basra refinery and can be viewed so far.
10. The testing samples results of waste water for some refineries showed that the tests after treatment exceeded rates of the environmental determinants which recognized internationally.
11. Throw drilling waste in the pits, these pits are initiated incorrectly in terms of geometric dimension so they are not appropriate in terms of capacity for the waste volumes dumped, causing leakage of liquid waste.
12. Uncorrected dealing with this pits after drilling operations, where it is buried by adding the amounts of soil from nearby areas and buries waste on site after the evaporation of some liquids.
13. No mechanism exists to separate the hydrocarbon liquid waste from other waste such as brines resulting from the processing units, as well as the existence of the old treatment plants non-conform to modern environmental standards.
14. Sludge residue from produced water treatment facilities was treated as solid waste and transferred to land fill as appropriate.

Conclusions and Recommendation:

This study presents a general review adopted to handle the generated waste streams and eliminate the potential hazards. However, if the oil industry complies with the new regulations, the environment with not noticeably affected by the operation of the oil industry. The most important step that must be done by the operators is the commitment in conservation and recycling during all stages of oil field operations.

Based on the study review, the following conclusions and recommendations can be put:

1. The common legislation that can apply to oil operations may include many issues among of them the following: a)environmental protection acts ,b)clan water and water acts ,c) standards for noise, radiation, chemical exposure ,d) discharge and management of wastes ,e) land contamination or land disturbance ,f) permitted chemical materials ,g)safety and fire regulations ,and h) control of major hazards.
2. The development of an environmental impact assessment (EIA) report constitutes an important component of the environmental approval process in Iraq .
3. The effective waste management plan must identify the materials and wastes at a particular site and list the best option to manage, treat, and dispose of those wastes and taken into consideration the environmental audit and its requirements.
4. For pits containing high salt or hydrocarbons levels, environmental demands require the use of an impermeable pit liner to prevent leaching to the surrounding.
5. A comprehensive site evaluation may be required before the optimum remediation process can be selected and properly implemented.Discharge of pollutants must be kept to minimum levels, and existing facilities should be upgraded and improved with respect to their effect on the environment.
6. Mixing of exempt and nonexempt wastes should be avoided if possible because the mixture may become nonexempt.
7. The injection wells must be tested every five years for mechanical integrity to verify that they do not permit a flow channel between the injection zone and overlying layers.
8. The major point with the operation of injection wells that must be taken into consideration the presence of nearby wells that may provide a communication path between the injection formation and under ground sources of drinking water (USDW).
9. Mix – bury – cover, land spreading and land spraying methods can be applied successfully at our drilling sites due to the following issues:
    a. The presence of wide area of land;
    b. Limited use of oil based mud (OBM) just to a certain drilled sections; and
    c. Generally, the pollution at most locations are in its acceptable levels.
10. Advanced adsorption technology options are recommended to be considered within any drilling waste management strategy due to the following:

a. This technology incorporate efficient processes for reclaiming valuable base oil, minimizing waste, and preparing solids for disposal;
b. It allows oil to be separated from drilling solids for recovery. Recovered oil can be reintroduced to the mud system and used as a supplemental fuel or sold for reuse in other location;
c. It provides a safe solids disposal at environmentally responsible and acceptable limits. After appropriate treatment, discharge material can be used as a base material in the construction of roads or building blocks; and it is field proven as commercially viable option.

11. Increasing our emphasis on health, safety and environment (HSE) in all aspects of our operations by put in place a comprehensive HSE management system to integrate vital HSE practices into our activities in line with international standards and practices.
12. Steps must be taken to prevent spills by putting in place appropriate preventive and control measures especially in high probability locations.
13. Operating procedures should be developed to prevent hydrocarbon releases. Gas detection, alarm and protection systems will be assessed during concept design.
14. The integrity of the current pipelines and protection barriers (corrosion inhibitors) should be reviewed and new pipelines must be designed and constructed to current industry good

practice standards and must be equipped with (i) pigging capability for routine cleaning and flow management and (ii) isolation and blow down valves.

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