Starting Out in the Oil Industry

DR. JAMIE KERR, CLARIANT OIL SERVICES
Table of Contents

– Oil Recovery

– Problems (and Opportunities)

– Roles of Chemists

– Chemistry Job Types

– My Experience

– Advantages and Disadvantages to Working in the Oil Industry
Oil Recovery
Basics of Oil Recovery

- Oil exists in the pore spaces of reservoir rock, not in big pools!
- Deposits are located by various surveying techniques.
- Initially this oil is under pressure – drilling into producing zones means oil will naturally rise to the surface (primary recovery, able to extract 5 – 15% oil).
- Once this pressure has depleted, we need to inject either water or gas to drive production (secondary recovery, gives us 35 – 45% recovery).
- Finally we can use different techniques to affect the mobility of oil which cannot be accessed via primary or secondary means. Injection of steam or surfactants is called enhanced oil recovery, results in production of 50 – 70% of hydrocarbons in a reservoir.
- Each of these stages costs money, application depends on the price of oil.
- With time, the amount of oil obtained at the surface drops. Many North Sea fields are currently at > 90% water cut!
Problems (and Opportunities)
Problems During Oil Recovery

- Numerous issues can arise when producing a reservoir.
- These depend on e.g.
  - Type of formation rock
  - Pressure
  - Temperature
  - pH
  - Formation water properties
  - Oil properties
  - Gas composition
  - Materials used to build rigs and pipelines
  - The presence of bacteria
Scale

- Scales are insoluble deposits formed during oil production.
- They block reservoir pores, pieces of equipment or entire pipelines!
Scale

- Scales are insoluble deposits formed during oil production.
- They block reservoir pores, pieces of equipment or entire pipelines!
- Scales can form when:
  - Injection waters (sulfate rich) meet formation waters (barium/strontium) rich – $\text{BaSO}_4(\text{s})$ or $\text{SrSO}_4(\text{s})$
  - Waters undergo a drop in pressure, releasing $\text{CO}_2(\text{g})$, raising the pH and encouraging precipitation of $\text{CaCO}_3(\text{s})$
  - High temperature, high pressure reservoirs release cations (iron/zinc/lead) which combine with sulfide – $\text{FeS}_\text{s}$, $\text{ZnS}_\text{s}$ or $\text{PbS}_\text{s}$
  - Highly saline brines cool on reaching the surface, depositing $\text{NaCl}_\text{s}$
- One BP field went from producing 30,000 barrels ($2$ million) PER DAY to zero in $24$ h due to scaling
Corrosion

– Corrosion of steels in the presence of water is a huge problem in the industry.

– Engineering and materials selection play an important role in the lifetime and safety of offshore installations.

– Corrosion of pipelines and equipment can be caused by oxygen, carbon dioxide or hydrogen sulfide.

– The actual process of corrosion can take several forms (general/local) with different results.
Corrosion

- Corrosion of steels in the presence of water is a huge problem in the industry.
- Engineering and materials selection play an important role in the lifetime and safety of offshore installations.
- Corrosion of pipelines and equipment can be caused by oxygen, carbon dioxide or hydrogen sulfide.
- The actual process of corrosion can take several forms (general/local) with different results.
Flow Assurance

– Oil, gas and water in reservoirs are at equilibrium; producing the fluids disturbs this and can lead to phase changes.

– Gas can evolve from oil, gas hydrates may form, solids (waxes, resins, asphaltenes) can deposit within the oil phase, flow characteristics may change.
Flow Assurance

- Oil, gas and water in reservoirs are at equilibrium; producing the fluids disturbs this and can lead to phase changes.

- Gas can evolve from oil, gas hydrates may form, solids (waxes, resins, asphaltenes) can deposit within the oil phase, flow characteristics may change.

- All of these disrupt the movement of fluids to surface facilities.

- Ensuring flow is becoming more of a challenge as deeper reservoirs, with heavier oils, are produced.

- This is a growing discipline, almost unheard of in the 1990s, has since caused months of lost production and even field abandonment.
Roles of Chemists
What can chemists do?

– Oilfield operators employ **chemical service companies** to manage these risks.

– It is our job to predict problems, design mitigation strategies, formulate, test and recommend chemicals that will allow problem free production.

– Successful companies will develop products that are:
  - Efficient (but not overly so)
  - Cost effective
  - Stable in the various environments to which they will be exposed
  - Environmentally acceptable
  - Detectable with confidence at the surface
  - Proven in other fields!
Chemistry Job Types
Chemistry Jobs in the Oil Industry

– The most common role is within a service company (Clariant, Nalco/Champion, MI-SWACO, Baker Hughes), conducting testing and development of products.

– The chemistry here is quite basic (using already available molecules) but very fast-paced, requiring the ability to adapt to new situations, recognise what customers desire, juggle multiple projects at once and keep within strict time-frames.

– The emphasis can be on finding the best product or the cheapest product, the aim is always to sell what the customer wants to buy!

– This job offers the opportunity to travel and gain experience in a number of disciplines.

– People often join service companies with a BSc or Masters degree – PhD is definitely not required.

– Service companies are located in various locations, many in Aberdeen.
Chemistry Jobs in the Oil Industry

– Most service companies have **divisions dedicated to innovative chemistries**.

– Workers in these roles will not interface with customers and will be less time-constrained.

– Their aim is to produce new chemistries to tackle existing problems or to pre-empt future problems (changing legislation, new product requirements).

– A broad knowledge of chemistry is necessary, being able to search a company’s patent portfolio to find compounds that may fulfil multiple roles.

– These jobs tend to require a PhD.

– Research chemists are less visible within a company and their roles are dependent on the requirement for new chemicals.

– Innovation centres are located overseas (Germany, USA).
Chemistry Jobs in the Oil Industry

- Service companies also send chemists **offshore** on a rotational basis.

- The work is very basic (sampling, labelling, sending back onshore) but physically demanding.

- Working to rule is critical offshore, everything must be documented and numerous safety procedures followed.

- Many operators look for experience in offshore staff, it would be very difficult to get an offshore chemist job without at least some previous experience in a service company.

- Some people suit offshore work (hours, salary), others don’t (missing family occasions, repetitive tasks).

- Positions may be lost if offshore rotas change.
Chemistry Jobs in the Oil Industry

- Some **universities** have petroleum research departments.
- In the UK we have Leeds and Cranfield (corrosion) plus Heriot-Watt (scale and flow assurance), overseas there is Rice University (Texas).
- These institutions receive direction from service companies, performing tasks that are either too time-consuming, expensive or niche for any one company to focus on.
- Projects are tackled by Masters or PhD students with results fed back around twice per year.
- This job is ideal for students who prefer academia, there is some time pressure but the harder you work, the more recognition you will get.
- You gain exposure to all service companies!
- Chemists are exposed to pressing issues of the moment.
My Experience

what is precious to you?

Public

Dr. Jamie Kerr
01.06.2015
My Career Path

– I completed my PhD research in 2011.

– I worked for Heriot-Watt University with Clariant Oil Services for three years.

– My role was to develop a new class of scale inhibitor for deployment in the Norwegian Sector of the North Sea.

– I was able to conduct my academic research at a faster pace, keeping in contact with the customer and seeing what “business as usual” meant at Clariant.

– I travelled to Norway, Germany and the USA, presenting at conferences and attending various training courses.

– At the end of the three years I decided to stay within the service company:
  - I wanted to see the results of my work quicker
  - I enjoyed the time demands
  - There was more collaboration than I found in academia
Advantages and Disadvantages to Working in the Oil Industry
Disadvantages

– All jobs in the oil industry are dependent on the price of oil.
– If our customers’ profits decrease, it has an immediate knock-on effect on us.
Disadvantages

- All jobs in the oil industry are dependent on the price of oil.
- If our customers’ profits decrease, it has an immediate knock-on effect on us.
- This boom and bust can make it a stressful job!
- In times of low oil price, certain roles are more liable to be cut (i.e. innovation, those focusing on development of new fields) and career progression may stagnate.

- It can be difficult to develop new technologies as operators are reluctant to be the first to try anything new.
- Innovation can be stifled by customers’ focus on keeping costs low, not seeing how novel chemistries may benefit them in the long run.
Advantages

- North Sea oil is declining but oil production is continuing around the world – oilfield chemistry is a global career!
- You can solve tangible problems with immediate effect. Building up a list of fields you have had a direct impact on rather than a list of publications.
- There is the opportunity to do real research in a number of disciplines.
- Chemists can become conversant with people from other roles (salespeople, geologists, engineers, ESHA).
- Travel is part of the job.
- There is the opportunity to go offshore.
- Salaries are competitive.
Any Questions?

JAMIE.KERR@CLARIANT.COM