

PETROL & SEWAGE DON'T MIX: THE 2007 SOUTH KEMPSEY PETROCHEMICAL INCIDENT



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ABSTRACT

High level contamination has always been an operator's worst nightmare. This paper details what happens when a large volume of petrochemical finds its way into the sewerage network, the treatment basins of a sewage treatment plant and finally into the tertiary ponds.

Although you think you are prepared for such incidents, the enormous potential impact on your treatment process, the environment and the eventual financial cost can not be predicted.

1.0 INTRODUCTION

Kempsey is situated on the Mid North Coast 6 hours travel south of Brisbane and 3 hours north of Newcastle and is the town centre for the Macleay Valley. The Macleay Valley is a fairly large shire as it has 10 inland & coastal Towns and villages.

The South Kempsey Treatment Plant was built during the 1935 to 1940 era, consisting of a basic inlet box, 2 sedimentation tanks and 2 Trickling Filters with a nominal capacity of 3,400 EP. It was upgraded in 1989 with the commissioning of a 2000 EP Pasveer channel to run in parallel with the existing treatment infrastructure as well as a new inlet works comprising Balance tank, course screenings, flow distribution and manual grit removal.



Figure 1: *Location of South Kempsey treatment plant*

There are also three [3] Effluent ponds including a catch pond. The effluent ponds have a detention time of 10 days at ADFW for a 5400 EP. Other features of the Plant include:

- Storm bypass from the balance tank to the catch pond.
- 3 sludge lagoons.
- Supernatant pump station
- Sludge pump to return humus sludge to head of works.
- New amenities building.
- Programmed sludge withdrawal system.

The Plant has an average dry weather inflow of 15l/s [1.29MI/day] and the peak wet weather inflow is 111.4l/s [9.6MI/day].

South Kempsey has a large catchment comprising 17 council owned pump stations and 4 privately owned pumping stations.

The wastewater transportation system is divided into 3 separate systems which independently discharge to the Wastewater Treatment Works.

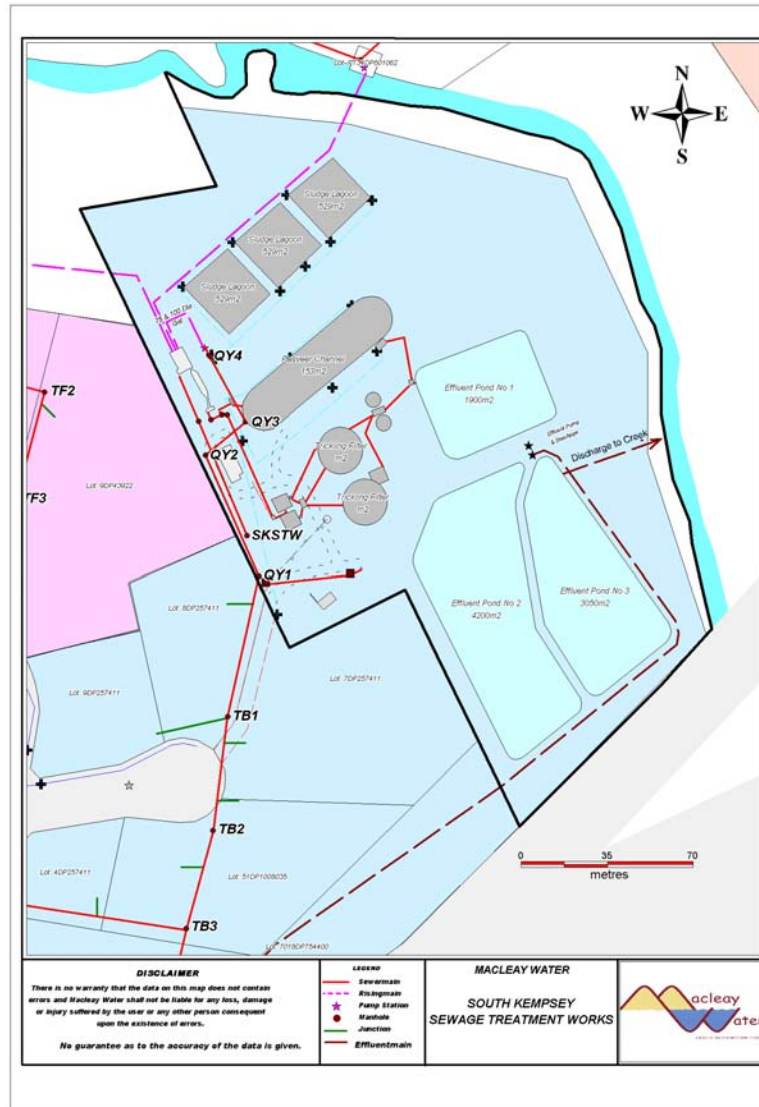


Figure 2: *South Kempsey sewage treatment plant lay out*

2.0 DISCUSSION

On the 13th of December 2007, the South Kempsey STP Operator started his day as normal. He first noticed a petrochemical smell in his plant while cleaning the bar screens at the head of works.

After waiting for the next inflow slug from the pump stations he noticed the smell had increased dramatically.

The operator immediately notified the Sewer Technical Officer and then commenced the investigation of the three feeding pump stations to determine the area of possible contamination.

The Technical Officer in junction with the Coordinator advised the Manager of Macleay Water of the potential problem at the plant and an emergency action plan was enacted.

The Coordinator's first priority was to attend the plant and determine the severity of the problem. On arrival the smell of petrol / sewerage mixture was strong.

2.1 Authorities Notified

After an inspection of the plant, the Coordinator updated the Manager, who had set up the Macleay Water's office as a command centre. The "command centre" contacted the authorities for advisement and relaying up to date information.

Authorities notified included:

- NSW Fire Brigade who attended the plant quickly to take control of the potentially highly explosive area.
- Department of Environmental and Climate Change (DECC).
- Department of Water and Energy.

2.2 On-site Actions were also taking place including

A number of on-site actions were also taking place including:

- Assessment of the plant and barricading the inlet works to isolate the area, because of the potential danger.
- Monitoring of all personal on site and seeking medical help for the operator who at that stage was complaining of headaches.
- Full cooperation with the NSW Fire Brigade to try to find the source of the problem.

2.3 Macleay Water Priorities

Macleay Water personal had two main priorities:

- Find and stop the influx of petrochemical into the sewerage network.
- Stop the contamination from entering the environment.

To do this Macleay Water split to have two main teams.

- The first group consisting of Councils Environmental and Technical Officers conducted a systematic search of the reticulation system.
- This was done with the use of gas monitors, testing pump stations and gravity sewer mains to determine the source of the Petrochemical.

- Meanwhile the second team were now concentrating on keeping the plant environmentally isolated and safe.
- Initial Actions:
 - Turn the Pasveer aeration off and raise the decant.
 - Redirect the Trickling Filter inflow to the Pasveer.
 - Pump down Tertiary ponds to make room for contaminated effluent.
 - Weir placement at outlet of the first tertiary pond

These actions increased the detention time through the works thus giving the petrochemicals longer to evaporate.

The Hazmat team who had been called by NSW Fire brigade then started skimming the top layer of liquid from the Pasveer. The oily liquid was transferred into a 20,000 litre storage tank brought in from another plant.

The Pasveer at that stage had all the Plant's inflow entering it, so it too had the top layer of liquid pumped to an empty sludge lagoon.

Later in the day the source of the contamination was located by the first team. The problem was found to be a broken petrol bowser line at a local fuel depot.

This leaking fuel was caught via an agricultural line which was directed into a wash down area storage pit. The liquid then drained into a large holding tank of approximately 16,000 ltrs capacity. The contaminate was pumped directly into Council's sewer gravity main, which in turn flowed into the pump station.

It was thought that between 1000ltrs and 2000ltrs was involved in the incident.

By mid afternoon an update meeting was held at South Kempsey Sewer Treatment Plant. Present were the Area Commander of the NSW Fire Brigade, Local Captain, Council's key staff from Macleay Water and Environmental services.

It was decided:

- The fire brigade would enter the fuel depot and ensure that the petrochemicals had been stopped from coming through the system.
- The sewer gravity mains would be flushed from fire hydrants from both directions to Angus McNeil Pump station.
- Manholes were vented by pulling the lids along the rising main to an area through the museum park.
- The mains were flushed four times and each time the Lower Explosive Levels (LEL) dropped in the pump station. After the fourth flush the reticulated sewer system was deemed safe for normal operation.

3.0 THE DAY AFTER

On the Thursday night the Trickling filter was left bypassed and inflow directed to the pasveer. The pasveer remained without aeration and the bypass to the lagoons remained in place.

The following day Council called gained expert advice from Port Macquarie Hastings Council's Sewerage Coordinator, who conducted bacteria testing to determine the extent of process damage.

It was determined that if the pasveer was "seeded" from an appropriate sewer plant the bacteria in the pasveer should survive. This was conducted using a pump out truck on that day with a total of 22,000 litres of seed being used.

Aeration was also turned back on to the pasveer following handover from NSW Fire Brigades Area Commander.

One trickling filter was later put back on line; the idea was to maximize flow through its filter bed in an endeavour to save one trickling filter rather than lose two.

4.0 SAMPLING

4.1 Sample Locations and Frequency

On the day of the incident water samples were collected from a number of points within the South Kempsey Sewage Treatment Plant (including the discharge point into Gills Creek) and along the sewerage network, working backwards from the Treatment plant until a likely source of contamination was identified.

The following day further water samples were taken from the same points.

Additional water samples were also taken from surface waters of the wetland associated with Gills Creek to the rear of the likely contamination source and one of the heavily contaminated pump stations, as well as soil samples from the rear of the likely source of contamination.

Follow-up sampling continued at the Treatment Plant for four days the following week to continue monitoring for petroleum hydrocarbons through the system and potential contaminated discharge into Gills Creek.

4.2 Results

Analysis of water samples taken on the day of the event from the Angus McNeil & Harry Boyes Ave pump stations and the inlet works, sediment tank and Pasveer at the STP revealed considerably high concentrations of petroleum hydrocarbons. A mixture of light chain (indicating petrol) and heavy chain (indicating diesel) petroleum hydrocarbons were detected within these samples.

Minor concentrations of petroleum hydrocarbons were detected at the inlet into the tertiary pond, with no detection of hydrocarbons at the discharge point into Gills Creek early on the day of the event. Very minor concentrations of hydrocarbons were detected at the discharge point later on the day of the event and some of the subsequent sampling days.

Table 1: *The combined test results*

South Kempsey (Lic 720) Report Period 04.12.07 to 13.02.08							
Date	BOD	TSS	O&G	pH	TN	TP	NH₃
	20	30	10				
04.12.07	7.00	3.00	2.00	7.50	7.58	3.5	5.19
17.12.07	7.00	4.00	2.00	7.10	5.21	3.86	3.61
02.01.08	7.00	8.00	2.00	7.30	8.35	3.46	4.10
16.01.08	5.00	4.00	2.00	7.30	4.21	1.65	1.86
30.01.08	5.00	8.00	2.00	7.30	6.78	3.52	2.90
13.02.08	3.00	10.00	2.00	7.10	5.53	0.97	1.61

No concentrations of petroleum related hydrocarbons were detected in the 3 soil boreholes to a depth of 1m at the rear of the likely contamination source.

No petroleum related hydrocarbons were detected in surface waters of the wetland associated with Gills Creek to the rear of one of the heavily contaminated pump stations.

4.3 Outcomes of Analysis

The above water sample results confirm the contamination of the sewerage system with a mixture of petroleum and diesel based hydrocarbons extending from the Angus McNeil Pump Station through to the Pasveer at the South Kempsey Sewage Treatment Works. The low concentration and nature of the hydrocarbons detected within the tertiary pond and the discharge point into Gills Creek indicate that petroleum based hydrocarbon contamination was largely or even entirely contained prior to reaching these points. These results combined with the fact that there was no petroleum related hydrocarbons detected in the soil boreholes at the rear of the likely contamination source or in surface waters of the wetland associated with Gills Creek, indicate there was no significant impact to the Gills Creek environment.

5.0 CONCLUSION

The operator who was taken for medical observation was treated for headaches and nausea. He returned to work the following Monday and is now OK. Other staff onsite also suffered minor headaches due to the volatile work areas, but required no medical treatment.

To date the South Kempsey Sewer Plant has not had any licence breaches since this incident. The pasveer recovered quickly after the incident and was deemed to be fully operational within a few days. The sludge samples were viewed under a microscope at different intervals over the recovery period to confirm Macleay Water's operations were successful.

It was decided to leave one biological filter off line and maximise the flow into the other. To date this has worked well with the working biological filter producing excellent results.

5.1 How to Stop a Recurrence

Council are currently investigating several options for the early detection of petrochemical products in the sewerage system in high risk areas. It is envisaged that the detection systems will allow council to immediately shut down and isolate the affected pumping station and closely monitor and detect the source of infiltration and quickly activate the required response.