CASE STUDY

OISD/CS/2025-26/PL/15 Dt: 06.11.2025

INTRODUCTION

Title: Gas leakage & Fire incident in Offshore section (near river mouth) of a Trunk Pipeline originating from Offshore Processing complex.

Location: Offshore section (near river mouth) of Trunk Pipeline.

Loss/ Outcome: Gas & Condensate

BRIEF OF INCIDENT

A sudden pressure drop was observed in an Offshore (Sub-sea & Sub-river) trunk pipeline which is used for transferring Gas along with condensate from an offshore Process Platform Complex to Onshore Gas Terminal. Immediately after pressure drop was observed, communication was established between process platform and Onshore gas terminal to ascertain the reason for pressure drop. Suspecting probable leakage in trunk line, gas flow to pipeline was stopped from process platform and depressurisation of the pipeline was started from both process platform and Onshore gas terminal ends.

During depressurisation of the gas pipeline, a fire was also observed at a point located approximately 400 m from the landfall point in the adjoining river mouth. This indicated a probable leak in the pipeline followed by ignition of released hydrocarbons.

After reduction of pressure, purging operations were commenced from Onshore gas terminal end using inert gas to displace any residual hydrocarbons within the pipeline. Fire was subsequently extinguished, after the complete isolation and cutting off gas supply from the source. No injuries, fatalities or third-party property damage were reported because of the incident.

Observations/Lapses

Basis site visit, interaction with officials, and checking of documents, following observations were made:

1. Processed gas along with condensate was being transported upon dehydration. After commissioning, pigging of the pipeline could not be carried out due to the unavailability

of adequate motive flow at the process platform complex. As gas condensate was being transported through the same line, the absence of pigging operations likely resulted in the condensate not being effectively removed.

2. Last As-Built survey of pipeline was carried out in 2023. As-Built Survey indicated 3 Nos. of Free Span in the sea section of the Pipeline. Free span survey could not be carried out in river section at that time due to nonavailability of required draft for movement of vessel.
3. Previously also, there was a leak incident in the pipeline in river section which was recorded as Near Miss incident. The clamp was provided at leak location. Free spans were observed in the river section near repair location, though no further actions were taken to address free span. However, it was recommended to get the complete free span survey done for the river section and take further necessary actions for safeguarding the pipeline.
4. As per design documents of pipeline, pipeline was laid buried in trench at a depth of 1.3 to 5 m in river section. Also, river scour depth was considered only 0.2 to 0.3 m which is not correct in current scenario as the pipeline is now getting exposed in river section.
5. Corrosion assessment of pipeline using techniques like Electronic/ Intelligent pigging or Internal Corrosion Direct Assessment in case Intelligent pigging was not possible was not carried out. Corrosion coupon was installed on offshore platform side; however, its inspection was not being done to assess corrosion rate.

Root Causes

Based on the observations above, it can be concluded that due to free span of pipeline in river section, high river flow currents during monsoon caused stress over pipeline, resulting in pipe failure. As per design document, pipeline was laid in trench and was not designed for free span in river section. Hence, operating pipeline without taking corrective actions for free spans and pipeline exposure inside river section led to pipe failure.

Recommendations

1. Organization shall take immediate action to identify free span and pipeline exposure inside the river section. Corrective measures to be taken for the identified pipeline sections.
2. Comprehensive corrosion assessment of the pipeline shall be undertaken as per OISD-STD-139. Wherever such inspections are not possible to be carried out due to operational or other constraints, risk mitigation measures to be taken.
3. Leak detection system to be considered for early warning in case of such incidents.
4. Incident categorisation to be done as per OISD guidelines, as previous year leak incident was wrongly reported as Near Miss.
5. ‘Guidelines for preventing Pipeline Failure due to heavy rainfall/ floods’ circulated by OISD on 15.10.25 (Attached as Annexure) also to be considered and relevant recommendations related to pipeline safety in river sections to be implemented.

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Guidelines for preventing Pipeline Failure due to heavy rainfall/ floods

Background:

In view failure incidents of the six pipelines due to sudden gush of water owing to heavy downpour, flash floods and change of river course, industry level meeting was organized by OISD on 25.09.2025 and 13.10.2025. The agenda of the meeting was reviewing these incidents and finalizing mitigation measures to avoid such pipeline failures in future.

During the meeting all aspects related to design requirements for new river crossing and requirements for existing river crossing were discussed in detail. Based on the discussion, the guidelines were finalized and agreed by all industry representatives, for taking necessary actions to prevent such incidents in future.

Guidelines:

Guidelines for taking necessary actions in new as well as existing pipelines to prevent failure due to heavy rainfall/ floods is as follows:

1) **Design requirements for new River crossings**: Design requirements are classified in two categories, i.e. for perennial and non-perennial rivers as detailed below:

    a. Crossings should be in a comparatively straight segment of the river at an angle of crossing as close to 90° as possible. Crossing close to meandering course of the rivers should be avoided. In case crossing near meandering course of the river is unavoidable, suitable precautionary measures like bank protection, longer length HDD etc. should be taken.

    b. Crossing of rivers in close proximity of downstream of Dam/Barrage should be avoided. In case where same is not possible, suitable precautionary measures should be taken.

    c. Parallel Laying of pipeline in proximity of any river should be avoided.

    d. **Perennial Rivers**: Following are to be considered while designing the pipeline crossing across perennial river:

        i. Pipeline crossing across perennial rivers shall be carried out through Trenchless techniques like HDD, Micro-tunneling etc. Incase single stretch trenchless method cannot be used due to technological limitations/ challenges, suitable alternate method may be used with engineering assessment and approval of competent authority not below the rank of Executive Director/Equivalent officer of entity.

        ii. Minimum depth of HDD/ Micro-tunneling from bank to bank, shall be maximum scour depth from lowest river bed plus 2.5m.

iii. Historical hydrological data (like High flood level, maximum flow, scour depth, river width, meandering etc.) of maximum available period shall be considered for designing of the HDD/Micro-tunneling. Based on these data, study for bank erosion, scouring rate & river meandering should also be done for next 25 years.

iv. Punch-in & punch-out point of HDD from riverbank (identified during design) should be 100 m or as per design requirement whichever is higher.

v. After completion of HDD/Micro-tunneling, riverbanks and hook-up points are shall be geo tagged and suitable physical marker (preferably with RFiD marker) shall be installed for identification & tracking of riverbank erosion in future, if any.

e. **Non-Perennial Rivers**: Following to be considered while designing the pipeline crossing across any non-perennial rivers:

i. Trenchless techniques shall be used for river/streams having a scour depth (from lowest riverbed) of more than 2.5 m and bank-to-bank width of minimum 100m. In this case, design requirement for trenchless method shall be same as mentioned above for perennial river crossings. Incase HDD method cannot be adopted due to technical challenges, laying with open cut method with additional cover of minimum 1 m (i.e. scour depth plus 3.5 m) may be carried out.

ii. Other smaller crossings (not meeting the criteria defined in above case) can be carried out through Open cut method.

iii. Anti Buoyancy measures such as concrete weight coating, anchors etc. shall be provided for complete section of the crossing (bank to bank) as minimum for open cut method.

2) **Requirements for existing River Crossings**: Following actions to be taken for existing River crossings/parallel pipeline sections:

a. For tracking the course change/riverbank erosion in future, Geotagging/ Physical pipeline markers (preferably along with RFiD markers) shall be installed for all the existing crossings at following locations:

i. At riverbanks for all river crossings (i.e. both perennial & non-perennial)

ii. At hook-up/tie-in point for HDD/Micro-tunneling/Open Cut crossings

b. Geotagging/ Physical pipeline markers (preferably along with RFiD markers) shall also be installed, for all the existing pipelines laid in parallel to rivers in close proximity (i.e. pipeline laid within 100m of riverbank). Markers shall be installed at every 50-100 m distance at pipeline to track the change in river course.

c. **Satellite/Drone imagery** may be used to monitor river course changes and bank erosion.

d. Amongst all existing river crossings in a pipeline, which are prone to erosion or near the river meandering locations, shall be identified. Suitable action like bank protection, bed protection, re-routing, longer HDD etc. shall be taken based on the review.

e. <u>Action to be taken for Perennial/Non-Perennial rivers</u>

i. Pipeline depth cover shall be measured at every 5m twice a year (i.e. pre-monsoon and post monsoon) in dry portion of the river and 100 m from either side up to river bank. The data shall be compared with previous data. In case, the depth is not meeting the OISD standard requirement, close monitoring with suitable action shall be taken.

ii. Bank erosion with respect to earlier bank marking (physical markers installed) shall be recorded along with depth cover. In case of bank erosion is observed, close monitoring with suitable action shall be taken.

f. In all existing pipelines, any new dam/barrage constructed/being constructed on perennial river within 100 km upstream of respective crossing shall be identified. In such cases, hydrological study (like bank erosion, meandering etc.) shall be conducted for its effect on the existing pipeline crossings and suitable mitigation measure shall be taken.

g. Check dams, if any, constructed in the close proximity (within 200m) of the existing pipeline crossing shall be identified and close monitoring shall be carried out for any erosion of the riverbed/riverbank near the pipeline crossing. Suitable action shall be taken, in case erosion is observed.

h. Gabion walls, sandbags are generally installed at washout locations to prevent any further washouts. However, regular monitoring is required along with taking up any other suitable action for permanent solution, if needed.

i. During the monsoon season, enhanced monitoring of the river crossing shall be carried with respect to bank erosion.

j. Regular meetings may be conducted with Irrigation Department/ Water resources to coordinate regarding the water release from Dam/barrage etc. Also, meetings to be conducted with district administration/ NDRF/ SDRF teams etc. to make them aware of pipeline river crossings & its emergency scenarios.

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