Camisea Pipeline Ruptures and Audit

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Camisea Project Background

- Pipeline component of Camisea Project awarded in October 2000.
- Pipeline construction consortium is *Transportada de Gas de Peru* (TGP), led by Tecgas (fully owned by Techint Group of Argentina).
- In addition to Tecgas, TGP consists of Pluspetrol (Argentina), Hunt Oil (US), Sonatrach (Algeria), Graña y Montero (Peru), SK Corporation (South Korea), and Tractabel (Belgium).
- Gas fields and Malvinas gas plant in Amazon.
- Gas wells are located in indigenous peoples reserve.
- Natural gas (730 km.) and natural gas liquids (560 km.) pipelines over Andes to Peruvian coast, estimated budget $820 million.
- Pipelines built by Techint, completed August 2004.
- Interamerican Development Bank (IDB) loan granted to TGP in September 2003 for $75 million.
Camisea Pipeline Route and Location in Peru
Source: Peru Ministry of Energy and Mines presentation on Camisea pipeline ruptures, March 2006
Configuration of Camisea Project NG and NGL Pipelines

Source: Peru Ministry of Energy and Mines presentation on Camisea pipeline ruptures, March 2006

Maximum altitude: 4,864 meters (15,800 feet)
## Design Flows and Pressures for NG and NGL Pipelines

source: TGP/Techint design basis specification 2794-R-ME-00002

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Design Pressure</th>
<th>Initial Flow</th>
<th>Maximum Flow</th>
</tr>
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<tbody>
<tr>
<td>NG</td>
<td>2,132 psig</td>
<td>250 mmcfd</td>
<td>1,179 mmcfd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(with Camisea II pipeline from km. 210 to LNG plant on coast)</td>
<td></td>
</tr>
<tr>
<td>NGL</td>
<td>1,769 psig</td>
<td>50,000 bbl/day</td>
<td>70,000 bbl/day</td>
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<tr>
<td></td>
<td>(@ 50,000 bbl/day)</td>
<td></td>
<td>(with one additional pump station)</td>
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Construction Inspection Issues

- Pipelines built under BOOT contract.
- Work commenced on NGL pipeline in spring 2002.
- Work commenced on NG pipeline in spring 2003.
- Major financial penalties ($90 million) for failure to complete both pipelines by August 2004.
- Gulf Interstate worked as owner’s inspector for TGP consortium.
- However, pipeline constructor Techint is also lead member, via wholly-owned Tecgas, of TGP consortium.
- Government inspection agency, OSINERG, in field periodically.
- Stone & Webster also in field periodically representing IDB.
Initial Reports of Problems During Construction in Jungle Sector

- URS Consulting, in field to monitor erosion control effort in right-of-way (ROW) on behalf of IDB, issued publicly available monthly summaries in 2002/2003.

- Global Village Engineers (GVE) conducted site inspection of pipeline ROW in jungle sector in June 2003 during final stage of pipeline construction.

Findings:

- URS: All effort directed at laying pipe, little or no effort being expended to install adequate erosion control measures, resulting in tremendous erosion.

- GVE: Erosion so bad in some sections there is no way these areas can be revegetated.
Background on E-Tech Involvement

- A condition of 2003 IDB $75 million loan was environmental and social audit of project beginning in August 2004 at inception of operational phase.
- E-Tech invited by Peruvian civil society in late 2003 to assist in development of audit scope-of-work.
- Welding inspector Carlos Salazar, who worked under contract to Techint for 1½ years on pipeline project, expresses interest in working on E-Tech audit team.
- Pipelines begin operation in August 2004.
- No significant action on audit by IDB until 5th NGL rupture occurred in March 2006 – at that time IDB moved forward and included new audit component addressing ruptures.
Pipeline ROW Terrain and Erosion Issues
Background – Construction in Jungle Sector

source: audit technical specifications prepared by OSINERG, March 2006.

- Delay in arrival of 32-inch NG pipe in 2002 (jungle ROW left open during Nov. 02 to April 03 rainy season awaiting pipe).
- Tremendous erosion evident – 117 erosion “critical points” identified by OSINERG inspectors in jungle sector.
- Seven hydrostatic test failures of NGL pipeline in jungle sector.
- No hydrostatic test failures of NG pipeline in jungle sector.
## NGL Pipeline Hydrostatic Test Failures (7) and Rupture Locations (5) During Operational Phase

<table>
<thead>
<tr>
<th>Hydrostatic test failure points</th>
<th>Rupture locations during operation</th>
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<tbody>
<tr>
<td>km 1.3</td>
<td>km 8.8</td>
</tr>
<tr>
<td>km 9.9</td>
<td></td>
</tr>
<tr>
<td>km 31.5</td>
<td>km 50</td>
</tr>
<tr>
<td>km 43.8</td>
<td>km 126</td>
</tr>
<tr>
<td>km 170</td>
<td></td>
</tr>
<tr>
<td>km 171</td>
<td>km 200</td>
</tr>
<tr>
<td>km 210</td>
<td>km 222</td>
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Hydrostatic Test Section Elevation Change – Length and Elevation Change of Selected Test Sections

- **NGL pipeline:**
  - 6 hydrostatic test sections reviewed.
  - Test sections from 3 miles to 21 miles in length.
  - Test section elevation difference ranged from 1,300 feet to 2,700 feet.

- **Natural gas pipeline:**
  - 6 hydrostatic test sections reviewed.
  - Test sections from 3 miles to 20 miles in length.
  - Test section elevation difference ranged from 1,500 feet to 2,700 feet.
1st Rupture, December 22, 2004, km. 8.8

- 723 barrels of NGL product spilled – enters Urubamba River.
- **Feb 05**: Metallurgical Consultants International (Houston) hired by TGP to analyze break. MCI states “very strong flexing during installation” probable cause.
- **Aug 05**: OSINERG report states bad weld, flexing during installation, and soil instability all causes.
- **March 06**: OSINERG hires TecnoGas (Canada) and InspectWeld (US) to assess cause of rupture. TecnoGas says soil instability only – external force – is probable cause.
- **Fundamental issue**: presence or lack of systematic flaws in construction of pipeline(s).
2nd, 3rd, and 4th Ruptures of NGL Pipeline

- 2nd rupture, August 29, 2005, km. 222, weld pore leak (Inspectweld states pore is construction defect).
  - Ground saturated with 16 barrels of NGL

- 3rd rupture, September 16, 2005, km. 200, sole cause cited is earth movement caused by unstable terrain.
  - 4,000 barrels lost, liquid product flow to Chunchubamba River

- 4th rupture, November 24, 2005, km. 50, six feet below streambed, cause determined but not public as of February 2007.
  - 4,630 barrels lost, liquid product flow to tributary of Urubamba River
Background on 3rd Rupture, km. 200, Toccate

- Known area of soil instability.
- Pipes caught in landslide on February 26, 2004 and left sticking in air (prior to start-up).
- Pipeline start-up in August 2004.
- Rupture in NGL pipe on September 16, 2005, break along girth weld 182 VBT/DOC.
- Soil movement identified as sole cause, temporary bypass installed.
- Final solution – 700 meter tunnel, $7 million investment cited by TGP.
Findings:

- Haste to meet completion target date to avoid $90 million in penalties contributed to shoddy workmanship and poor erosion control.
- Accelerated internal corrosion in significant portion of pipe.
- Inadequately trained welders, some with illegitimate certificates.
- Unacceptable stresses imposed to maintain the pipe ends in position to permit welding at some tie-ins.
- Uncertified weld radiograph interpreters.
- 100% of radiographs should be re-interpreted by independent qualified radiographic interpreters.
- Remedial action plan should be developed by independent team.

Sources of information: Inspectors who worked on project, detailed project specifications, field certification and field test documents.
Critical Weak Points in 210 km. Jungle Sector Identified by E-Tech

- E-Tech identified the following points in the jungle sector, ~5% of total length, as especially prone to failure due to difficult topography, unstable soil, and difficult welding/inspection conditions:
  - Paratori: km. 29
  - Pongo y Ponguito: km. 42-45
  - Ilcabamba: km. 52
  - Mantalo: km. 70
  - Alto Shimaa: km. 101
  - Umiroshiato: km. 125
  - Segakiato: km. 140-141
  - Comerciato: km. 150-1
5th Rupture, March 4, 2006, km. 126, 0.219” pipe: 4,700 barrels (200,000 gallons) of product spilled
Auditor must at a minimum:

- Verify quality of construction (pipe quality, fabrication certificates, welds, pre-operation tests, compliance with construction standards API, ASME, etc.).
- Survey the ROW to determine status of erosion control efforts.
- Analyze information from various measuring instruments (pigs).
- Verify geotechnical conditions in the context of the ruptures.
- Identify critical (erosion) zones and recommend short- and long-term remediation.

Estimated audit duration: 8 to 12 months.
Government Orders Audit of Ruptures, March 2006

- March 06: Government declares it will contract for technical audit of ruptures.
- March 06: OSINERG develops terms of reference (ToR), estimates audit budget of approximately $1.6 million.
- June 06: Special audit ToR committee waters-down OSINERG ToR in key areas, 9-month timeline for audit established, audit ToR goes out to bid.
- Most main audit objectives identified by minister of MEM in March 2006 are eliminated or are restricted to file review (import manifests, welding school certifications, etc.).
- Very fast-track proposal turnaround required of bidders.
- July 06: Only 1 of 11 invited bidders, Germanischer Lloyd de Mexico, submits proposal – bid declared void.
Key Elements of Original Audit Scope Removed by Special Audit ToR Committee

Key elements eliminated:

- Review of geotechnical studies of pipeline route options prepared prior to selection of actual route.

- Review of pipe storage practices from fabrication to installation in pipeline.

- Onsite verification of erosion control measures in use at 117 critical points identified by OSINERG in first 150 km. of jungle sector.

- Review of 100% of weld radiographs.
Stance of TGP, MEM, IDB – No systemic problems, international experts verified everything

- Technical contractors included: TGP (Gulf Interstate), IDB (Stone & Webster), OSINERG (Canadian Petroleum Institute), MEM (Embridge, Inc.).

- Minister MEM March 2006 statement: “Few pipeline projects anywhere in the world have ever been subject to such technical scrutiny.”

- In response to E-Tech claims that deficient welds were left in place and unqualified welders were used on the project, MEM implies that with so many international contractors it could not have happened.

- This has been the standard TGP, MEM, and IDB response to E-Tech claims of deficiencies.
Congressional Pipeline Rupture Investigating Committee Report, June 2006

Findings:

- Severe deficiencies in the government’s fulfillment of its regulatory, audit, and supervisory functions.
- Government is institutionally weak - staff of oversight agencies (OSINERG) is poorly equipped to carry out supervisory and oversight functions.
- Adequate soil studies (and control measures) could have avoided the permanent erosion and slides in the jungle sector.
- Deadlines set by the government were too short for (proper) execution of preliminary studies.
- OSINERG has the responsibility to get involved in “intelligent pig” inspection, to supervise it, and to verify it.
- Necessary that OSINERG technicians review all of the radiographs and associated reports.
- Critical that TGP prioritize revegetation efforts in ROW.
Purpose: provide additional supporting evidence of irregular procedures and violation of construction specifications:

- Summary of ultrasound spot tests that showed accelerated corrosion of pipe.
- Photos of inadequately protected pipes and improperly buried pipes.
- Copy of Gulf Interstate owners inspector report documenting unqualified welders working in final stages of construction (June 2003).
- Copy of original pipebook for km. 455 – 459 documenting missing data on welders and radiographs for numerous welds.
- Photos of inadequate shrink sleeves used on NGL pipe joints in jungle sector.
32-inch NG Pipe in Water with Interior Exposed, 14-NGL Pipe in Direct Contact with Rocks
Gulf Interstate Non-Conformance Report – Unqualified Welders and Bad Welds

TGP/GIE

NON-CONFORMANCE REPORT No.: CHIM-080

Contractor: Techint
Crew: NG Welding Crew

Spread No.: CHIMPARINA  Date Issued: 26th June 2003
Work Location: New Km 92+600

Issued by: A. Elangovan  Signature:

Received by: ING. S. GANAPATHY  Signature:

CONTRACTOR IS CITED IN NON-CONFORMANCE OF THE CONTRACT TERMS & CONDITIONS, SPECIFICATIONS, AND/OR OTHER CONTRACT DOCUMENTS REFERENCED THEREIN. CONTRACTOR SHALL SUBMIT A REMEDIATION PLAN TO COMPANY REPRESENTATIVE IMMEDIATELY.

Description of Non-Conformance:

NG pipeline joint No. 92/46E to 92/71 have been welded by using unqualified welders in contravention to the various stipulations and provisions of API 1104/99 code, Project Specification No. 2794-L-SP-00012 and Welding Procedure Specification No. 2794-L-SP-00136/00137.

Remedial Action Required:

1. Cut Out all joints welded by unqualified welders and re-weld with qualified welders to the applicable procedure.
2. Conduct Welder Qualification Test as per provisions of API 1104 code for TGP approval.
Poor Adhesion of Polyguard Shrink Sleeve on NGL Pipeline Joints in Jungle Sector and Implications
Original Pipebook km. 455-459: Lack of Prior Geotechnical Study Results in Cut Pipe and Lost Data
Excerpts Explaining Missing Pipebook Data: km. 455 – 459 Section of NG Pipeline

- **Weld joint #54 km 455**: Intended to be cut, though it was not cut, and the pipe was buried. Later an attempt was made to locate the weld but it could not be found.

- **Weld joint #56 km 455**: This weld disappeared (it is unknown who did the weld).

- **Weld 458/07 is united with weld 458/24**: The union of these two joints created weld 455/T56.

- **Weld joints #58 and #59 of km 455**: Weld 58 was joined with weld 12 of 458 km to form 455/T58. The identification of the welders who welded this joint is unknown.
Controversy Surrounds Auditor Selection

- Special audit ToR committee almost immediately goes out to 2nd round of bidding after voiding 1st round due to insufficient number of bids, provides more time for bidders.

- Four bids received in early September 2006, three accepted (GL Mexico, Moody’s, Aptech).

- GL Mexico bids $1.9 million, Moody $5.8 million, Aptech > $5.8 million.


- Controversy continues over the legitimacy of the audit bidding process.
Significance of Audit Results – Camisea II Hangs in Balance

- Hunt Oil is requesting $400 million IDB loan for Camisea II.
- Camisea II includes expansion of natural gas production, new pipeline to coast that ties-in at with existing 32-inch NG pipeline at km. 210, and LNG liquefaction plant on Peruvian coast.
- Peruvian president Alan Garcia has lobbied for Camisea II in Washington, DC.
- IDB has indicated it will make no decision on loan request until audit of Camisea I issues is completed.
Conclusions

- $400 million IDB loan for Camisea II dependent on favorable result of audit.
- Tremendous pressure to find no significant problems.
- More ruptures will occur if audit does not address systematic construction weaknesses in Camisea pipelines.
- Cursory audit will invite more poorly planned and executed projects.
- Extremely fragile environment, and indigenous peoples attempting to maintain traditional way-of-life, cannot withstand less-than-the-best construction practices.
- Rapid deterioration of environmental and social conditions will occur in Amazon if governments and lending institutions do not insist on best practices and adequate independent supervision of oil & gas projects.