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Case Study:
Bad Practices of Electric Power Infrastructure Investment / Development

August 25th 2015

Purpose of the Case Study

- To understand potential problems that may arise from disregarding the quality of infrastructure and to derive lessons to procure high quality infrastructure through case studies of electric power infrastructure procurement

Notes

- The case studies we are going to present are cases that occurred around the world when procuring electric power infrastructure
- Information in relation to country names/company names, date etc. is undisclosed
- No photos are used due to copyright reasons

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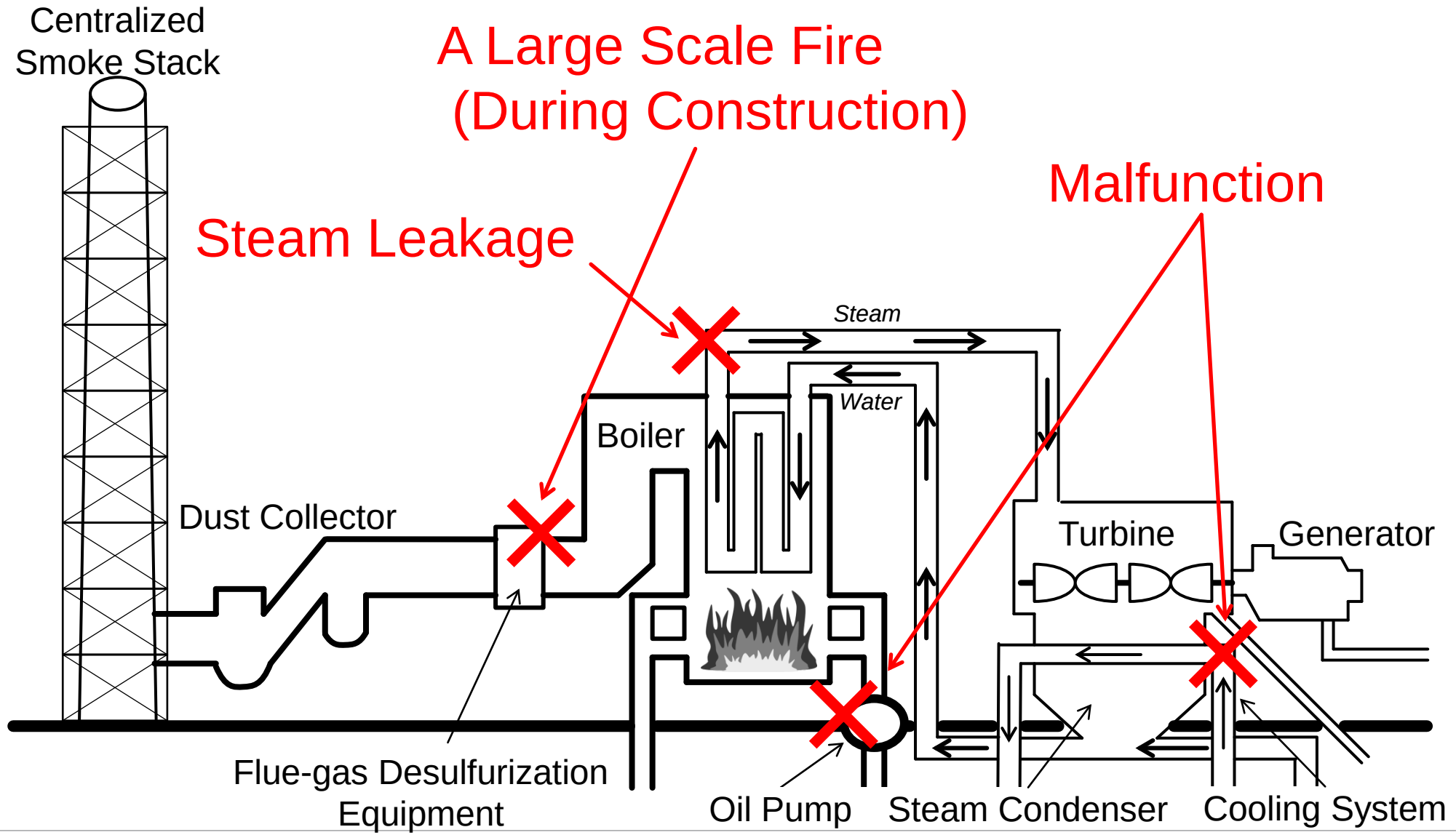
Case Study 1:
Coal-fired power plant

Case Study 1:
Overview of the Electric Power Infrastructure

- Electric Power Company A of Country B constructed a coal-fired power plant consisting of three units during the period 20xx through 20yy.
- Company A procured construction and maintenance of the power plant from Company C of Country D on an unsolicited tender.
- The capacity per unit of the coal-fired power plant was 300MW and unit 1 started operation in 20zz, and Units 2 and 3 started operation in 20yy.

Case Study 1:

Overview of the Problem (1)

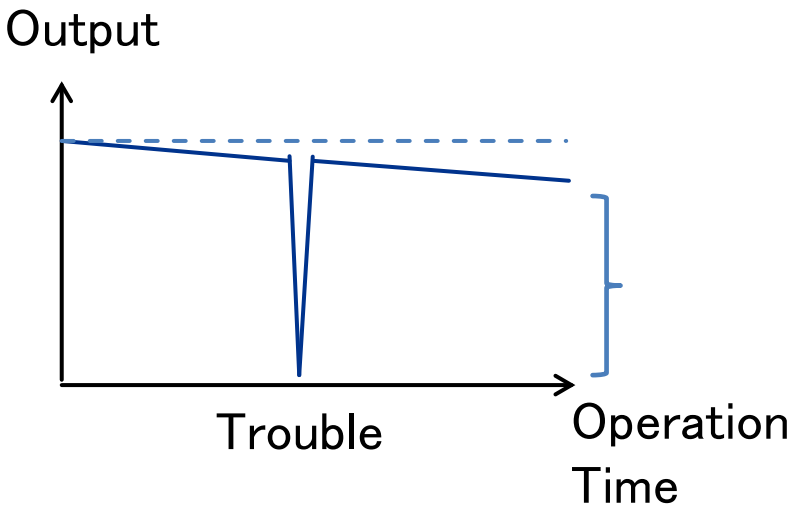


Case Study 1:
Overview of the Problem (2)

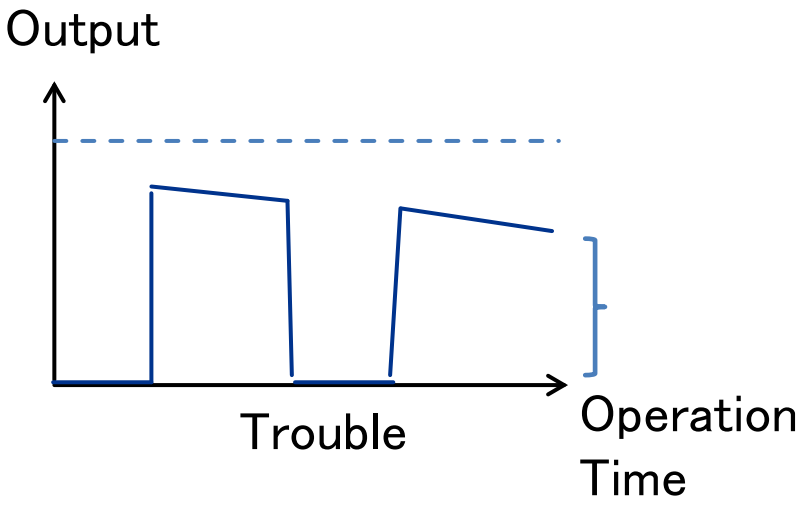
- In October 20vv, the flue-gas desulfurization equipment in Unit 1, which was under construction, caught fire from the sparks of welding, leading to a large scale fire. As a result, the construction schedule of Unit 1 was delayed.
- In 20zz after the operation started, blackouts frequently occurred due to malfunction. The problem was caused by faults in various points such as the relay system of the oil pump motor and the cooling system and steam leakage in the boiler.
- Steam leakage occurred in December 20ww, but the equipment to identify the location of the fault was not available in Country B, due to its unique feature. Therefore, Company A was required to import this equipment from a foreign country, which took one month. As a result, Company A was forced to halt operation in the long term, leading to significant economic loss.

Case Study 1:
Problems of the Electric Power Infrastructure

Ideal Capacity



Case 1 (Capacity)



- Delay in construction schedule
- Low operation rate
- Required significant time to recover from stoppage of operation

Case Study 1:
Cause of the Problem

- The cause of the fire that occurred in October 20xx was the lack of education for workers in relation to the standard operation procedure of welding by Company C. In addition, the workers did not comply with the manual.
- The malfunction that occurred after the start of operation in 20xx was caused by a mechanical defect and a functional defect in part of the generator. These defects occurred because the design of the power plant Company C constructed did not take into consideration some specific conditions (such as quality of bituminous coal) of Country B.
- The significant economic loss from the long-term shutdown in December 20xx may have been caused due to deficiency in the recovery manual (for steam engine troubles).

Case Study 1:
Observation by KPMG (1)

Items the ordering party (Company A) could have considered

- Company A could have confirmed the construction/maintenance ability of Company C by requesting Company C to submit a list of past orders received and construction experience of full-time engineers.
- Company A could have requested Company C to explicitly indicate education for workers in the construction plan submitted at the time of construction contract and could have ensured the workers comply with rules.
- Company A could have requested Company C to submit and comply with the recovery plan (at the time of a disaster/trouble) at the time of operation and maintenance contract.

Case Study 1:
Observation by KPMG (2)

Lessons learnt from the case study

- The ordering party could conduct P/Q assessment and set relevant engineer/experience requirements in order to ensure completion and start of operation as scheduled.
- The ordering party could consult with the operator in relation to the education for workers/operators after signing the contract in order to prevent delay in construction by the workers and stoppage of operation due to operational failure by the operators.
- The ordering party could confirm whether the contractor has prepared and complied with the recovery plan (at the time of a disaster/trouble) after signing the contract.

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Case Study 2:
Coal-fired power plant

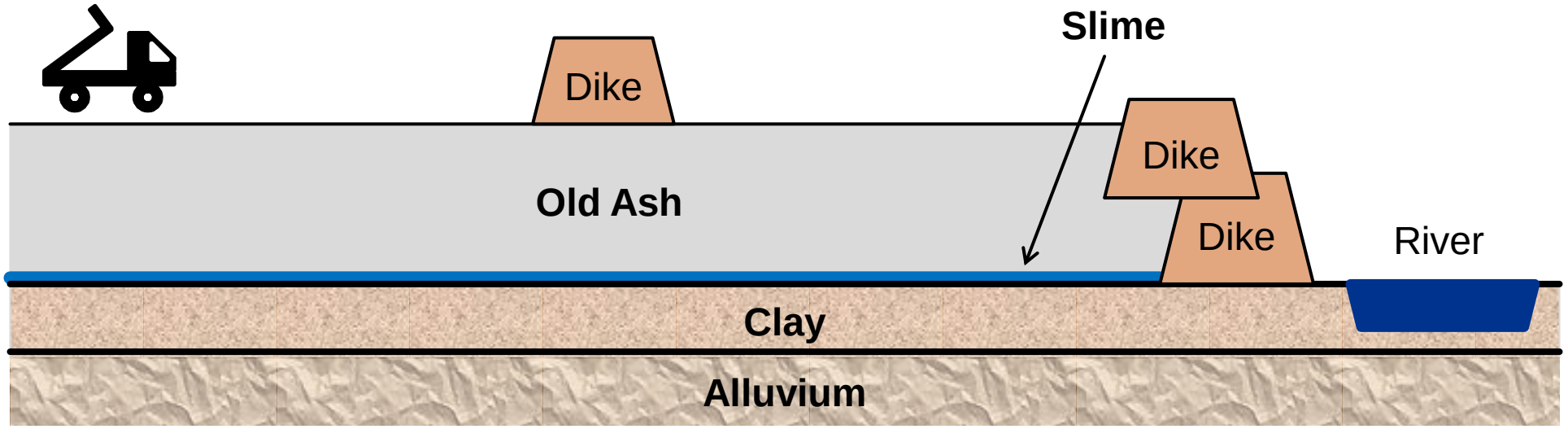
Case Study 2:
Overview of the Electric Power Infrastructure

- In 19xx, Company E in Country F constructed a coal-fired power plant alongside River G and River H.
- The power plant generated 10 million MWh annually and discharged 1,000t of coal ashes daily as a by-product (as of 20xx).
- Company E stored coal ashes in the three ash ponds located within the power plant premises. In 19xx, the capacity of the ash ponds became full. However, there was no more land in which an additional ash pond could be established.
- Accordingly, in 19xx, Company E established a new ash pond surrounded by dikes on the top of the fully loaded ash pond and continued dumping coal ashes therein.

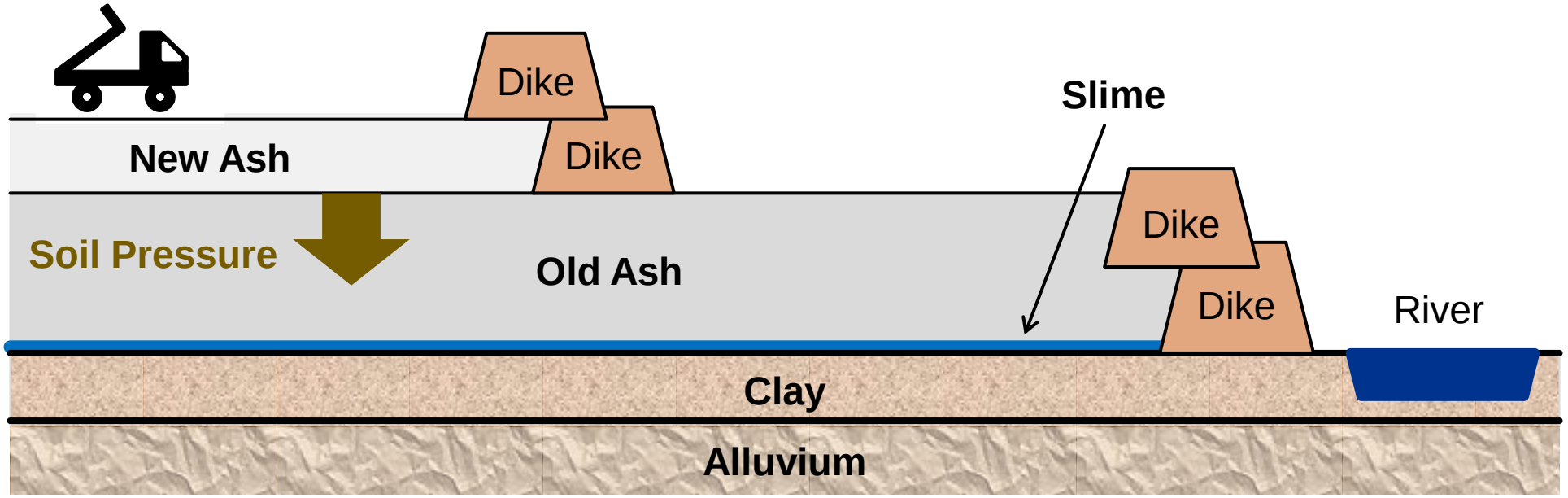
Case Study 2:
Overview of the Problem

- In 20xx, a large scale land slide occurred in the new ash pond constructed by Company E and 4.12 million kl of coal ashes leaked as a result of the collapse of dikes.
- The damage spread over a wide area including 45 houses and gas pipe lines.
- In addition, the leaked coal ashes flowed into the two adjacent rivers. As a result, toxic substances (i.e., arsenic, mercury, etc.) exceeding the stipulated value was detected from the rivers.
- Company E paid approximately USD1.1 billon as decontamination cost, as of 20xx.
- Furthermore, the citizens who suffered health damages are requesting Company E for compensation for such damages.

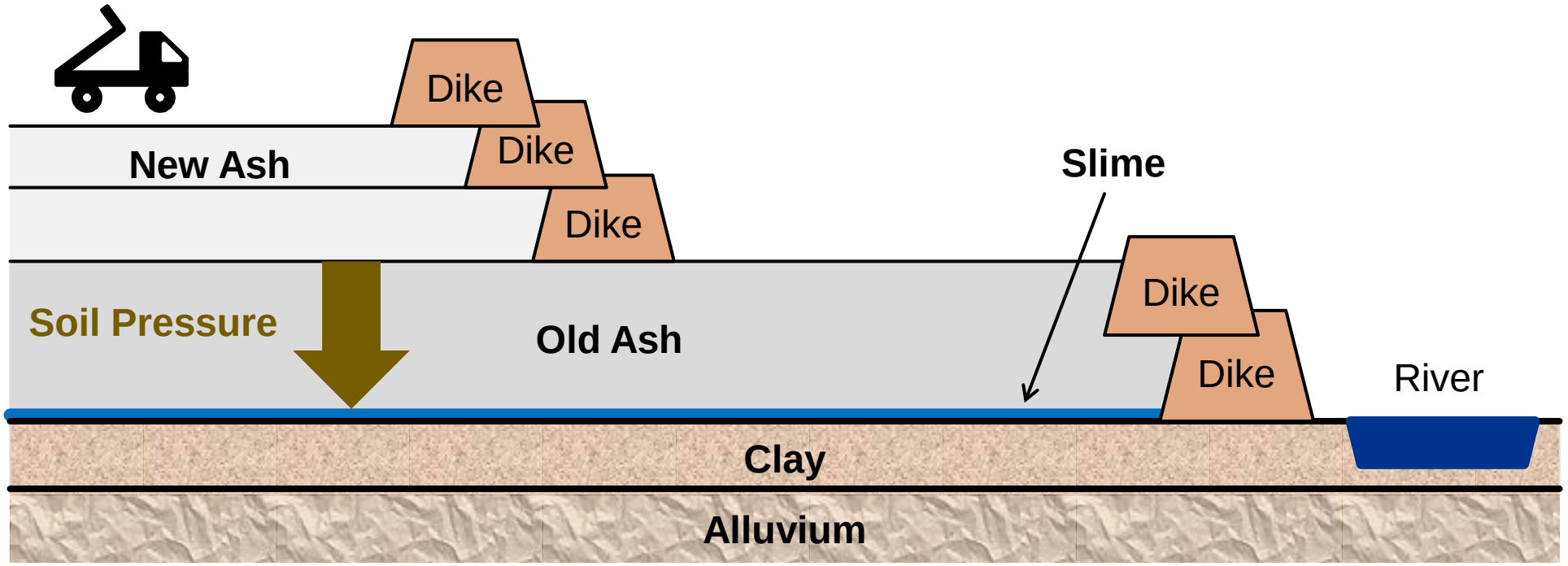
Case Study 2:
Diagram (1)



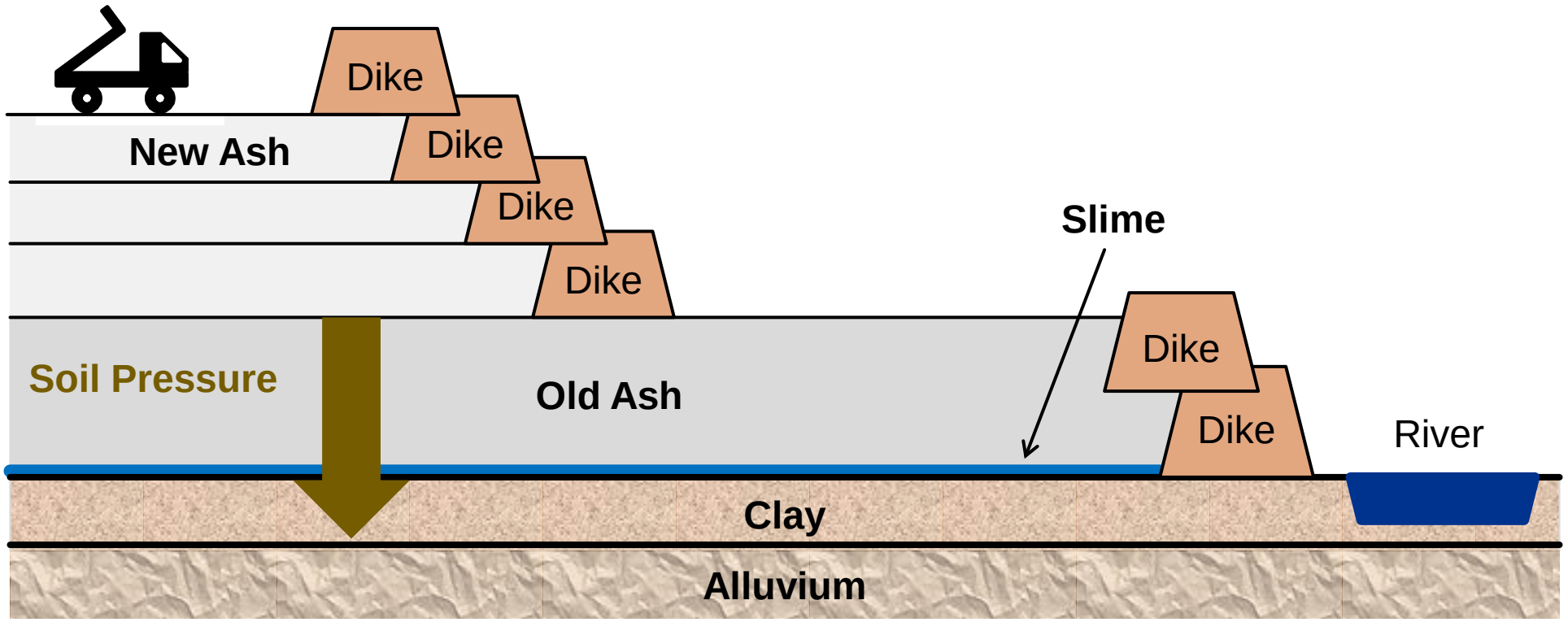
Case Study 2:
Diagram (2)



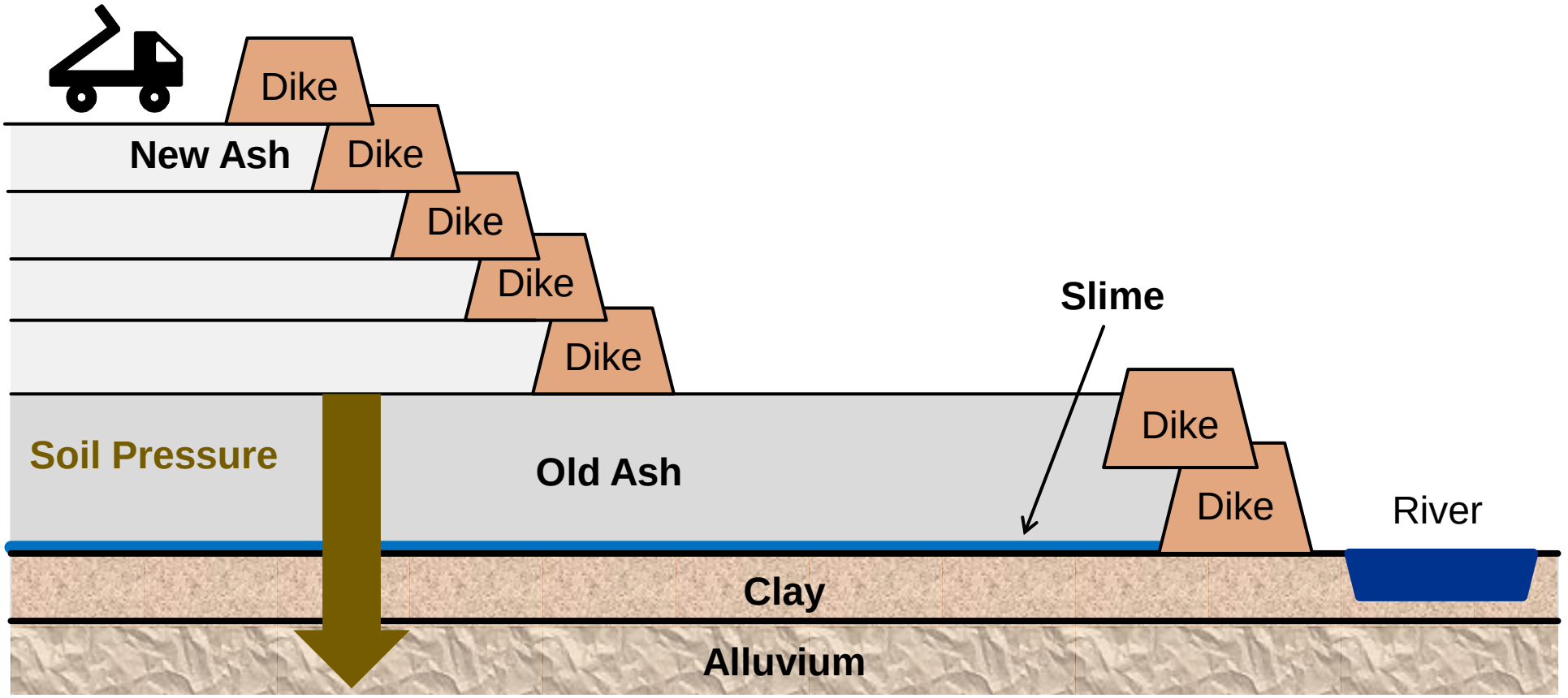
Case Study 2:
Diagram (3)



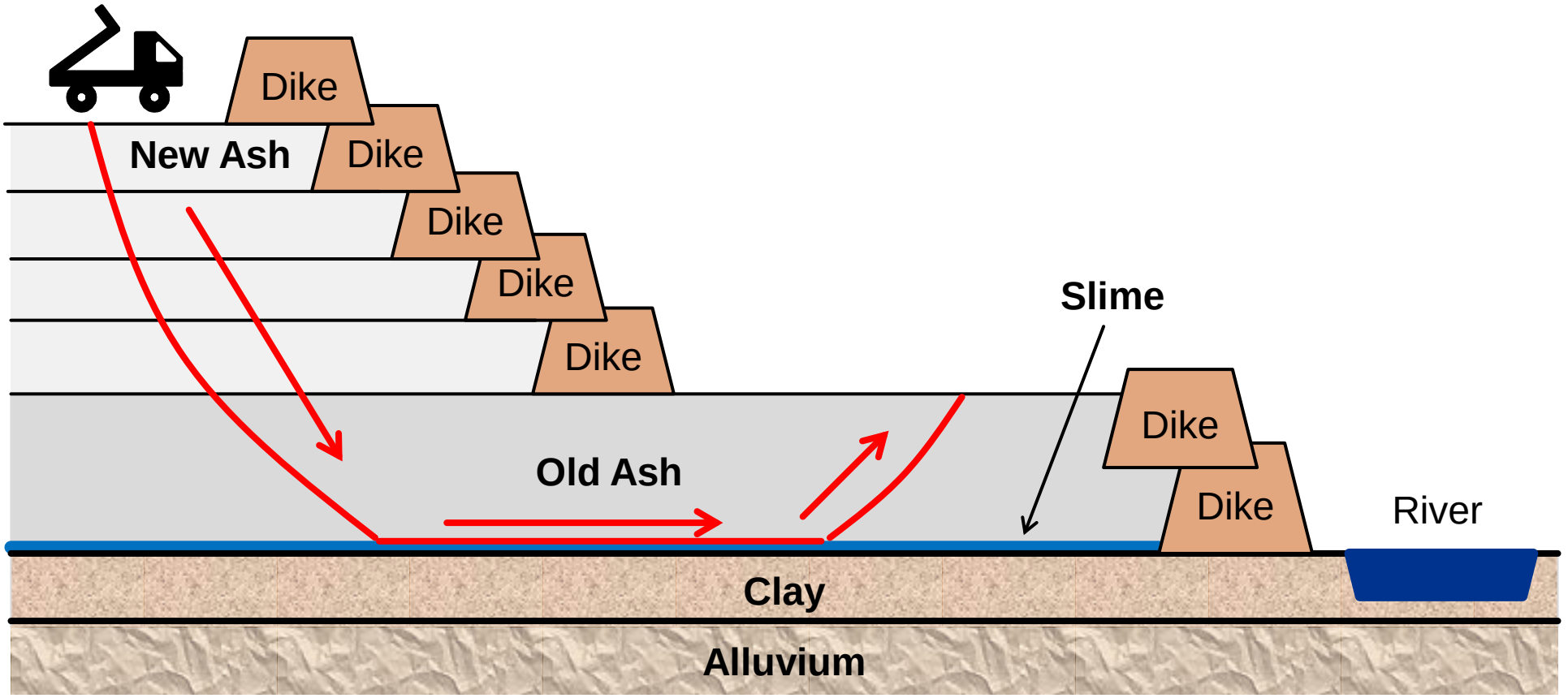
Case Study 2:
Diagram (4)



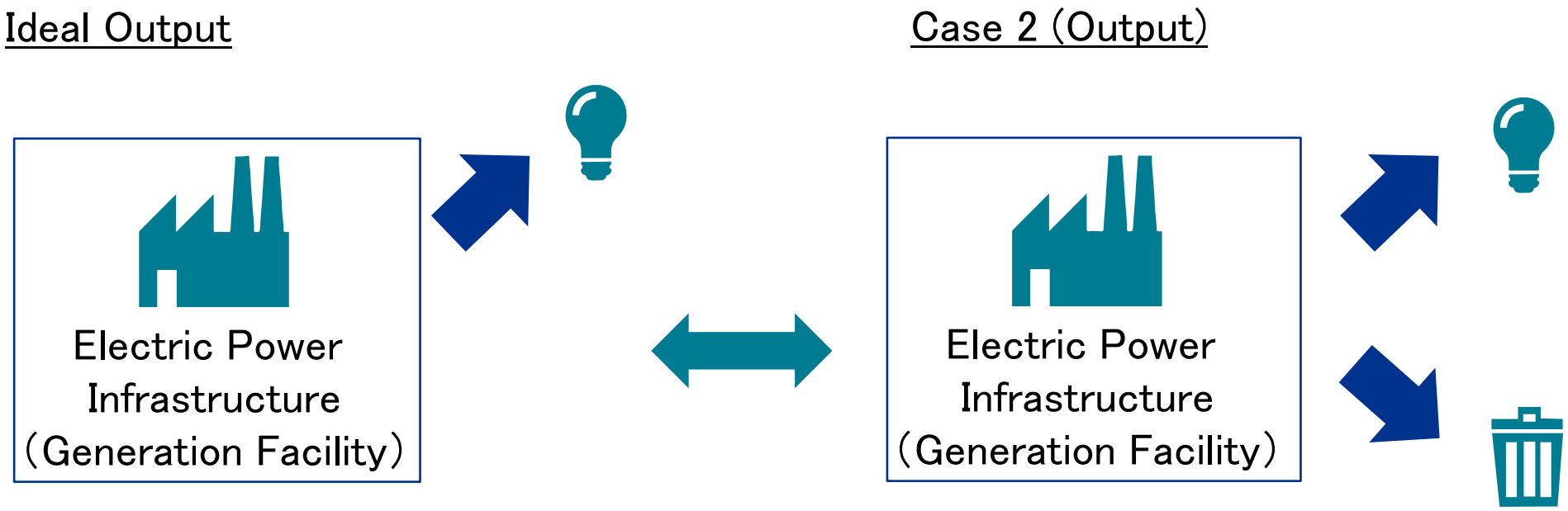
Case Study 2:
Diagram (5)



Case Study 2:
Diagram (6)



Case Study 2:
Problems of the Electric Power Infrastructure



- Caused environmental destruction to the neighboring areas
- Caused direct damage to road infrastructures and private properties

Case Study 2:
Cause of the Problem

- The base of the old ash pond located below the newly established ash pond was composed of a clay stratum, and a large scale land slide occurred as a result of the pressure caused by the newly dumped coal ashes.
- The operator had identified several small scale surface slips since 20xx. In addition, an external engineering consultant had pointed out the danger of the ash pond. However, Company E did not take any immediate action against the issue.
- Company E concentrated its investment into assets directly linked to sales and profit such as generation facilities, and insufficient investments were made in other assets such as the ash pond. Company E paid little attention to environmental preservation and safety management.

Observation by KPMG (1)

Items the ordering party (Company E) could have considered

- It can be assumed that the consultant that designed the new ash pond did not conduct sufficient geological survey or that there was a miscalculation in the stress computation used as an assumption of the design. Therefore, Company E could have selected a consultant with a certain level of ability as their contractor.
- Company E could have stopped dumping coal ash and taken various measures (e.g., consideration for neighboring citizens) to ensure safety of the ash pond at the time they recognized the indication of a large accident.
- Investment in environmental preservation and safety management related assets such as ash ponds could have been made, as the total cost (decontamination cost, damage compensation) exceeded the initially expected cost as a result of focusing on cost reduction.

Case Study 2:
Observation by KPMG (2)

Lessons learnt from the case study

- The ordering party could consider not only the initial cost, but other aspects which are difficult to evaluate in monetary terms (e.g., environmental preservation, safety management) in order to minimize life cycle cost.
- The ordering party could set engineer/experience requirements in order to ensure bidders knowledge on environmental preservation and safety management.
- Constant investment in environmental preservation and safety management related assets could be made in order to ensure the quality of electric power infrastructure.

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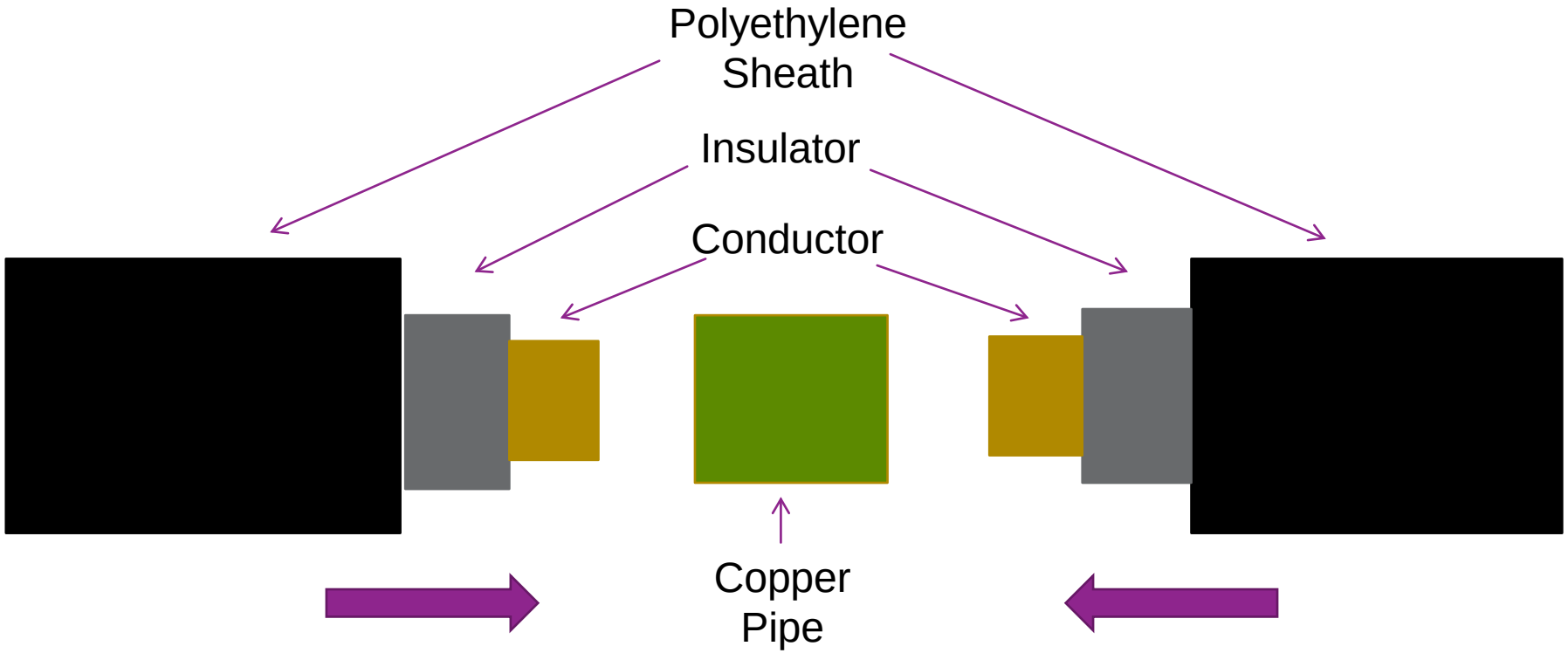
Case Study 3:
Underground electric line

Case Study 3:
Overview of the Electric Power Infrastructure

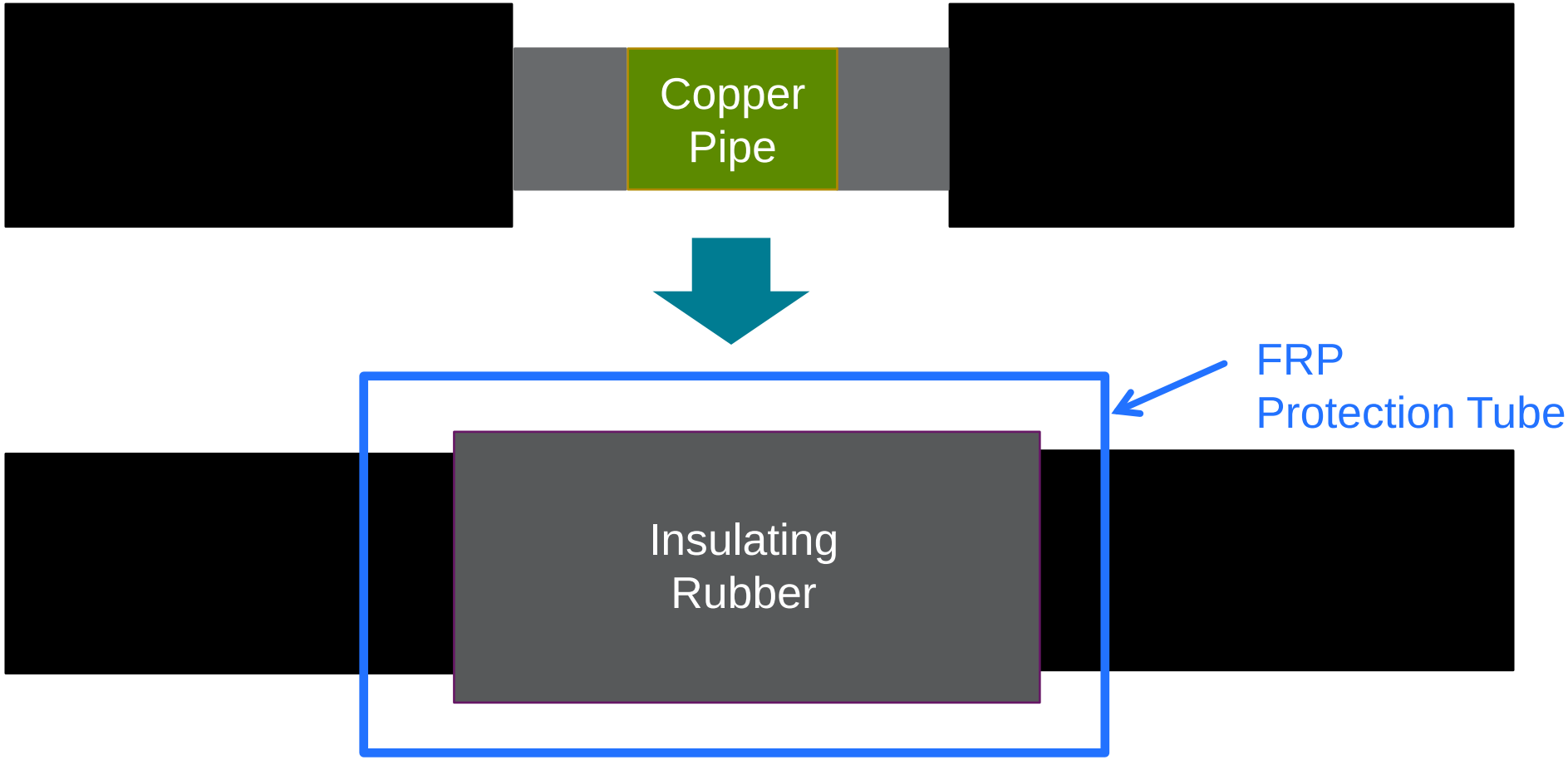
- A large electric company of Country I, Company J completed a 5.9km underground electric line (duct line system) in City K, in October 20xx.
- Company J prioritized price over the compatibility between a cable and a joint (joint that conforms to cable specifications) when purchasing materials to be used in the underground electric line.
- Company J independently conducted the construction and a test of the underground electric line, and the power distribution commenced in October 20xx.
- As Company J only had a maintenance department and did not possess specific know-how on the construction of electric lines, it can be assumed that the objective of independently designing and constructing the electric line was merely for cost reduction.

Case Study 3:
Image of a joint (1)



- A joint is a material used at a connecting point to connect two cables. An electric cable is inserted into the copper pipe from each side and swaged by squashing the copper pipe.

Case Study 3:
Image of a joint (2)



- The joint tends to be a weak point in the underground electric line as the durability is low compared to other parts.

Case Study 3:
Overview of the Problem

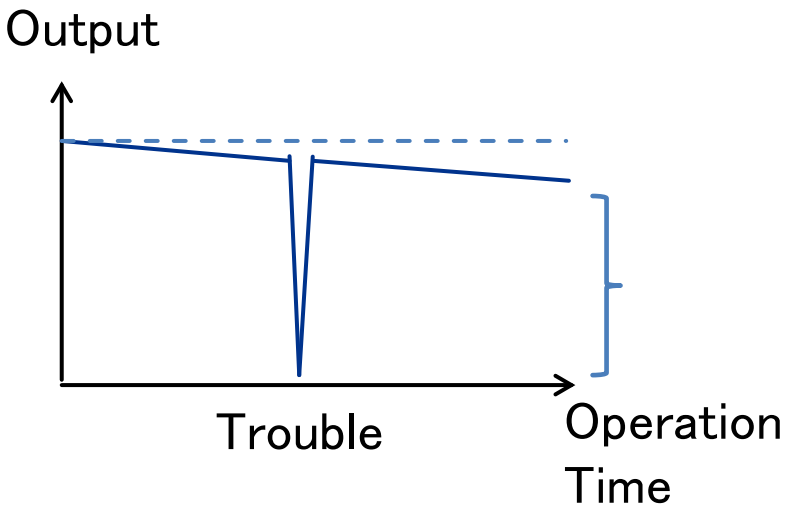
- Five large scale blackouts have occurred to date, including the one immediately after the start of power distribution, which caused significant damage to both City K and Company J.

  （1st blackout） 20xx/October （immediately after the start of power distribution）
  （2nd blackout） 20xx/December
  （3rd blackout） 20yy/February
  （4th blackout） 20yy/April
  （5th blackout） 20zz/February

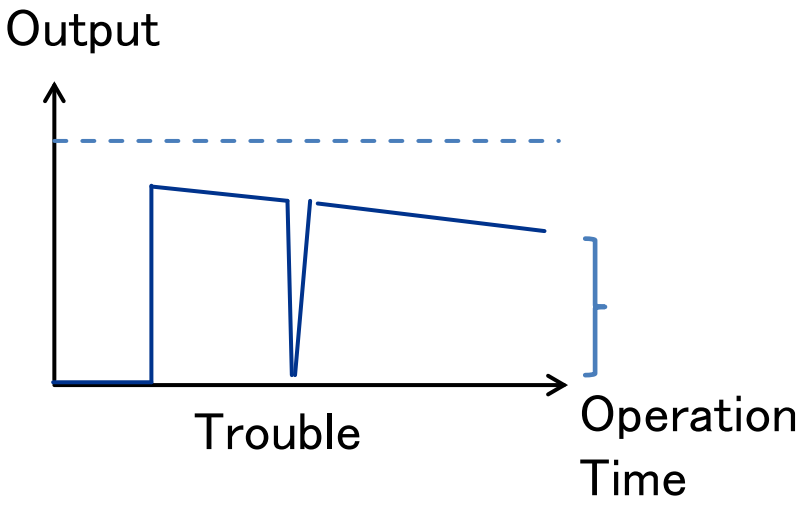
- The cause of all the blackouts was corruption of the joint.

Case Study 3:
Problems of the Electric Power Infrastructure

Ideal Capacity



Case 3 (Capacity)



- Blackout and disconnection of cables immediately after the start of power distribution
- Low operation rate

Case Study 3:
Cause of the Problem

- The number of joints required was significantly greater than the number of ordinary transmission lines due to the poor design of the underground structure.
- The joints were damaged as the joints/terminals were not suitable for the cable.
- The joints should have been protected by asphalt etc. due to its low water resistance. However, no water proof measures were taken.
- Sufficient working space/time was not obtained due to the inadequate design of the pipe line/manhole, and various issues occurred, such as workers partially omitting construction procedures of joints and failure to maintain sufficient working environment (lighting, temperature, humidity).

Case Study 3:
Observation by KPMG (1)

Items the ordering party (Company J) could have considered

- The cost incurred due to blackouts exceeded the total cost initially anticipated as a result of focusing on initial cost reduction. Therefore, Company J could have compared the cost of multiple plans incorporating the risk of failure from independently conducting design/construction at the planning stage.
- Company J could have procured transmission line products/design/construction in bulk from a party with knowledge on transmission lines.

Case Study 3:
Observation by KPMG (2)

Lessons learnt from the case study

- The ordering party could order products/design/construction of transmission lines in bulk from a party with knowledge on transmission lines to ensure stable supply of electricity.
- The ordering party could set engineer/experience requirements in order to ensure commencement of electric supply as scheduled.
- The ordering party could consider not only the initial cost, but the compatibility of transmission facilities in order to minimize life cycle cost.

Thank you very much for listening

- We have discussed our insights on what an ordering party could have considered at procurement and lessons learnt from each of the case studies
- Please discuss your opinions, insights and comments on the case studies