

Health & Safety Executive
Chemical and Hazardous Installations Division
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For the attention of Ms J Haswell

Dear Madam,

Corrosion of Pipelines due to induced A.C.

We are writing to advise you that a major UK cross country pipeline has recently sustained severe and rapid corrosion damage, as a result of alternating current induced on the pipeline from nearby overhead high voltage transmission lines.

The damage was detected following an inspection using a magnetic flux leakage intelligent pig.

Cathodic protection monitoring (including close interval potential surveys CIPS) did not reveal a corrosion problem.

In the light of the foregoing we believe it would be prudent for pipeline operators to assess the risk of a.c. corrosion damage to their existing pipelines and, where necessary, install mitigation measures.

The attached document provides further information on the subject and suggests a strategy for avoiding pipeline corrosion damage due to induced a.c.

Yours faithfully,



HM Inspector of Health & Safety
Pipelines & Gas Team

Corrosion of Pipelines due to induced A.C.**Introduction:**

Until recently a.c. corrosion of pipelines had not been reported in the UK, although it has been experienced elsewhere in Europe and in Canada.

Pipelines at risk are those where part of the length runs parallel to overhead high voltage transmission lines.

Parameters:

Published literature suggests there is current density threshold value of 20 amp m⁻², below which a.c. corrosion will not occur .

The a.c. current density at a coating defect is proportional to the a.c. potential and inversely proportional to the soil resistivity and coating defect diameter.

It follows that higher current densities will occur at small coating defects in low resistivity soils.

It has been found that the amount of induced a.c. on affected pipelines fluctuates substantially. On the particular pipeline where severe a.c. corrosion was experienced, peak current densities occurred (400 amp m⁻²) in the hours between 0100hr and 0500hr.

Measurements:

A.C. current density can be measured by the use of steel coupons buried near the pipeline in conjunction with dataloggers.

It has been found that the optimum area of bare steel coupon for this work is 1cm².

Mitigation:

To reduce the amount of induced a.c. on an affected pipelines it is necessary to "ground" it.

This should be done in a way that will not compromise cathodic protection levels.

The installation of lengths of buried zinc ribbon connected to the pipeline at above ground test facilities, has been found to be effective in reducing induced a.c. to a minimum level.

On the corroded pipeline two 150 metre lengths of zinc ribbon were installed in the affected area resulting in a dramatic reduction in a.c. current density .

Recommendations:

1. undertake resistivity measurements in areas where pipelines have been or are to be constructed near and parallel to overhead power lines;
2. in such areas where low resistivities are observed, install buried test coupons with conventional cathodic protection test facilities to enable monitoring of a.c. current density. The recommended exposed surface area for the coupon is 1 cm². (This is much smaller than the coupons used by Transco which have an exposed surface area of 6.25 cm²);
3. install mitigation in the form of buried zinc ribbon where significant a.c. current densities are observed; 4. continue to monitor to ensure mitigation is effective; 5. revisit the on line inspection programmes for affected pipelines and amend to reflect the increased risk of damage.