EUROPEAN COMMISSION
DG-JRC – Institute for Advanced Materials
Joint Research Centre

ASSESSMENT OF THE ISI SIMULATION PART OF THE ENIQ PILOT STUDY

December 1999 ENIQ Report nr. 17 EUR 19025 EN

Approved by the Steering Committee of ENIQ

Directorate-General
Joint Research Centre

Published by the
EUROPEAN COMMISSION

Directorate-General
Telecommunications, Information, Industries and Innovation

L-2920 LUXEMBOURG

LEGAL NOTICE

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information.

Catalogue number: CD-NA-19025-EN-C

Printed in the Netherlands

CONTENTS

Contents 1

1. Scope 2

2. Applicable documents 2

3. Results obtained for the fatigue defects 4

3.1 Components and defects 4
3.3 Conduct of the ISI simulation 6
3.4 Assessment of the obtained inspection results 7
3.5 Conclusions 8

4. Results obtained for the “IGSCC” defects 9

4.1 Test pieces and defects 9
4.2 Conduct of ISI simulation for the 1st set of test pieces containing “IGSCC” type defects 13
4.3 Assessment of the obtained inspection results 13
4.5 Conclusions 14

5. Comparison between qualification trials and ISI trials (1st set) 15

6. Conclusions 18

1. SCOPE

The purpose of the first ENIQ pilot study was to verify he feasibility of the European methodology and to explore ways of how to apply this methodology. During the pilot study the European methodology was applied to a very specific inspection example. The main steps of the pilot study consisted of qualifying the inspection of an austenitic pipe to pipe weld through a combination of technical justification and practical trials and then applying the qualified inspection to test pieces representing the actual component. The latter inspections simulate the in service inspection. Comparison of the data obtained during qualification with that from the "ISI" provides evidence for the effectiveness of the qualification. Therefore it is important that the results obtained in the blind and open qualification trials on the one hand and in the ISI trials on the other hand, were consistent with each other, independently of whether the inspection results themselves were good or bad.

Two sets of ISI assemblies were inspected: a first set which is very similar to the qualification test pieces and second set which is not.

In this report the results are reported on the first set of ISI assemblies, which is, as mentioned before, very similar to the qualification test pieces (materials used, structure and defects inserted). The 2nd set of ISI specimens was removed from American Boiling Water Reactors (BWR). However, as a result of the pilot study, it has now been appreciated that the defects in these specimens offer a valuable and unique opportunity to collect data about real IGSCC and its ultrasonic response. Consequently, it has been decided to carry out extensive further measurements on these samples before they are sectioned. As a result, there is no precise knowledge of the nature or size of the defects in these particular test pieces. The results on this second set will be reported later once the destructive examination results are known.

2. APPLICABLE DOCUMENTS

The following documents were used during the assessment:

- European methodology for qualification of NDT, EUR EN 17299, Published by the European Commission, Brussels-Luxembourg, 1997
- QA programme (first ENIQ pilot study), ENIQ Report 8, EUR 18112 EN, Published by the European Commission, Brussels-Luxembourg, 1998
- Input information (first ENIQ pilot study), ENIQ Report 7, EUR 18111 EN, Published by the European Commission, Brussels-Luxembourg, 1998

- Qualification procedure (first ENIQ pilot study), ENIQ Report 9, EUR 18113 EN, Published by the European Commission, Brussels-Luxembourg, 1998
- ENIQ.PILOT(96)8: Detailed description of the qualification test pieces
    - Part I: test pieces used for the open trials (draft of 25 April 1997)
    - Part II: test pieces used for the blind trials (under preparation)
- Results of the destructive examination of the ENIQ pilot study: defect catalogue, ENIQ Report 19, EUR 19024 EN, Published by the European Commission, Brussels-Luxembourg, 1999
- Assessment of the results of the qualification part of the pilot study (post-destructive examination), ENIQ Report 16, EUR 19023 EN, Published by the European Commission, Brussels-Luxembourg, 1999

It is important to mention also the final report on the pilot study in which all the results achieved during the ENIQ pilot study are summarised (ENIQ Report 20, EUR 19026 EN).

3. RESULTS OBTAINED FOR THE FATIGUE DEFECTS

3.1 COMPONENTS AND DEFECTS

Two components, ENIQ test piece 11 and 13, were used for the simulation of the ISI inspection.

In Table 1 an overview is given of the essential parameters identified for the components and to which extent the ISI components are within the tolerance/range given for the different essential parameters.

ENIQ test piece 11 contained 1 real fatigue crack. ENIQ test piece 13 did not contain any defects at all. Information on the dimension of the real fatigue crack can be found in Table 2.

Table 1: Overview of extent to which the first set of ISI specimens are within the range/tolerance of the identified essential parameters (case of fatigue cracks)

Essential parameters component	Range	Extent to which test pieces are within variation of essential parameters
Geometry of component	No, double sided access	All straight tubes
Weld crown configuration	Less than 1.5 mm over a surface of 50 mm x 50 mm	Test pieces within these limits
Weld root	Length: 0-30 mm Protruding part: maximum 4 mm	• ENIQ 11: ground, presence of buttering used to introduced fatigue crack • ENIQ 13: not ground (within limits as given)
Wall thickness	13.5 - 30 mm	Wall thickness considered: ENIQ 11:28 mm ENIQ 13: 28 mm
Pipe diameter	320- 700 mm	Diameters considered: • 407 mm (2 x)
Counterbore taper angle	< 30 °	• ENIQ 11: taper angle in some location larger than 30° • ENIQ 13: within tolerance given
Position counterbore with respect to weld center line	Between 5 and 180 mm	• Case of 180 mm considered in 2 assemblies • Counterbore geometry in ENIQ 11 very irregular as compared to other test pieces
Macrostructure base material	Similar base material as qualification test pieces	
Macrostructure weld material	Similar welding procedure as qualification test pieces	

Table 2: Dimensions of fatigue crack (normal weld) present in test piece 11 used for the ISI simulation (1st set of ISI specimens)

Defect number	Type of defect	Defect position in weld	Through-wall extent (mm)	through-wall extent (% of wall thickness)	Length (mm)
11.1	Fatigue crack	Weld	13	48	73

The fatigue crack had a tilt and skew angle of 0º. Destructive examination learned that the defect consisted of 2 parallel parts of which one is longer than the other. Furthermore, there was also still the presence of a buttering layer of about 1 mm. This buttering layer is the remnant part of a buttering in which a starter notch for the fatigue crack has been introduced. This buttering was not completely removed after introduction of the fatigue crack and is clearly visible on the ultrasonic images.
It should be mentioned that the manufacturer had quite some problems with the introduction of the fatigue cracks in this test piece. Originally the Reference Laboratory had asked for 2 fatigue defects in ENIQ test piece 11. However the presence of the second fatigue crack could not be confirmed by destructive examination. Also the inspection teams did not report any indication corresponding with this second fatigue crack.
As already mentioned the characteristics of the counterbore area of ENIQ 11 are very different from what was done for all the other test pieces by the same manufacturer. This is probably due to the fact that additional machining was performed in order to remove the buttering used for the starter notch of the fatigue crack.

3.3 CONDUCT OF THE ISI SIMULATION

The inspection for the 1st set of ISI specimens was conducted in 2 times. ENIQ 10, 12 and 13 were inspected in the period of from 24/3/97 till 27/3/97 and from 7/4/97 till 10/4/97. ENIQ 11 (due to the late delivery time) was inspected from 21/1/98 till 29/1/98. The inspection was performed by the following persons:

- Team leader and overview of inspection activities (data acquisition and data interpretation): B. Eriksen (level III ultrasonics), JRC Petten
- Data acquisition and data interpretation: G.-P. Battagin, JRC Petten

The ISI simulation was continuously invigilated by H. Lohner (JRC Petten). A log book was kept in which all activities are noted. Here follows an overview of the sequence of events during the ISI smulation (1st set):

- 24/3-25/3: ENIQ 10, detection and sizing
- 25/3-27/3: ENIQ 12, detection and sizing
- 7/4-10/4/97: ENIQ 13, detection and sizing
- 21/1/-29/1/98: ENIQ 11, detection and sizing

3.4 ASSESSMENT OF THE OBTAINED INSPECTION RESULTS

Detection

The fatigue crack was correctly detected. The inspection team also correctly characterised the defect by stating that it was multi-branched.

False calls

No false calls were made by the inspection team in ENIQ test piece 13, that did not contain any defects.

However the inspection team reported 2 relatively long indications in ENIQ test piece 11 with a through-wall extent of 4 and 9.5 mm, respectively. The specific geometry of the counterbore of ENIQ test piece 11 is very different from those present in the other test pieces. Its shape is very irregular and the surface is rough, which is probably the cause of reflections which were misinterpreted by the inspection team as defects. This is very clear when comparing the ultrasonic signals coming from the counterbore of ENIQ 11 with those observed on other test pieces.

The fact that false calls were made on this assembly during the ISI simulation can be attributed to the fact that the counterbore of ENIQ 11 is completely different from those of the qualification test piece. The problem revealed here is hence not one of the European methodology but rather one of correct input information. Two questions arise here:

- Does the the counterbore geometry of ENIQ 11 falls within the range/tolerance of counterbore essential input parameters which have been defined?
- Have the correct essential input parameters for the counterbore been considered in the input information?

Irregular shape or rough counterbore surface seem to be parameters which affect more significantly the inspection performance than the taper angle. It is clear that the geometry of the counterbore of ENIQ 11 was not considered in the qualification trials.

Depth sizing

The inspection team reported a through-wall extent of 13.8 mm which can be considered as a satisfactory result when compared with the through-wall extent of 13 mm measured by destructive examination.

Length sizing

The inspection team gave for the fatigue crack a length of 125 as compared to the 73 mm measured by destructive examination. The error made of 52 mm is relatively large. Further investigation after the ISI trials of the ultrasonic signal used to measure the crack length learned that the defect signal can be subdivided in 2 parts. There is a very clear indication, the length of which as measured by ultrasonics is 82 mm.

However, next to this indication, along the weld center line, there are a number of intermittent smaller indications which the inspection team grouped together with the large "defect" signal as one indication. The origin of these smaller indications is not completely clear but has most probably to do with the defect manufacturing method used. They can certainly not come from the weld root as it was removed when the buttering layer was machined away.

3.5 CONCLUSIONS

Although the detection and depth sizing criteria were met during the ISI simulation for the fatigue type defects that was not the case for length sizing and false calls:

- two false calls were made in the counterbore area of one of the ISI test pieces (ENIQ 11)
- the length of the fatigue crack was oversized significantly

The fact that 2 false calls were made in ENIQ 11 can be attributed to the fact that the specific geometry of the counterbore of this test piece is completely different from that of the other test pieces.

The problem revealed here is hence not one of the European methodology but rather one of incorrect input information.

The inspection team gave for the fatigue crack a length of 125 as compared to the 73 mm measured by destructive examination. The error made of 62 mm is relatively large. The origin of a number of smaller indications next to the main indication corresponding with the fatigue crack is not completely clear but has most probably to do with the defect manufacturing method used..

Note that the obtained inspection results for the fatigue type defect during the ISI trials are conservative and are not safety significant. The discrepancies observed between the

qualification and ISI trials can be attributed on the one hand to an incorrect definition of the input information for what concerns the counterbore and on the other hand to (probably) the defect manufacturing method used to introduce realistic fatigue cracks. They are not due to application of the European methodology in one way or the other.

4. RESULTS OBTAINED FOR THE "IGSCC" DEFECTS

4.1 TEST PIECES AND DEFECTS

In total 7 defects, simulating "IGSCC" type defects, and introduced in 2 different assemblies (ENIQ 10, ENIQ 12) were used for the 1st set of ISI specimens.

In Table 3 an overview is given of the essential parameters identified for the components and to which extent the ISI components are within the tolerance/range given for the different essential parameters.

Table 3: Overview of extent to which ISI components are within the tolerance/range given for the different essential parameters

Essential parameters component	Range	Extent to which test pieces are within tolerance essential parameters
Geometry of component	no, double sided access	OK
weld crown configuration	Less than 1.5 mm over a surface of 50 mm x 50 mm	test pieces within these limits
weld root	not ground; length: 0-30 mm protruding part: 4 mm	test pieces are within these limits
wall thickness	13.5 - 30 mm	Wall thickness considered: 25 mm (2x)
pipe diameter	320- 700 mm	Diameters considered: 320 mm (2x)
Counterbore taper angle	< 30 °	ENIQ test piece 10: no counterbore ENIQ test piece 12: short counterbore
Position counterbore with respect to weld center line	Between 5 and 180 mm	Case of 6 mm considered in ENIQ test piece 11
Macrostructure base material	Same as qualification test pieces for “IGSCC” type defects	
Macrostructure weld material	Same welding procedure and weld repair method as the one used for qualification test pieces	ENIQ 10: same manufacturer as ENIQ test piece 9 ENIQ 12: same manufacturer as ENIQ test piece 1 and 2

Information on the dimensions of these defects can be found in Table 4.

Table 4: Defects used to simulate “IGSCC” type defects, present in the test pieces used for the 1st set of ISI specimens

Defect number	defect type	Position	through-wall extent (% of wall thickness)	Through-wall extent (mm)	length (mm)
10.1	“IGSCC”	Weld	91	22.9	62
10.2	“IGSCC”	Weld	21	5.3	51
10.3	“IGSCC”	Weld	46	11.6	42
10.4	“IGSCC”	Weld	77	19.6	52
12.1	“IGSCC”	Weld	24	6	23
12.2	“IGSCC”	Weld	50	12.2	30
12.3	“IGSCC”	Weld	66	15.9	49

Note that ENIQ 9 (blind trials) and 10 were fabricated by the same manufacturer and that ENIQ 12 was fabricated by the same manufacturer as ENIQ 1 and 2. The results of destructive examination of these defects can be found in the defect catalogue (see section 2) but they are very similar to what was found for the qualification test pieces.

In Table 5 an overview is given of the essential parameters identified for the defects and to which extent the defects in the ISI components are within the tolerance/range given for the different essential parameters.

Table 5: Overview of extent to which variation of essential defect parameters was covered with the “IGSCC” type defects introduced in the 1st set of ISI specimens

Essential parameters defects	Range	extent to which test pieces are within tolerance defined for the essential parameters
defect size	3 mm - 100 % TWE	OK
defect position along TWE	not relevant for “IGSCC” as they are all surface-breaking	-
defect position with respect to weld center line	weld	OK
tilt angle	0-30 °	worst case is 0° all defects are at 0°
skew angle	±10 °	all defect are at 0°
Roughness of “IGSCC” type defects		Similar as in qualification test pieces
Branching of “IGSCC” type defects		Similar as in qualification test pieces

In Table 6 the different limit cases are given for the defects, which were identified as a result of the technical justification.

Table 6: Different limit cases for the “IGSCC” type defects, considered in the 1st set of ISI specimens

different limit cases for “IGSCC”	Requirement	Situation for 1st set of ISI specimens
detection “IGSCC” : small size	At least 2 defects with size < a_{100}	Size < a_{100}: 2 a_{100} < size < a_{qual} : 1 size > a_{qual}: 4
detection “IGSCC” : • Tilt of 0° • Skew ± 10°	At least 2 defects of each case	tilt: 4 at 0° skew: all 0°
sizing “IGSCC” : small and large size	At least 2 defects with size < a_{100} At least 2 defects with size > a_{qual}	Size < a_{100}: 2 a_{100} < size < a_{qual} : 1 size > a_{qual}: 4

4.2 CONDUCT OF ISI SIMULATION FOR THE 1ST SET OF TEST PIECES CONTAINING "IGSCC" TYPE DEFECTS

The inspection of the components (ENIQ 10 and 12) containing "IGSCC" type defects was conducted in conjunction with that of ENIQ 11 and 13 (see section 3.2).

4.3 ASSESSMENT OF THE OBTAINED INSPECTION RESULTS

Detection

All defects were detected.

False calls

No false calls were made in either ENIQ test piece 10 or 12.

Depth sizing

In Table 7 a summary is given for the depth sizing performance achieved for the "IGSCC" type defects.

Table 7: Depth sizing performance for the "IGSCC" type defects, achieved during the ISI simulation trials (1st set)

Defect Number	Reference TWE	Measured TWE (mm)	Sizing error (mm)	Remarks
10.1	22.9	19.9	- 3.0	Probably signal from defect
10.2	5.3	13	+ 7.7	Signal from implant
10.3	11.6	14.8	+ 3.2	Signal from implant
10.4	19.6	17.9	- 1.7	Probably signal from defect
12.1	6.0	7.9	+1.9	Probably signal from defect
12.2	12.2	16.6	+4.2	?
12.3	15.9	16.1	0.2	Probably signal from defect

The oversizing results made for defects 10.2 and 10.3 can be attributed to the implant. The large sizing error made for defect 12.2 can not be readily explained.

None of the defects was undersized by more than 25 % of the wall thickness.

The RMS error considering all defects is 3.8 mm. The RMS error is 4.5 mm considering only the defects of ENIQ test piece 10 and is 2.4 mm considering only the defects of test piece 12.

Length sizing

The length sizing results obtained for the 1st set of ISI specimens containing “IGSCC” type defects are summarised in Table 8. The corresponding RMS error is 15.6 mm. Considering only test piece 10 the RMS error is 14.0 mm. Considering only test piece 12 the RMS error is 17.5 mm.

Table 8: Length sizing performance for “IGSCC” achieved during ISI simulation (1st set of ISI specimens)

Defect	Reference length (mm)	Measured length (mm)	Sizing error made (mm)
10.1	62	66	+ 4
10.2	51	49	- 2
10.3	42	68	+ 26
10.4	52	42	-10
12.1	23	36	+ 13
12.2	30	41	+ 11
12.3	49	74	+ 25

4.5 CONCLUSIONS

For what concerns the IGSCC type defects all ISI objectives were met during the qualification and ISI trials except for depth sizing.

For depth sizing no undersizing errors were made larger than 25 % of the wall thickness. The RMS error criterion was, however, in general not met.

The fact that the RMS error criterion was not met can most probably be attributed to the defect manufacturing method used for the IGSCC type defects.

5. COMPARISON BETWEEN QUALIFICATION TRIALS AND ISI TRIALS (1ST SET)

An overview of the extent to which the ISI objectives were met during qualification and ISI simulation is given in Table 9 for what concerns the fatigue defects and in Table 10 for what concerns the “IGSCC” type defects.

Table 9: Overview of the extent to which the ISI objectives were met during qualification and ISI simulation for the fatigue defects

Requirement	Technical justification	Open trials	Blind trials	ISI
100 % detection rate or defects exceeding 25 % TWE	Evidence given: • PISC III trials • Limited laboratory trials	OK (12 out of 12)	OK (11 out of 11)	OK 1 out of 1
80 % detection rate for defects between 3 mm and 25 % TWE	Evidence given: • PISC III trials • Limited laboratory trials	OK (1 out of 1)	OK (1 out of 1)	No such defects present
Maximum undersizing permitted is 25 % TWE or 5 mm	Limited evidence on depth sizing given	OK	OK	OK
RMS error for depth sizing < 3 mm	Limited evidence on depth sizing given	OK RMS = 1.9 mm	OK RMS = 1.6 mm	Absolute depth sizing error = 0.8 mm
RMS error for length sizing < 20 mm	No evidence given as amplitude drop methods are commonly used methods for length sizing	OK RMS = 7.4 mm	OK RMS = 6.0 mm	Absolute length sizing error is 62 mm
false calls	• Not treated explicitly in technical justification • A lot of effort was devoted to optimising decision tree for detection/sizing	OK	OK	- 2 false calls in counterbore of ENIQ 11 - geometry of counterbore of ENIQ 11 not considered during qualification

Table 10: Overview of the extent to which the ISI objectives were met during qualification and ISI simulation for the “IGSCC” type defects

Requirement	Technical justification	Open trials	Blind trials	ISI		
				all	ENIQ 10 (similar to test piece used for blind trials)	ENIQ 12 (similar to test piece for open trials)
100 % detection rate for defects exceeding 25 % TWE	Evidence given: • PISC III trials • Limited laboratory trials	OK, 3 out of 3	OK, 3 out of 3	OK (5 out of 7)	OK (3 out of 3)	OK (2 out of 2)
80 % detection rate for defects between 3 mm and 25 % TWE	Evidence given: • PISC III trials • Limited laboratory trials	OK, 1 out of 1	OK, 1 out of 1	OK (2 out of 2)	OK (1 our of 1)	OK (1 out of 1)
Maximum undersizing permitted is 25 % TWE or 5 mm	Limited evidence on depth sizing given	OK	OK	OK	OK	OK
RMS error for depth sizing < 3 mm	Limited evidence on depth sizing given	Not met RMS = 4.4 mm	Not met RMS = 4.6 mm (implant) RMS = 1.8 mm (defects)	Not met RMS = 3.8 mm	Not met RMS error = 4.5 mm (implant)	Met RMS error = 2.4 mm
RMS error for length sizing < 20 mm	No evidence given as amplitude drop methods are commonly used methods for length sizing	OK RMS = 19.6 mm	OK RMS = 11.6 mm	OK RMS error = 15.6 mm	OK RMS error = 14.0 mm	OK RMS error = 17.5 mm
false calls	• Not treated explicitly in technical justification • A lot of effort was devoted to optimising decision tree for detection/sizing	OK	OK	OK No false calls	OK No false calls	OK No false calls

6. CONCLUSIONS

One of the major objectives of the pilot study was to verify the feasibility of the inspection qualification principles as given in the European methodology.

During the pilot study the European methodology was applied to a very specific inspection example. The main steps of the pilot study consisted of qualifying the inspection of an austenitic pipe to pipe weld through a combination of technical justification and practical trials and then applying the qualified inspection to test pieces representing the actual component. The latter inspections simulate the in service inspection. Comparison of the data obtained during qualification with that from the "ISI" provides evidence for the effectiveness of the qualification.

In this report the results are reported on a first set of ISI assemblies, which is very similar to the qualification test pieces (materials used, structure and defects inserted)

A 2nd set of ISI specimens that were removed from American was also inspected. However as a result of the pilot study, it has now been appreciated that the defects in these specimens offer a valuable and unique opportunity to collect data about real IGSCC and its ultrasonic response. Consequently it has been decided to carry out extensive further measurements on these samples before they are sectioned. As a result, there is no precise knowledge of the nature or size of the defects in these particular test pieces.

The purpose of the ENIQ pilot study was to verify the feasibility of the European methodology. Therefore it was important that the results obtained in the blind and open qualification trials on the one hand and in the ISI trials, obtained on a set of ISI specimens made using the same welding methods as the qualification test pieces, on the other hand, were consistent with each other, independently of whether they were good or bad.

In most cases it was demonstrated that the inspection personnel, procedure and equipment met the inspection and qualification objectives set. This was confirmed by the results obtained in the inspection of the 1st set of ISI specimens.

In case of depth sizing of the IGSCC type defects it was not possible to meet the RMS criteria. This was the case during the open and blind trials and was confirmed during the ISI trials. The problems observed for depth sizing of the IGSCC type defects can be attributed to the defect manufacturing methods used

There were 2 cases where the results between the qualification trials and the ISI trials were not consistent.
The first case concerns different inspection results due to the geometry of the counterbore which was completely different in one of the ISI test pieces as compared to that found in all other test pieces (both ISI and qualification). This difference observed between the qualification and ISI trials can therefore be attributed to an incorrect definition of the input information. This shows the need to identify all essential parameters for a particular inspection and to ensure that test piece design takes account of these.
The second case where a difference has been observed between qualification and ISI trials concerns the length sizing problems observed for the fatigue defect, which could be attributed to the defect manufacturing method.

Finally, it can be concluded that the results obtained in the framework of this pilot study show that the European methodology is a satisfactory basis for qualification. The consistent results obtained during qualification and ISI trials demonstrate this. The problems which were observed were not due to inherent weaknesses of the European methodology but could be attributed to differences in test piece features of significance to NDT from those of the real components to be inspected (incorrectly defined input information) and the specific defect manufacturing methods used. These problems would have arisen also with other qualification methods.

The major conclusion one can draw for these ISI trials is that the inspection results are consistent with the results achieved during the qualification trials which provides evidence for the effectiveness of the qualification approach followed.

EUROPEAN COMMISSION
EUR 19025 EN 19 pages

Editors: P. Lemaitre, B. Eriksen, M. Melbi

Luxembourg: Office for Official Publications of the European Communities

1999 – 19 pag. – 21.0 x 29.7 cm

Physical sciences

EN

Catalogue number: CD-NA-19025-EN-C

Copies of this ENIQ report can be obtained by writing to the following address:
JRC Petten
Institute for Advanced Materials
P.O. Box 2
NL – 1755 ZG Petten
The Netherlands

ABSTRACT

The present report gives the results of the ISI simulation part of the first ENIQ pilot study. The pilot study has also revealed features of qualification that require further work and the report discusses this. In addition, the pilot study showed the need for a number of Recommended Practices on different aspects of qualification according to the ENIQ Methodology to clarify how it should be carried out. It also provided information on how these should be written.

The Joint Research Centre

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies.

As a service of the European Commission, the JRC functions as a centre of science and technology reference for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, private or national.

The JRC carries out Community research programmes decided by the Council and funded by the European Union budget with additional funding from associated countries. It also provides customer-driven research as scientific and technical support for other Community policies, such as those on the environment, agriculture or nuclear safety. It is involved in competitive activities in order to validate its expertise and increase its know-how in its core competencies. Its guiding line is that of "adding value" where appropriate rather than competing directly with establishments in the Member States.

Five separate sites, located in Belgium, Germany, Italy, The Netherlands and Spain, house the eight JRC institutes, each with its own focus of expertise.

The institutes produce their own Annual Reports, where readers will find more detailed information. The JRC also publishes numerous technical reports and contributes to scientific journals, presents papers to conferences and organises workshops to disseminate its scientific output. Further information can be found on the JRC website: www.jrc.org.