PRACTICAL EXPERIENCE OF MACHINE TRANSLATION
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THE IMPORTANCE OF FEEDBACK FROM TRANSLATORS IN THE DEVELOPMENT OF HIGH-QUALITY MACHINE TRANSLATION

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Until fairly recently, those involved in the design and development of M.T. systems tended to be expert programmers and moderately competent linguists, often with a good working knowledge of several foreign languages, but seldom, if ever, with any first-hand experience of professional translation. Perhaps this explains why M.T. was introduced first and foremost in the area of information scanning where huge lexical data bases in combination with rather rudimentary translation programs provided usable results. However, now that a number of translators have begun to use M.T. as an aid in their day-to-day work, the feedback received from them is proving to be a vital source of information, not only in the correction of present shortcomings but in the further enhancement of systems at all levels.

INTRODUCTION

At the beginning of this year (1981), translators at the Commission's translation division in Luxembourg began making use of Systran machine translations as an aid in their routine work. While many have reacted somewhat negatively to this new approach, the enthusiasm demonstrated by others seems to mark something of a turning point in the interplay between man and machine in this field.

In my analysis today, I should therefore like to examine some of the possible reasons why translators have been so hesitant to turn to the computer for assistance in high-quality translation work despite the fact that M.T. systems have been in operation for a good many years. I shall also give a brief account of the types of feedback received from translators and the vital part it now plays in M.T. development at the Commission.

It is not a primary aim of this conference to describe the workings or mechanics of the systems under consideration. Indeed, a considerable amount of literature has already been published on the subject. But for the purposes of this talk, let me just say that Systran as used by the Commission is a free-syntax batch-operated system covering many subject fields which produces raw machine translations without any human intervention apart from text input.

EARLY DEVELOPMENTS

If we trace back the history of M.T., we find that most of the basic design and development work in the fifties and sixties was carried out by expert computer programmers assisted by a new breed of linguists, soon to be known as computational linguists. However, seldom, if ever, were actual translators involved.

This is perhaps not surprising for a number of reasons. Firstly, the hardware systems available at the time were extremely limited in capacity and performance, with the result that any program had to be carefully adapted to the constraints of the machine. Secondly, in the absence of any dependable high-level computer languages, the programming itself had to be done in

machine language which was virtually incomprehensible to linguists and translators. Thirdly, translators themselves were very sceptical about M.T. in general and it was therefore up to programmers and computational linguists to prove that translation could in fact be handled by computers.

There were, as we all know, many ups and downs in the early days. Large sums of money were invested but for the most part results were very disappointing. Indeed, the publication of the ALPAC report in 1966 with its recommendation that investment in M.T. development should be discontinued seemed to have finally put an end to further progress.

SUCCESS IN INFORMATION GATHERING

Nevertheless a number of individuals remained convinced that machine translation was indeed feasible and one or two of them continued development work privately. In particular, by the late sixties Dr Peter Toma's original Russian-English Systran system was providing extremely useful output for the U.S. Air Force. Soon after, the Logos system started producing satisfactory translations from English into Vietnamese, and a version of the Georgetown system was used to a limited extent by the EC research centre in Ispra.

But all these systems were used primarily for information gathering purposes. The aim was not so much to produce elegant translations for general distribution and publication as to provide experts with a rough-and-ready indication of the topics covered by documents they were unable to read in the original language.

Translators who had the opportunity to examine these early results were almost invariably highly critical of the quality standards reached and some took great delight in compiling lists of particularly hilarious M.T. output. We have all been reminded time and time again of how the Russian saying "Out of sight, out of mind" allegedly produced "Invisible idiot" in English.

Yet the users themselves, above all scientists and technicians working for the U.S. Air Force, reacted quite differently. They continued to put in more and more requests for raw Russian-English machine translations, covering an ever increasing number of subject fields. As a result, the Air Force extended its financing of the Systran Russian-English system, which as time went by was to serve as a prototype for developments covering other language pairs.

The success of these earlier systems undoubtedly lay in the huge machine dictionaries containing hundreds of thousands of technical terms in dozens of subject fields. Yet as computer performance increased, the translation programs were significantly improved, producing an ever more intelligible standard of output.

THE COMMISSION'S INVOLVEMENT

It was indeed this success which encouraged the EC Commission to acquire the Systran system in 1976 for translation from English into French and later from French into English and English into Italian. However, while initial tests seemed to indicate that M.T. could be used for information scanning purposes, as in providing raw translations of databases connected to Euronet, the Commission's primary objective, that of assisting in-house translators in their day-to-day work by providing M.T. printouts for human post-editing, proved to be a much more difficult task.

For example, of those translators who were invited to participate in the

initial development of Systran, all but one left the project after the first two months, either on the grounds that they were unable to understand the technical workings of the system or, more often, because they simply did not believe the standard of output could ever be significantly improved. Then again, despite some rather positive statistics on gains in cost-efficiency documented in evaluations carried out on the Systran system, translators generally opposed the introduction of M.T., maintaining the output provided was simply of no use to them.

Although these reactions were very disappointing at the time - and indeed threatened to jeopardize the entire future of the project - in retrospect they can be understood.

Whereas information scientists had been content with intelligibility, the Commission's translators were far more concerned with the accuracy of a translation. Moreover, even in cases where a machine translation was accurate, in the sense that the meaning of the translation was the same as that of the original, translators had the impression that mistakes in terminology, syntax and, for example, capitalization outweighed any benefits.

Some of these reactions may have been psychological. Seasoned translators could hardly be expected to relish the thought of having to correct errors from the computer which a 10 year-old child would never have made, nor could they be expected to give overwhelming support to a system which, to them at any rate, seemed to pose a real threat to their future.

Yet on closer analysis, it appeared that many of the negative reactions received stemmed from the fact that the quality of the machine output - however intelligible - was simply not suitable for post-editing.

BRIDGING THE GAP WITH TRANSLATORS

A great deal of effort was therefore put into generally upgrading the quality of the systems under development by introducing more terminology, improving the performance of the analysis and synthesis programs and providing easily readable print-outs in upper and lower case. Yet in the absence of any real feedback from translators in the form of post-editing, those of us responsible for quality improvement could only guess at what the real priorities were.

To help us identify these we entrusted Margaret Masterman of C.L.R.U. with a study on the future potential of Systran. One of the most important recommendations which came out of this study was that translators should be provided with full documentation on the system in natural language in order that they could play an active part in its improvement. This recommendation led to a further study by C.L.R.U. to examine the feasibility of automatically transcribing the Systran program from IBM macro into natural English.

The "opening-up of the black box" resulting from this work (which is still in progress) proved to be a major step forward in encouraging translators to take an interest in the system and was paramount in overcoming one of the psychological barriers between the human translator and the machine.

Another study which provided us with a much better idea of translators' requirements was that undertaken by Veronica Lawson on the applicability of Systran to the translation of patents. The strict discipline of working closely with a translator over a number of months led to a better understanding on our part of what was or what was not acceptable and indeed resulted in major improvements. The carefully annotated printouts we received from Mrs Lawson and her colleagues proved to be an excellent source of

feedback, particularly as errors considered to be "serious" were highlighted by colour coding. Finally, the study showed that professional translators were indeed willing and able to make a real contribution to M.T. Moreover, if the system could be adapted to patent translation, there appeared to be no reason why it could not be adapted to the translation of various types of Commission texts.

In 1979 we therefore began using Systran for translating a number of documents originating in our own department. Fortunately, we were able to find one or two "motivated" translators who were happy to post-edit the machine output and advise us on priorities for further quality improvement.

By the beginning of 1981 we were thus in a position to introduce a Systran service for translations from English into French and Italian and from French into English in cases where documents were considered to be suitable for M.T. The aim here was to provide the translator with a raw machine translation on paper which he could either post-edit directly or use as *a* basis for dictating his own translation. In fact, most of the documents were post-edited and returned to us, often with critical comments.

The large quantity of feedback received in this way has proved enormously helpful in adapting the system to the specific needs of translators and now forms the main basis for on-going development. In addition, we have arranged a number of meetings and seminars with the translators involved, designed to explain the workings and limitations of the system to them and to hear their ideas on its further development and use.

FEEDBACK AND ITS USE

Feedback reaches us in many forms. By far the most voluminous kind comes in the form of corrections (or post-edits) made on the raw machine print-out. As the translator is expected to upgrade quality to that normally produced by conventional means, these corrections include everything from punctuation and capitalization to terminology, idiom and style. The average sentence may carry up to four or five changes, many of them minor, but in some cases whole sentences or parts of sentences are retranslated.

The most immediate and direct way in which we can make use of edited printouts is by making additions or alterations to the system's dictionaries. In particular, missing terminology is immediately coded up and introduced into the system at regular intervals. Many of the other errors can also be dealt with at the dictionary level but, of course, some are of a more general nature and are dependent on the translation programs themselves. Efforts are made to add these to the system where possible but great care has to be taken in defining sound linguistic logic in order to avoid unwanted side effects. Finally, there are a number of changes relating to style, paraphrasing and restructuring which are extremely variable from one translator to another and in any case would be very difficult to incorporate in the machine process.

Another extremely useful form of feedback comes in the form of notes from the translator giving his overall assessment of the quality of the output, often with details of the most important missing terminology or with lists of repetitive errors of a general nature. Even the most negative comments are often extremely useful in pinpointing areas requiring further work, if only to render the task of post-editing less irritating for seasoned translators.

However, perhaps the most useful form of feedback for defining development priorities results from discussions with individual translators or groups of translators. Once they become better acquainted with the mechanics of M.T.,

translators are often in a position to make very sensible suggestions as to where we should concentrate our efforts. For example, it has become clear that correct terminology is more important to them than perfect syntax or style whereas in the past we may have tended to overrate syntactic accuracy in the interests of intelligibility.

Among the most irritating phenomena for the translator seem to be the translation of proper nouns and expressions (such as the names of companies), non-recognition of frequently occurring idioms, and errors of elementary style (including choice of articles and prepositions). While these do not necessarily increase post-editing time, they certainly discourage many translators from making use of M.T. and are therefore being eliminated wherever possible.

Finally one of the more general lessons we have been taught during the course of our experience with translators is that the more M.T. output a translator handles, the more proficient he becomes in making the best use of this new tool. In some cases he manages to double his output within a few months as he begins to recognize typical M.T. errors and devise more efficient ways of correcting them. Working hand in hand with translators we are also beginning to gain a better idea of the types of document best suited to the process and of those subject fields on which we should concentrate our terminology work.

CONCLUSIONS

M.T. systems developed for purposes of information gathering are probably not ideally suited to serve as an aid to translators. Designers of new systems should bear this in mind.

If machine translation is to be used for high-quality translation work, it is vital that feedback from translators be incorporated so as to increase the real aid offered by the system.

The recent enthusiasm expressed by a number of Commission translators would indicate that M.T. will, from now on, become an ever more important aid in the human translation process.

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Information Market and Innovation**

Raw SYSTRAN output (E-F, F-E, E-I),

post-edited by Commission translators,

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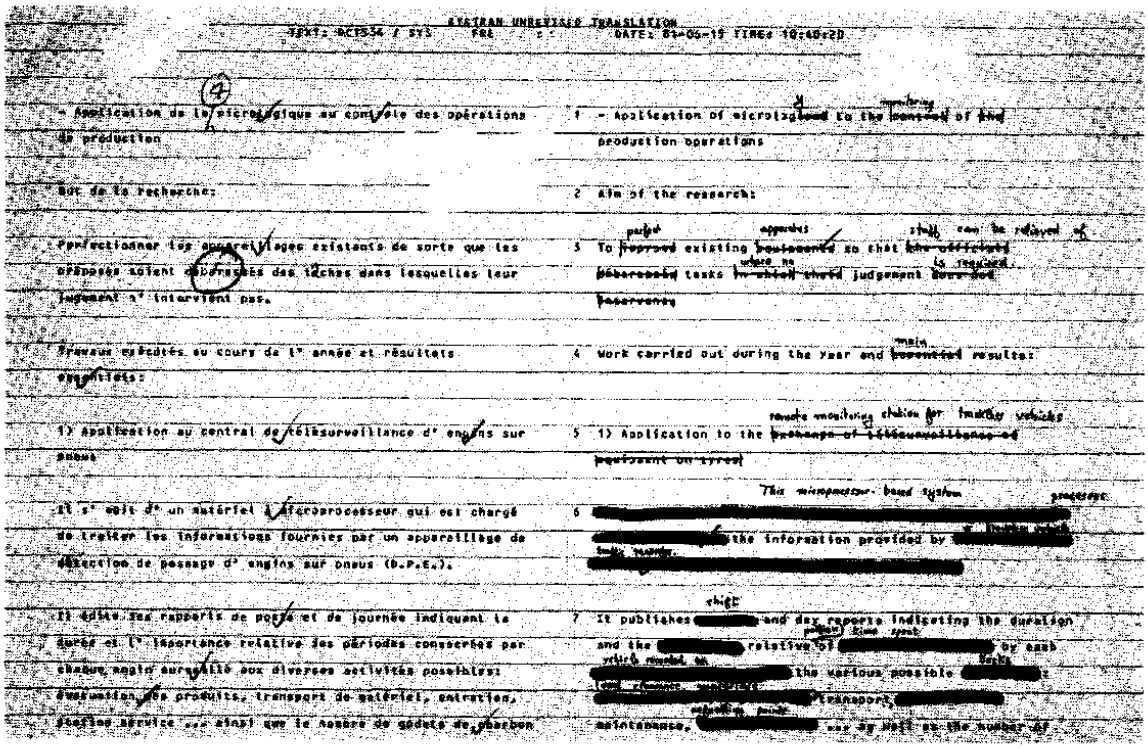
SYSTRAN UNREVISED TRANSLATION
TEXT: DC41U4 / SYS ENG : DATE: 81-07-06 TIME: 09:49:27

$TSE.DC41U4.	1	$TSE.DC41U4.
WATER INFORMATION FOR EUROPE - THE ART AND TECHNOLOGY OF COMMUNICATION.	2	INFORMATIONS SUR L'EAU À L'INTENTION DE L'EUROPE - L'ART ET LA TECHNOLOGIE DE LA COMMUNICATION.
P.J. RUSSELL, DR. W.R. WILKINSON and R.I. ODELL.	3	P.J. RUSSELL, DR W.R. WILKINSON et R.I. ODELL.
Communications Group, Water Research Centre, U.K.	4	Groupe de communications, CENTRE de recherches sur l'eau, ROYAUME UNI
Summary.	5	Sommaire. RESUME
About half a million people are employed in the water industry in the EEC countries.	6	Environ un demi million des personnes sont employées dans l'industrie de l'eau des pays DE LA CEE.
The water industry is thus a major employer with wide-ranging, multidisciplinary information requirements.	7	L'industrie de l'eau est donc ainsi un employeur important ayant des besoins d'information étendus et multidisciplinaires en matière d'information.
Specific and general data bases to meet these requirements now exist on EURONET.	8	Les bases de données spécialisées et générales qui permettent de répondre à ces exigences existent maintenant sur EURONET.
However, many engineers and scientists in the industry are not aware of these data bases and this problem must be overcome before training in use of the systems can begin.	9	Cependant, beaucoup d'ingénieurs et de scientifiques de l'industrie ne sont pas conscients de ces bases de données et le problème doit donc être surmonté (la formation à l'utilisation des systèmes peut commencer).
Advances in communications technology do not necessarily lead to improved communications.	10	Les développements en technologie de communications ne conduisent pas nécessairement à une amélioration des communications.
A description is given of how the Water Research Centre attempts to communicate with other European water institutes to achieve collaboration in research projects and successful literature exchange.	11	Une description est donnée de la façon dont le Centre de recherches sur l'eau essaye de communiquer avec d'autres instituts européens de l'eau pour réaliser la collaboration dans des projets de recherches et l'échange réussi de littérature.
1.	12	1.
THE WATER INDUSTRY.	13	L'INDUSTRIE DE L'EAU.
The water industry of the EEC countries is a large concern in terms of numbers of employers (about 500, 000 in total) and annual turnover (about #1450 million in the U.K. alone).	14	L'industrie de l'eau des pays DE LA CEE est un grand souci en terme des (nombre des employés (environ 500, 000 dans le total) et du chiffre d'affaire annuel (environ 1450 millions de livres sterling pour le seul ROYAUME-UNI seulement).
It is a conservative industry which has not been dependent on highly technological advances.	15	C'est une industrie conservatrice qui n'est pas dépendante des développements hautement technologiques.
Nevertheless it is multidisciplinary in its requirements for information which cover the chemical, biological and engineering sciences as well as management, legislative and	16	Néanmoins elle est multidisciplinaire dans ses besoins en information qui couvrent les sciences chimiques, biologiques et de l'ingénieur ainsi que les aspects de gestion,



SYSTRAN UNREVISED TRANSLATION
TEXT: 8C1534 / SYS FRE
DATE: 81-05-15 TIME: 10:40:20

- Application de la microélectronique au contrôle des opérations de production

- Application of microelectronics to the monitoring of coal production operations

But de la recherche:

Aim of the research:

Perfectionner les appareillages existants de sorte que les ordres soient débarrassés des tâches dans lesquelles leur jugement n' intervient pas.

To improve existing equipment so that the operators are relieved of routine tasks in which their judgment is not required.

Travaux exécutés au cours de l' année et résultats obtenus:

Work carried out during the year and main results:

1) Application au contrôle de télésurveillance d' engins sur chenilles

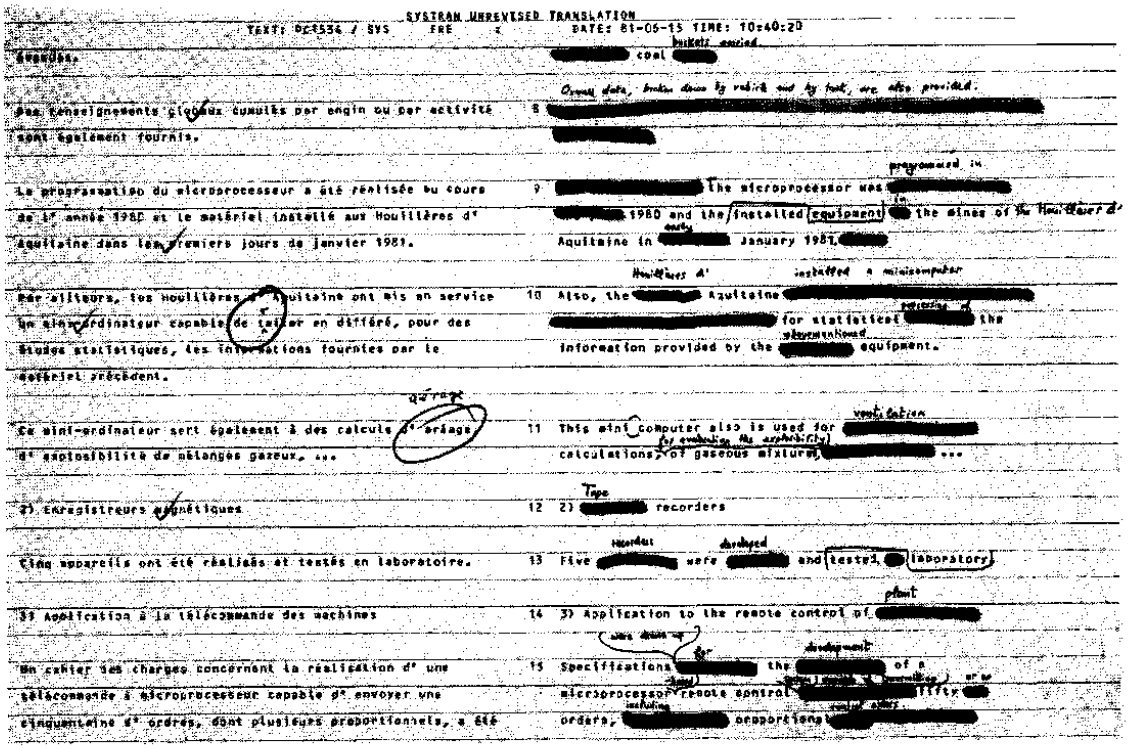
1) Application to the remote monitoring of tracked vehicles

Il s' agit d' un matériel à microprocesseur qui est chargé de traiter les informations fournies par un appareillage de détection de passage d' engins sur chenilles (D.P.E.C.).

This microprocessor-based system is designed to process the information provided by the tracked vehicle detection equipment.

Il édite des rapports de poste et de journée indiquant la durée et l' importance relative des périodes consacrées par chaque engin surveillé aux diverses activités possibles: exploitation des produits, transport de matériel, entretien, service ... ainsi que le nombre de godets de charbon

It publishes shift and day reports indicating the duration and the relative importance of time spent by each vehicle monitored on the various possible activities: coal production, transport of equipment, maintenance, etc., as well as the number of buckets emptied.



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Des renseignements circonstanciés cumulés par engin ou par activité sont également fournis.

Detailed data, broken down by vehicle and by task, are also provided.

Le programmation du microprocesseur a été réalisée au cours de l' année 1980 et le matériel installé aux Houillères d' Aquitaine dans les premiers jours de janvier 1981.

The microprocessor was programmed in 1980 and the installed equipment in the mines of the Houillères d' Aquitaine in early January 1981.

Par ailleurs, les Houillères d' Aquitaine ont mis en service un mini-ordinateur capable de traiter en différé, pour des usages statistiques, les informations fournies par le matériel précédent.

Also, the Houillères d' Aquitaine installed a minicomputer for statistical purposes the information provided by the aforementioned equipment.

Ce mini-ordinateur sert également à des calculs d' abrasivité d' explosibilité de mélanges gazeux, ...

This mini-computer also is used for abrasivity evaluation calculations of explosibility of gaseous mixtures, ...

2) Enregistreurs magnétiques

2) Tape recorders

Cinq appareils ont été réalisés et testés en laboratoire.

Five recorders were developed and tested in the laboratory.

3) Application à la télécommande des machines

3) Application to the remote control of plant

Un cahier des charges concernant la réalisation d' une télécommande à microprocesseur capable d' envoyer une cinquantaine d' ordres, dont plusieurs proportionnels, a été

Specifications were drawn up for the development of a microprocessor remote control capable of sending fifty or so orders, including several proportional orders,

SYSTRAN UNREVISED TRANSLATION
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DC9114.	1 SYSE.DC9114.
INTERNATIONAL SAFEGUARDS VERIFICATION CAPABILITIES AND CONSTRAINTS IN LWR FABRICATION PLANT.	2 CAPACITÀ ED OBBLIGHI INTERNAZIONALI DI VERIFICA DELLE SALVAGUARDIE IN UN IMPIANTO DI FABBRICAZIONE LWR.
A. Rota and R. Simonet (EURATOM / Safeguards Directorate Luxembourg) and P. Boermans (FBFC / Dessel - Belgium).	3 A. Rota e R. Simonet (EURATOM / salvaguardie la direzione Lussemburgo) e P. Boermans (FBFC / Dessel - Belgio).
Abstract.	4 Riassunto.
In the light water reactor cycles two points of paramount importance for the implementation of the international safeguards: the output of the fabrication plants and the input of the reprocessing plants (dissolution and liquor accountancy).	5 Nel ciclo del reattore ad acqua leggera due punti di importanza primaria per l' esecuzione delle salvaguardie internazionali: l' output degli impianti di fabbricazione e l' input degli impianti di ritrattamento (dissolvimento e contabilità del liquore).
In the latter the information generated in the former has to be safeguards relevant.	6 Nell' ultimo sono le informazioni prodotte nel primo punto che devono essere pertinenti per le salvaguardie.
Till to-day no technical means capable to measure directly the whole assembly content are available;	7 Fino ad oggi non sono disponibili mezzi tecnici in grado di misurare direttamente l' intero contenuto degli assemblaggi di elementi di combustibile;
the verification of the relevant nuclear material data, as	8 la verifica dei dati pertinenti del materiale nucleare,

SYSTRAN UNREVISED TRANSLATION
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declared by the operator, is obtained through indirect inspector's activities.	8 dichiarata dall' operatore, è ottenuta attraverso le attività di ispettori indiretta.
One of the possible practical approaches, suggested by the above mentioned situation, is described on the basis of a real case, taken as significative example.	9 Uno degli approcci pratici possibili, suggerito dalla situazione sopra citata, è descritto sulla base di un caso reale preso come esempio significativo.
Some inspection activities, capable to provide elements of judgement to assess the credibility of the operator's data concerning the fabricated assemblies, have been envisaged.	10 Alcune attività di ispezione, capaci di fornire gli elementi di giudizio per valutare la credibilità dei dati dell' operatore riguardo agli assemblaggi fabbricati, sono state previste.
They have been designed in the respect of the limitations imposed by the international safeguards agreement.	11 Sono stati concepiti nel rispetto delle limitazioni imposte dall' accordo di garanzia internazionale sulle salvaguardie.
1.	12 1.
Introduction.	13 Introduzione.
The LWR fuel cycle includes two points which are of crucial importance for safeguards implementation.	14 Il ciclo del combustibile LWR include due punti che sono di importanza fondamentale per l' esecuzione delle salvaguardie.
They are the output of fuel fabrication plants and the input of reprocessing facilities.	15 Sono l' output degli impianti di fabbricazione del combustibile e l' input degli impianti di ritrattamento.
In fact these points represent respectively the last physical verification possibility for the nuclear material	16 Infatti questi punti rappresentano rispettivamente l' ultima possibilità fisica di verifica per il materiale