

NILU : OR 12/97  
REFERANSE : N-90043  
DATO : MARS 1997  
ISBN : 82-425-0858-5

**FoU Bygningsforvaltning –  
internasjonalt engasjement  
Årsrapport 1996**

**Svein E. Haagenrud**

## Forord

NILUs internasjonale engasjementer innen feltet “Bygningsforvaltning og Miljøvirkninger på bygningsmassen” delfinansieres av Norges forskningsråds prosjekt FoU-Bygningsforvaltning ved Multiconsult. Dette er årsrapporten over hovedaktivitetene i 1996.

*Svein E. Haagenrud*  
*Seniorforsker*  
*Norsk institutt for luftforskning*

# Innhold

	Side
<b>Forord.....</b>	<b>1</b>
<b>Sammendrag.....</b>	<b>3</b>
<b>1. Mål og resultater .....</b>	<b>4</b>
<b>Vedlegg A EUROCARE National Report from Norway 1996 .....</b>	<b>6</b>
<b>Vedlegg B Assessment of Durability and Service Life .....</b>	<b>11</b>
<b>Vedlegg C Assessment of Working Life of Building and building products through characterisation of degradation environment and modelling of degradation.....</b>	<b>16</b>

## Sammendrag

NILUs internasjonale engasjementer innen feltet "Bygningsforvaltning og Miljøvirkninger på bygningsmassen" delfinansieres av Norges forskningsråds prosjekt FoU-Bygningsforvaltning ved Multiconsult. Dette er årsrapporten over hovedaktivitetene i 1996. Disse har vært:

- 1. Deltagelse i EUROCARE-arbeidet som styremedlem og som leder for det norske nettverket for å skape flest mulig Eureka-prosjekter innen feltet.*
- 2. Deltagelse i standardiseringsarbeidet innenfor ISO TC59/SC3/WG9 "Design life of buildings", og framføre/innarbeide norsk kompetanse/synspunkter.*
- 3. Deltagelse i arbeidet innenfor CIBW80/RILEM 140 Prediction of Service Life og CIB/TG 20 "GIS-applications".*
- 4. Følge med i EUs FoU-programmer med relevans for bygd miljø, og utarbeide søknader.*
- 5. Utarbeide og holde foredrag om arbeidet innenfor EUROCARE, ISO TC59/SC3/WG9, CIB og RILEM.*

# FoU Bygningsforvaltning – internasjonalt engasjement

## Årsrapport 1996

### 1. Mål og resultater

Disse har vært:

1. *Delta i EUROCARE-arbeidet som styremedlem og som leder for det norske nettverket for å skape flest mulig Eureka-prosjekter innen feltet.*

**Resultat:** NILU har deltatt i 2 styremøter og ellers i en arbeidsgruppe som ser på en koordinering av Eureka/EUROCARE med EU-programmene og COST initiativet. Pr dato deltar Norge nå i 6 EUROCARE-prosjekter. Aktiviteten beskrives nærmere i vedlagte "EUROCARE National Report from Norway 1996" (vedlegg 1).

2. *Delta i standardiseringsarbeidet innenfor ISO TC59/SC3/WG9 "Design life of buildings", og framføre/innarbeide norsk kompetanse/synspunkter.*

**Resultat:** Haagenrud sitter i Executive Committee og har deltatt på 3 møter samt medvirket til opprettelse av en norsk referansegruppe under NBR. Gruppen har hatt 2 møter og utarbeidet kommentarer til de 2 utkastene som er distribuert. Framdriften av arbeidet med standarden er god, særlig etter at England har satt på store prosjekttressurser. Arbeidet har verdensomspennende internasjonal deltagelse og stor oppmerksomhet, og vil få stor betydning. Den har nå et betydelig "miljøkarakteriseringskapittel", hvor Haagenrud har et hovedansvar for utformingen.

Arbeidet er forankret i det europeiske standardiserings- og godkjenningsarbeidet gjennom CEN og EOTA. Innspill fra Haagenrud og Sjöström til BTS-1 om FoU behov (vedlegg 2) har resultert i en "dedicated call" fra EU/SM&T programmet 15. juni på temaet "Assessment of working life of buildings and building products through characterization of degradation environment and modelling of environment". Haagenrud er koordinator for en større internasjonal søknad som ble levert 28. november 1996. Sammendraget av prosjektforslaget vedlegges, vedlegg 3. NILU vil spille en svært sentral rolle i denne om den innvilges.

3. *Delta i arbeidet innenfor CIB W80/RILEM 140TSL og CIB/TG 20 "GIS-applications".*

**Resultat:** Som formann i Arbeidsgruppe 2 innenfor CIBW80/RILEM 140TSL har Haagenrud utarbeidet rapportutkastet "Environmental Characterization including equipment for monitoring", som er sendt på høring innenfor et omfattende internasjonalt nettverk. Den har fått en positiv mottagelse og mange kommentarer. Disse vil bli innarbeidet og rapporten ferdigstilt i 1. kvartal 1997. Rapportene fra de fem arbeidsgruppene sammenfattes og publiseres i en egen bok. Haagenrud er med i redaksjonen for denne.

Haagenrud deltar også i den nyoppnevnte CIB gruppen CIB/TG 20 “GIS-applications”, som bl.a har som mål å beskrive muligheten for bruk av GIS ved analyser, simulering og visualisering av bygd miljø. Oppstartsmøte var 4.–5. oktober 1996.

4. *Følge med i EUs FoU programmer med relevans for bygd miljø, og utarbeide søknader.*

**Resultat:** Har bl.a. resultert i søknaden “WorkLife” (se pkt. 2).

5. *Utarbeide og holde foredrag om arbeidet innenfor EURO CARE, ISO TC59/SC3/WG9, CIB og RILEM.*

**Resultat:** Haagenrud har holdt følgende foredrag:

- (1) Haagenrud, S. (1996) Assessment of Durability and Service Life. Presented at the *17th Meeting of CEN BTS-1 in Brussels on Feb. 1, 1996*. Kjeller, Norwegian Institute for Air Research (NILU F 4/96).
- (2) Caluwaerts, P., Sjöström, C. and Haagenrud, S.E. (1996) Service Life Standards – Background and Relation to the European Construction Products Directive, in *7th International Conference on the durability of building materials and components. Stockholm, May 1996*.
- (3) Haagenrud, S.E. and Henriksen, J.F. (1996) Modelling and Mapping of Degradation of Built Environment from available Data and GIS based Information Tools, in *7th International Conference on the durability of building materials and components. Stockholm, May 1996*.
- (4) Haagenrud, S.E. (1996) Management of a durable built environment – A joint environmental effort. Presented at the *BRE RILEM Seminar on Sustainable Use of Materials. Building Research Establishment, Garston, UK, September 23–24 1996*. Kjeller, Norwegian Institute for Air Research (NILU F 19/96).

## **Vedlegg A**

# **EUROCARE National Report from Norway 1996**

NILU :  
REFERENCE : 90043  
DATE : 96.11.09

# **EUROCARE National Report from Norway**

**To Board Meeting 2/96  
in Brussels 1996-10-18**

**Svein Haagenrud and Elin Dahlin**



# EUROCARE National Report from Norway

## 0. Summary

The EUROCARE National Organization in Norway is fairly good, as are the project portfolio in terms of industrial involvement and number of projects. However, both the networking and the resulting project portfolio could be much further improved, but both issues suffer from lack of funding. Important issues in this period have been

- following up existing EUROCARE projects,
- circulating and following up incoming proposals.
- following up the very important standardization work in ISO TC 59, which is also linked to important work within the joint Commission CIBW80/RILEM 140-PSL.

## 1. Organization

The Research Council of Norway (NFR)/Building and Construction Section Committee is responsible for funding the Board function and as well the networking via the national SAP. The organization is quite good, but, lack of resources hinders a better functioning of the network. The funds available for international work linked to EUROCARE, CIB/RILEM and Standardization are 25KECU for 1996, which give basis just for following-up the main tasks and existing projects, and not much for doing networking to create *new* EUROCARE projects. We still hope that the newly established Norwegian Institute for Research on Cultural Heritage (NIKU) may give a better base for Norwegian participation. Although the co-operation with NIKU is quite good, so far their resources are too limited for any substantial involvement in EUROCARE activities.

The funding for 1997 is not yet clear.

## 2. Project facilitating and monitoring

Norway is leading the following projects:

EU 446: CAREBUILD (A)  
 EU 455: PROWOOD (A)-finalized  
 EU 615: WETCORR (A)  
 EU 793: HERITAGE (A) - recently withdrawn  
 EU 802: ENACCOUNT (A)-finalized  
 EU 803: GLUELAM '94 (A)-withdrawn  
 EU 1394: ISOLASER(A)

and is also **participating** in the projects:

- EU 640: WETDRY-DEP.
- EU 791: EUROLIME
- EU 1098: EUROCRETE

The industrial involvement and market orientation of these projects are basically fairly good. Funding problems, however, are typical for some of the projects. More detailed from each project:

#### **EU 446 CAREBUILD**

Was expected to be finalised by June 1994. After a delay of about two years with political and economic vacuum on whether to build the envelop building, the decision to build was taken earlier this year. It is anticipated that it will be finalised by the end of next year. Work is now going on to revitalize the R&D/EUROCARE part. **It is expected to be running during 1997.**

#### **EU 455 PROWOOD-finalized**

This project was **finalized** according to plans by the end of 1995. The summary report from the Jotun company was enclosed to the previous national report, and the **EUREKA Final Report has been submitted.**

#### **EU 615 WETCORR**

Project will be finalised by the end of 1996. Progress has been according to plans.

The WETCORR instrument is designed for multi-point recording of the wetness and temperature condition in the micro environment of objects, buildings and constructions. The first commercial series of 10 instruments were produced in 1995. The sensor developed so far consists of a small gold cell for measuring time of wetness, TOW<sup>100</sup>, defined as the time with 100% RH and/or rain, condensation etc., and a temperature sensor for recording the surface temperature.

Work is going on to develop other types of sensors, such as for example sensors for measuring resulting moisture uptake and temperature within wood. This work is going on within the EU Environment & Climate funded project "WOOD-ASSESS (" System and Methods for Assessing Conservation State and Environmental Risks for Outer Wooden Parts of Cultural Buildings"). The instrument is delivered with one Windows based software package for communication, parameter setting and recording and presentation of data. Presentations within geographical information systems (GIS) is also available.

#### **EU 793 HERITAGE-withdrawn**

In the definition phase the research part of this project was developed into the EU- funded project WOOD-ASSESS, which started 1996-02-01. At the same time the proposer, NORWEGIAN HERITAGE has left the project for financial reasons. This EUROCARE project is therefore now withdrawn.

#### **EU 803 GLUELAM-withdrawn**

**The project has now been withdrawn**

#### **EU 1394 ISOLASER**

A successful definition phase was completed this summer. A report (IFE/KR/E-96/004) G. Åberg and D. E. Stijfhoorn: " Determination of weathering and conservation of sculptured stone by use of laser method" was delivered in September 1996.

The project is based on a Nd YAG-laser for the determination of depth of weathering and conservation by use of stable carbon and oxygen isotopes in carbonate rocks. An investigation of the market potential for the technique, based on over 30 answers from all over Europe, shows a remarkable interest. Complementary analyses of calcareous sandstone samples, linseed-oil doped and exposed to accelerated weathering, give very promising results. The project has recently found an industrial partner producing a conservation agent and the project will continue doing the tests once again on a broader scale.

### 3. Standardization

Much work has been given to the tasks of representing EUROCORE in the Executive Committee of the ISO TC 59/SC 3/WG9 "Design life of buildings". This standardization initiative was launched on the initiative of EUROCORE, CIB/RILEM and CEN/BTS-1. Following up this work is an important issue for EUROCORE.

Dr. Haagenrud is a member of the Executive Committee of WG9, and has been given the task of chairing the Task Group for elaboration of Chapter 6, which is "Characterization of Key Environmental Degradation Factors and the Concept for the Classification relating to specific Types of Materials and Components".

The European representatives of the Executive Committee (Haagenrud, Sjøstrøm and Brown) has managed to organize a strong European support for the work. Accordingly, Haagenrud presented the background and the short and long-term need for pre-normative and co-normative research to the 17th meeting of CEN/BTS-1 on Feb 7 in Brussels. A summary of the talk is annexed to this report (Annex 1). The result was the approval of the following topic as a subject for a dedicated call to the Standards, Measurements and Testing programme, namely "Assessment of Working Life of Building and Building Products through characterization of degradation environment and modelling of degradation." This call was released on Sept. 15 with deadline Nov 28. Dr. Haagenrud is the project-coordinator for a European wide Consortium putting together a proposal.

Minutes from the last WG9 meeting in Stockholm in May is annexed to this report (Annex 2). EUROCORE member countries are requested to become members of this ISO standardization work. Germany, Greece, Iceland, Ireland, Hungary and Spain have not yet joined the work.

The work in ISO TC59 is also closely connected to the work within the CIBW80/RILEM 140-PSL group, where Dr. Haagenrud is co-ordinator for Sub-group 2 "Environmental characterization, including equipment for monitoring". The draft report distributed for comments on 96-04-30, has received a lot of attention and comments and will be published by the end of the year (Annex 3).

### 4. Annexes

1. Summary of talk at BTS1 in Feb. 1996
2. Minutes from ISO TC59/SC3/WG9, May 1996
3. Front-page of CIB/RILEM draft report

## **Vedlegg B**

### **Assessment of Durability and Service Life**

Summary of presentation given at the 17th meeting of CEN/BTS-1 on 1996-02-07.

# Assessment of durability and service life

by

Dr.ing. Svein Haagenrud  
Norwegian Institute for Air Research  
P.O. Box 100, N-2007 Kjeller, Norway

*Summary of presentation to be given to the 17th meeting of CEN/BTS-1 on 1996-06-07*

## 1. Introduction

The methodologies for service life prediction of building products have for many years been a focus area for research collaboration within the two organizations CIB and RILEM. Partly based on that and on some already existing national standards, work on international standards addressing the design life of buildings are currently being elaborated by ISO. The working group ISO TC59/SC3/WG9 was set up on the request and support of among others CEN/BTS-1. The knowledge base is in several areas and from many aspects mature enough for standardization to start, but undoubtedly there also exists major RTD needs. The work to be done has great relevance to the needs in Europe for standards addressing the issue of working life of buildings and building products.

## 2. CIB/RILEM research collaboration on service life prediction

The joint CIB/RILEM research collaboration on service life prediction, that started in 1982, aimed at the establishment of generic methodologies for assessing the service life of buildings and building products. Already from the beginning the ambition was to set a basis for a future standardization in the area.

In the first work period (1982-86) the work focused on establishing a generic methodology for service life prediction. This methodology was in 1989 accepted as a RILEM Technical Recommendation (1).

During 1987-89 the CIB/RILEM joint activities focused on methodologies for the feedback from practise of durability data by inspection of buildings (2, 3).

The present work programme, which will be reported in 1996, is addressing five areas with the aim to further detailing the methodology for service life prediction (4).

## 3. The EUREKA/EUROCARE initiative

The EUREKA umbrella EUROCARE which started out in 1986, deals with the problem of the degrading built environment. As a EUREKA umbrella it aims at facilitating and promoting market oriented EUREKA projects, which should counteract the degradation of Europe's built environment, including the cultural heritage and within a sustainable development context.

18 of the EUREKA countries and CEC are now members of the EUROCARE umbrella, comprising a network of more than 350 organizations and a project portfolio of more than 40 EUREKA projects. The long term strategic goal of these projects is to increase

the service life of the built environment and decrease the yearly life cycle cost for its conservation, restoration and maintenance. As a consequence EUROCARE early adopted the service life prediction methodology established by CIB and RILEM as a guiding concept for its RTD projects. The ISO/TC59/SC3/WG9 was therefore set up after a joint initiative for standardization by EUROCARE and CIB/RILEM towards the Commission of the European Communities and CEN in 1991.

#### 4. International standards on design life of buildings

The group was established by ISO in 1993, after the request by CEN/BTS-1 and based on the Vienna agreement on mutual co-operation between CEN and ISO. The first standard document to be issued by the group is closely described by Browne and Soronis (5), and the vision of the standards that on a longer perspective need to be developed are described by Frohnsdorff, Nireki and by Frohnsdorff, Martin (6).

The ISO work is to a large extent supported by the CIB/RILEM activities in the field and is also based upon national standards and codes of practise that were developed during the end of the 1980s, e.g. the British Guide to Durability of Buildings and Building Elements, Products and Components, the Japanese Principle Guide for Service Life Planning of Buildings, and the Canadian Guideline on Durability in Buildings.

#### 5. Co- and pre-normative RTD needs

It is a considerable body of durability data and knowledge available and the area is mature enough for standardization to start. However, there is an urgent need for both co-normative and pre-normative research to support the standardization in the field of working life of buildings and building products, and for technical assessment of the fitness of products for their intended use. Briefly summarized and considering the state of the art on the present knowledge base and its application the following RTD subjects may be pointed out:

- *Performance analysis*  
The development of a systematic and internationally accepted methodology for preparing requirement lists for important types of construction products is an urgent need.
- *Characterization, mapping and classification of environmental degradation factors*  
and
- *Identification and modelling of degradation mechanisms and dose/response functions*  
Insufficient knowledge of exposure environment and Dose-response functions relating this environment to the response of materials are major barriers to reliable predictions. The environmental research area has generated substantial knowledge and data on these issues in cost- benefit analysis of degradation of the built environment as input to policy desicions on abatement strategies. Much data exist for the environmental exposure conditions on e.g. the European macro and meso level, and good functions also exist for quite a few important building materials (7). The environmental degradation factors should be classified and mapped and presented by GIS. A standard classification system that may be used as a model already exists for some metals (8).

A major task is the transition from knowledge based on dose/response functions to service life predictions and performance over time for real constructions. Building inventories and testing under in-use conditions have to be done.

The supported documents for the dedicated call "Assessment of working life of buildings and Building products through Characterization of Degradation Environment and modelling of Degradation" addresses these questions.

- *Development of long-term and short-term test facilities and test programmes*  
Relevant test methods are of an absolute and vital importance. A network of standardized field test sites in various climatic zones in Europe should be established. The network must be linked together through comparative and extensive environmental characterization. A good basis for a network exists through the UN/ECE International Co-operative Programme for Materials, which has operated a well monitored network of approximately 40 test sites throughout Europe and USA/Canada for the last eight years.

Short-term test facilities such as climate chambers and simulated and accelerated test programmes must be developed for European environments and elsewhere. The methods for comparison between artificial ageing and natural weathering need to be further developed.

The proposal DURATEST ("Control methods and validation of short-term tests for durability of selected cultural materials") for the SMT programme, is aimed at addressing this problem.

- *Life cycle cost models*  
Research is needed on life cycle cost models connecting durability and service life of materials and components to the economic performance of the building during its whole working life.
- *Information technology*  
IT systems need to be developed to incorporate into building design the service life methodology. Degradation data from laboratory testing, various types of field testing and condition assessment surveys in the built environment should be made available through GIS based information systems (9).

## 6. Conclusions

- Knowledge and data base sufficient to pursue Standardization of durability/Service Life issues.
- Urgent need for co- and pre-normative RTD in support of standardization.
- Interdisciplinary co-operation a must. Much knowledge exist in the environmental research area.
- Extensive modelling and mapping of materials exposure, environment and degradation possible from available tools and data.

- Joint effort for cost-benefit analyses of Degradation And Maintenance of Built Environment in Europe should be pursued.

## 7. References

- (1) Masters, L.W. and Brandt, E. (editors) (1989) Systematic methodology for service life prediction of building materials and components. *Materials and Structures*, 22, 385–392.
- (2) Sjöström, Ch. (editor) (1990) Feedback from practice of durability data: Inspections of buildings. CIB report, publication 127.
- (3) Brandt, E. (editor) (1990) Feedback from practice of durability data: Appendix. Examples of field investigations. CIB report, publication 128.
- (4) Sjöström, Ch. (1994) CIB W80/RILEM 140-TSL on Service life prediction. Methodologies and research needs. Proceedings of Vision EUREKA Conference “New Technology for Management and Maintenance of Old and New Built Environment”, Lillehammer, Norway, June 1994.
- (5) Browne, R. and Soronis, G. (1996) A proposed ISO-standard for service life of buildings: Part 1 General Principles. *Durability of Building Materials and Components 7*, (ed. Ch. Sjöström), E & FN Spon, London.
- (6) Frohnsdorff, G. and Martin, J. (1996) Towards prediction of building service life – The standards imperative. *Durability of Building Materials and Components 7*, (ed. Ch. Sjöström), E & FN Spon, London.
- (7) Haagenrud, S.E. and Henriksen, J.F. (1996) Degradation of built environment – Review of cost assessment and dose response functions. *Durability of Building Materials and Components 7*, (ed. Ch. Sjöström), E & FN Spon, London.
- (8) International Standardisation Organisation (1992) Corrosion of metals and alloys – Corrosivity of atmospheres – Classification. ISO 9223:1992.
- (9) Haagenrud, S.E., Henriksen, J.F. and Skancke, T. (1996) Modelling and mapping of degradation of built environment from available data and GIS based information tools. *Durability of Building Materials and Components 7*, (ed. Ch. Sjöström), E & FN Spon, London.



## **Vedlegg C**

### **Assessment of Working Life of Building and building products through characterisation of degradation environment and modelling of degradation**

Summary of proposal for the Standards, Measurements and Testing Programme, dedicated call av 1996-11-28.

The built environment constitute more than 50 per cent of each country's real capital. The state and the condition development of this built environment in Europe have become an economical, technical, cultural and environmental concern of increasing importance. As reflected in the European Construction Products Directive (CPD) this requires more knowledge on durability and service lives of the built environment. Due to the entry into force of the CPD there is an urgent and increased need for standards addressing the issue of durability.

This proposal to the dedicated call of 15. June, subject 2, addresses these needs with the following objectives in compliance with the supporting documents:

- 1 – Mapping and classifying environmental degradation agents relevant for important industrial materials on European macro and local scale (in cities), by the use of existing environmental data and dispersion models.*
- 2 – Identify and model the degradation mechanisms and dose-response/damage functions for chosen important materials and components in various operating conditions.*
- 3 – Make the data and models available for exploitation in a user-friendly geographical information system (GIS)*

To achieve **objective 1**, existing environmental data and models from the environmental research field will be scrutinized and put together in maps. This implies *prioritization* of degradation agents relevant for important materials, *prioritization* of cities in Europe which covers a European context and also can provide data and models.

To achieve **objective 2**, existing data and knowledge from ongoing long term field exposure programmes, building condition surveys and assessments, and service life data from industrial practice will be assessed and evaluated into reconciled dose-response/damage functions. The functions and resulting service life will be related to classes developed within ISO TC59/SC3/WG9 "Design Life of Buildings" and CEN/ EOTA .

To achieve **objective 3**, existing versions of GIS based surveillance and information systems for air quality and corrosion assessments will be further developed and validated into pilot versions serving the aims of WorkLife. These versions will be intended for subsequent commercial exploitation.

Main deliverables of the project are

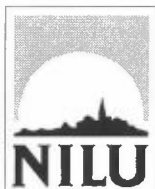
- 1. A set of "best available" dose-response and damage functions for industrially important building materials, that are based on*
  - a huge amount of experimental data and experience
  - assessment of degradation mechanisms
  - assessment of realistic performance criteria
- 2. Calculated set of working life classes corresponding to suggestions by ISO TC59/SC3/ WG9 and CEN/EOTA*
- 3. Tables and maps in GIS format on the European scale and for the "demo cities"/region chosen*

- *maps exhibiting levels and/or concentrations of selected environmental degradation agents expressed in relevant formats*
  - *acceptable levels of degradation agents corresponding to standardized classes of service life/working life for important building materials*
  - *damage functions and service lives/working lives classified according to ECE ICP mapping procedures and standardized classes (from ISO and CEN/EOTA- see WP2)*
4. *Validated pilot version of GIS WorkLife Europe, containing informations from deliverables 1 to 3, integrated and mapped for the European macro scale (EMEP area) and the meso and local scale in the “demo-cities” chosen*

As for *exploitation* the results will be directly applicable for standards, and in parallel the intention is also to make the information system commercial with rights being regulated among the partners in a Consortium Collaboration Agreement.

Fulfilment of the project objectives require co-operation between environmental and building research organizations, and building and construction industries in a European geographical context. The broad consortium covers this requirement, having public and private research organizations from Sweden, Norway, UK, France, Spain, Italy and the Czech Republic. The environmental partner is a member of the EEA European Topic Centre for Air Quality, and is also the Chemical Co-ordinating Centre for the UN ECE EMEP programme, ensuring close links to the relevant environmental research in Europe. Two major European construction industries ensures industrial context and quick information dissemination and exploitation.

The necessary links to relevant standardisation groups and bodies are already established and forms one basis for the proposal. In addition several of the partners are members of EOTA (European organisation for technical approvals), the European Union for technical approvals in the construction industry (UEAtc), and ENBRI.



# Norsk institutt for luftforskning (NILU)

Postboks 100, N-2007 Kjeller

RAPPORTTYPE OPPDRASTYPE	RAPPORT NR. OR 12/97	ISBN 82-425-0858-5 ISSN 0807-7207	
DATO 13.3.97	ANSV. SIGN. <i>Øystein</i>	ANT. SIDER 18	PRIS NOK 30,-
TITTEL FoU Bygningsforvaltning – internasjonalt engasjement Årsrapport 1996		PROSJEKTLEDER	
		NILU PROSJEKT NR. N-90043	
FORFATTER(E) Svein E. Haagenrud		TILGJENGELIGHET * A	
		OPPDRASTGIVERS REF.	
OPPDRASTGIVER Norges forskningsråd Postboks 2700 St. Hanshaugen 0131 OSLO			
STIKKORD Miljøvirkninger bygg	Bygningsforvaltning	Internasjonal EU	
REFERAT NILUs internasjonale engasjementer innen feltet "Bygningsforvaltning og Miljøvirkninger på bygningsmassen" delfinansieres av Norges forskningsråds prosjekt FoU-Bygningsforvaltning ved Multiconsult. Dette er årsrapporten over hovedaktivitetene i 1996.			
TITLE RTD Management of Built Environment – International activities			
ABSTRACT			

\* Kategorier: A Åpen - kan bestilles fra NILU  
B Begrenset distribusjon  
C Kan ikke utleveres