**SPRU – SCIENCE AND TECHNOLOGY POLICY RESEARCH**

# The Management of Technological Risks (832N1)

**30 Credits, M Level**

**Spring Term 2006**

**Option Course**

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**Contents**

(with links to lecture slides)

## 1: OVERVIEW

Technological risks (arising in areas such as military activity, fossil fuels, nuclear power, medical interventions, genetic modification, toxic chemicals and waste management) continue to loom large in newspaper headlines, public policy and corporate strategies alike. Yet – amid all the smoke and noise – it remains unclear how society might best go about managing the complex consequences of technological innovation.

First taught in January 2000, this Spring Term course option on 'the management of technological risk' takes a broad, interdisciplinary and pragmatic view of this wide and hotly contested topic. Focusing primarily on public policy challenges, a range of different conceptual approaches are discussed, including probabilistic and decision analytic views of risk, as well as key insights from sociological, psychological, cultural and communications perspectives. A critical and discriminating view is encouraged concerning the points of convergence and conflict between the major schools of thought. Attention is focused on providing a grounding in the concrete methods and tools which arise in these different fields, including conventional quantitative assessment techniques, qualitative 'deliberative and inclusionary' procedures and some of the various hybrid methods. The emerging agendas of 'precaution', 'technology assessment' and 'diversity' are reviewed and the practical implications explored both for public policy and corporate practice.

## 2: AIMS AND CORE ISSUES

The course aims to introduce students to a wide variety of relevant disciplinary perspectives on the business of managing technological risks in modern industrial societies. It focuses at the same time on an exploration of fundamental underlying issues, whilst concentrating attention on the practical implications for the work of government, commercial and non-governmental organisations engaged in the risk debate.

The course is introduced with a historical review of the emergence of the current *status quo* on technological risk. Subsequent content falls into two main parts:

*(i)* ***background perspectives:*** strengths, limits and weaknesses of the analytical conceptions of risk in economics and decision theory; the approaches taken in psychological, cultural and communication studies; and emerging notions of risk in social and democratic theory.

*(ii)* ***tools, techniques and strategies:*** examines the key features of a number of practical decision-aiding methodologies arising in a variety of disciplines, ranging from deliberative and participatory procedures, through quantitative techniques to emerging new hybrid methods. Goes on from this to review strategies available in a commercial and public context, drawing conclusions for the emerging role of flexibility, precaution and diversification.

## 3: OBJECTIVES AND LEARNING OUTCOMES

In common with other courses, there are two basic elements to the objectives of this option.

The first set of objectives relates to the substantive body of knowledge that it is the purpose of this course to convey. Here, students should at the end of the course be able to:

*(a)* command a good knowledge and critical understanding of the central ideas (and associated terminology) in an array of key disciplinary perspectives on technological risks;

*(b)* enjoy a familiarity with the main features of a broad interdisciplinary literature on technological risks;

*(c)* display an appreciation both for the fundamental theoretical difficulties and limitations as well as the practical imperatives and constraints associated with social decision-making on technological risks;

*(d)* undertake critical evaluation and choice concerning the practical application of a range of different tools and procedures for assisting social decision-making on technological risks;

*(e)* actively participate in the design of real risk appraisal exercises (such as consensus conferences or multi-criteria assesments), although not being fully proficient as practitioners.

The second set of objectives relates to a series of aptitudes and skills that the course aims to help foster. Here, students should find that the course has:

*(f)* enhanced their flexibility in adapting to new disciplinary perspectives and understandings;

*(g)* conveyed a more pluralistic attitude to best practice than is usual in some areas of academia;

*(h)* helped to foster independent critical thought;

*(i)* encouraged group as well as individual working skills;

*(j)* provided a training in the drafting of short prioritised briefings.

## 4: SCOPE

The course covers a lot of ground. It is interdisciplinary and pluralistic rather than specialist in character. Students should not therefore expect to receive an exhaustive grounding in the particular disciplines and techniques addressed, but rather a working familiarity with the key features, strengths and weaknesses in different practical contexts.

The course will address a wide variety of materials, ranging from the rather abstract qualitative concepts of social theory, to the precisely formulated quantitative procedures of probability theory. It is not necessary to have a background in any one of these areas, nor in the other specialist fields touched on (such as psychology, economics or decision theory) but it will be an advantage to be open-minded, inquisitive and flexible in the face of different styles of thought.

The scope of this course is complementary to other options offered as part of the SPRU STP, STS and TIM MSc programmes. Consequently, the course does not go into areas of energy and environmental regulatory policy addressed in the parallel courses, such as *Environmental Policy and Industrial Technology*, *Innovation Management* or the *Social Institution of Science*. Since the focus is on the general challenges of managing risks in society, the course does not deal with specific issues arising in project or operations management within technology-based organisations.

The boundaries and emphasis displayed by this course were initially guided (amongst other things) by an informal survey of perceptions concerning postgraduate education on risk on the part of a small sample of representatives of a variety of government, non-governmental and industry organisations. These consultees were selected in order to provide a picture of the priorities applied to the recruitment of new postgraduate staff for work in the area of technological risk. The feedback obtained in this way helped inform key choices in the development of this course, such as the emphasis on short prioritised briefings and the relative omission of certain aspects of risk such as contracts, liability law and insurance. Over subsequent years, the course has been refined and developed in response to student reactions.

## 5: STRUCTURE

The group activities in this course take place in a series of ten weekly blocks over the Spring Term, each divided into two sessions (except for the first block, which is divided into three sessions). The ***first block*** runs from 1400 to 1730 in the Freeman Centre room G24-5 on Tuesday 10th January 2006. All subsequent sessions are held in the same room every ***Tuesday beginning at 1400 and continuing to 1730*** with a break between sessions from 1530 to 1600.

The substance of the course is structured around a series of ten lectures (with associated discussion) and seven seminars, each occupying a single session of one and a half hours in length. In addition, there are four ‘workshop’ sessions later in the term devoted to different forms of interaction, providing opportunities for group work, more practical ‘hands-on’ experience and, in some cases, with a role-playing element. These workshop sessions take the forms of an adversarial debate, a ‘consensus conference’ and a ‘multi-criteria appraisal’. Aside from one guest lecture, all the lectures, seminars and workshop sessions are taken by Andy Stirling.

The timetable for the course is set out in Section 11, with more detail on lecture themes and associated reading lists provided in Section 13 of this course outline.

## 6: READING

Each of the ten lecture themes is provided with a reading list (set out in Section 13). This identifies 'essential', 'background' and 'supplementary' reading, including web resources. The material on each list is generally addressed in two or more sessions, one lecture and at least one seminar and/or workshop. Essential reading is flagged up for study ***before the lecture***. Guidance is given in Section 13 for choice from the lists of background reading for each session.

Supplementary reading is provided for those preparing presentations to seminar or workshop sessions or those with an interest in greater depth. Additional materials covering empirical aspects of particular case study fields are available separately from Andy. Master copies of all key readings are provided in a special course readings file in the SPRU Library photocopier room.

A good general source text for the initial part of the course is: Ragnar Lofstedt, Lynn Frewer, *Risk and Modern Society*, Earthscan, 1998 (278p, ISBN 1-85383-504-8, pbk, £16.95) [SPRU Library RES 07F LOF]

Another useful general overview of issues cropping up in the middle part of the course is: Deborah Lupton, *Risk*, Routledge, 1999 (184p, ISBN 0-415-18334-0, pbk, £10.99) [SPRU Library RES 03C LUP, Sussex University Library HN230 LUP]

A good but rather technical background to many of the theoretical issues covered in the course can be found in C. Jaeger, O. Renn, E. Rosa, T. Webler, '*Risk, Uncertainty and Rational Action*', Earthscan, London, 2001 (320p, ISBN 1 85383 770 9, pbk, £ 19.95) [SPRU Library RES 07F JAE]

A useful general source for many issues coming up in the last part of the course is: Arie Rip, Thomas Misa, Johann Schot (eds), '*Managing Technology in Society: the approach of constructive technology assessment*', Pinter, London, 1995 (361p, ISBN 1 85567 340 1, pbk, £16.99) [SPRU Library RES 07F RIP, Sussex University Library HS 21100 MAN]

A good readable overview from one critical viewpoint on risk assessment can be found in Mary O'Brien, '*Making Better Environment Decisions: an alternative to risk assessment*', MIT, Cambridge, 2000 (286p, ISBN 0 262 15051 4, pbk, £ 15.50) [SPRU Library RES 06G OBR]

Useful expression of conservative attitudes on risk regulation and the precautionary principle are provided in J. Morris (ed), '*Rethinking Risk and the Precautionary Principle*', Butterworth Heinemann, London, 2000 (294p, ISBN 0 7506 4683 7, pbk, £ 15.50) [SPRU Library RES 07F MOR, Sussex University Library HN230 RET]

A rich series of examples documenting the case for the precautionary principle can be found in European Environment Agency, '*Late Lessons from Early Warnings: the precautionary principle 1896-2000*', EEA Environmental Issue Report 22, Copenhagen, 2001 [SPRU Library RES 07F EEA, Sussex University Library DOCS EU/EEA E-3522]

Some recent key policy reviews of issues covered in the course can be found on the web:

- The German Advisory Council on Global Change, WBGU, (Worlds in Transition: strategies for managing global risks) at http://www.wbgu.de/wbgu_jg1998_engl.html
- The UK Prime Minister's Strategy Unit report (Risk: Improving Governments Capability to Handle Risk and Uncertainty) at: http://www.number-10.gov.uk/SU/RISK/REPORT/01.htm
- The UK Health and Safety Executive report (Reducing Risks Protecting People) at: http://www.hse.gov.uk/dst/r2p2.pdf

- The European Environment Agency report (Late Lessons from Early Warnings: the precautionary principle 1898 – 1998) at: http://reports.eea.eu.int/environmental_issue_report_2001_22/en
- The US Presidential Risk Commission report (Framework For Environmental Health Risk Management) at: http://www.riskworld.com/nreports/1997/risk-rpt/pdf/epajan.pdf
- The US National Research Council report (Understanding Risk) at: http://www.nap.edu/books/030905396X/html/

Further general web resources which may be of interest as a starting point for exploring links to web-based material are the following:

- The Society for Risk Analysis (a technically-oriented professional association with a quantitative emphasise) at: http://www.sra.org/
- The 'Riskworld' organisation at: http://www.riskworld.com/
- The American Council on Science and Health (a lobby group concerned about the over-regulation of industry) at: http://www.acsh.org/
- The Interdepartmental Liaison Group on Risk Assessment (A UK Government body concerned with harmonising national approaches to risk) at: http://www.hse.gov.uk/aboutus/meetings/ilgra/index.htm

## 7: SEMINARS AND 'WORKSHOP' SESSIONS

Approximately half the course sessions are devoted to active student participation in seminar or workshop discussion. The precise configuration of these sessions depends on the size of the class as a whole.

Seminars involve brief presentation assignments to individuals, or to teams of two or more students. Workshops involve more highly structured sessions, often involving some element of team-work and role-play. There is a variety of ways in which students may contribute to these participatory sessions. Tasks include presenting, facilitating, rapporteuring and observing functions for small group discussions and debates, as well as some role-playing in other participatory sessions and opportunities for working in pairs or larger teams.

In the interests of time efficiency, Andy will assign the associated tasks on an equitable basis among assessed students. However, students are encouraged to look ahead at the programme and identify areas where they may have a particular interest (either individually or as groups). If Andy is given enough advance notice, he is happy to accommodate as many preferences as possible. The sessions are described in some detail in ensuing sections of this course outline. In the interests of equity and transparency, a record of committed and completed assignments will be circulated weekly on the 'signing in' sheet.

For a large class, students will be allocated by Andy into one of up to four seminar groups depending on timetabling and other consideration. During seminar sessions, these groups will typically sit in parallel in separate rooms, reporting back to a plenary of the whole class at the end of the session. For workshop sessions, it may be necessary to divide the class into two groups, each holding the session at a different time according to the timetable given in section 12 below. Although there is nothing to prevent collaboration between teams across groups, team presentations must involve members of the same group.

## 8: ASSESSMENT

In this course, all assessment is carried out on an individual basis and based exclusively on the final term paper. By contrast with the single 5000 word essay assessed in other courses, this course will require submission of ***one 2000 word (4-5 page) 'briefing paper'***. Students have the option of submitting an initial 'trial' briefing paper, if they wish, during the first half of the course. This first paper will not be formally assessed. The idea behind this is to give an opportunity for feedback on the kind of thing that is required in briefing papers, as distinct from essays. The assessed briefing paper may be submitted at any stage during the later half of the course, but in any case no later than the first day of the Summer term (18th April 2006).

Seminar presentations will not be formally assessed. Briefing papers may be based on the topics of seminar presentations, or may be entirely independent of these. Topics must be agreed with Andy, but the idea is to be as open as possible about the areas in which the concepts introduced in the course can be applied. Whatever, the topic, briefing papers must be carefully constructed with full use of appropriate graphic aids (such as charts, bullet points and box diagrams). The second briefing paper will be assessed under the following criteria (in order of diminishing priority):

***Accuracy of description:*** in use of terminology, citation of authors and factual accounts.

***Depth of analysis:*** critical observations, creative synthesis of themes, innovative conclusions

***Clarity of structure:*** stated aims, logical cumulative sequence, no gaps or repetition

***Coherence of argument:*** paper should construct a clear substantive position

***Use of diagrams and bullets:*** succinctly convey complex points and summarise lists

***Balance of coverage:*** acknowledgement of countervailing arguments, with refutation

***Brevity of Expression:*** minimise words use, no unnecessary, superfluous excessive adjectives!

***Breadth of scope:*** draw on the full range of pertinent concepts and source material

***Practical examples:*** short citation of specific cases, restricting attention to key features

The idea behind the briefing papers is that they form the basis for a hypothetical presentation to a busy decision-maker (in a governmental, commercial or public interest organisation, depending on context). Less attention will be paid to narrative style and exhaustive referencing than is the case for conventional academic essays (although attribution of key sources is important). No oral presentation will actually be made – only the submitted paper will be assessed.

## 9: DISSERTATION

If students wish to develop further aspects of their work under this course, then there is the option of writing a dissertation on a topic relating to the area of the management of technological risks. A wide range of issues present possibilities, including all those mentioned in the first paragraph of this outline, as well as many more. The options in this regard will be discussed later in the course, at a time when students will have had the chance to explore the extent of their interest in this subject.

## 10: EVALUATING STUDENT OPINION

Students will be invited to complete a form appraising the organisation and teaching of the course. These questionnaires are anonymous. Normally the forms are distributed, completed and then collected up by one of the students in the class. They are then taken in an envelope to the Teaching Programme Coordinator with responsibility for Masters programmes to be analysed. The Director of Studies records the quantitative and qualitative results and gives feedback to the tutor.

## 11: ILLUSTRATIVE TOPICS FOR ASSESSED WORK

Subject to the constraints imposed by assessment, it is the aim of the risk course to be as flexible and responsive as possible to the interests of individual students. The wide variety of conceptual themes and empirical areas covered by the course, presents a wealth of possibilities. This potential open-endedness is typically welcomed by some, but may cause anxiety for others. In order to reassure those who might be disturbed by the degree of choice, the following discussion provides a more concrete idea of the type of subject that might be chosen for a briefing paper, or even as a basis for more extended treatment as a dissertation topic. However, those who have firm ideas or interests of their own should not be put off if these do not appear in the discussion below. Andy is open to discussing any topic that relates to material covered in the course.

In general, typical briefing papers may adopt one of the following formulas:

- in-depth explorations of the strengths and weaknesses of individual approaches to the appraisal and management of risk as covered in lecture themes 1 – 10.
- general critical comparisons and contrasts between different analytic or management approaches.
- specific case studies of the way that different approaches have been applied in practice in one or more empirical areas.

In past briefing papers, the particular approaches to risk management addressed in this way have been drawn from among the following:

| | | |
|---|---|---|
| - risk assessment | - risk amplification | - blame management |
| - cost-benefit analysis | - risk communication | - safety audits |
| - decision analysis | - psychometric analysis | - the analysis of trust |
| - uncertainty heuristics | - cultural theory | - precautionary appraisal |
| - participatory deliberation | - diversity and resilience | - multi-criteria mapping |

One or more of these (or some other theme) have been examined in relation to empirical case studies drawn from among the following:

- nuclear power
- chemical / biological weapons
- endocrine disrupting chemicals
- waste incineration
- global climate change
- radioactive waste management
- GM crops
- genetic testing
- mobile phones
- information technology
- BSE
- urban air pollution
- compulsory vaccination
- gulf war syndrome
- agricultural pesticides
- ozone depletion

For those who prefer an even more specific degree of prescription, the following provide illustrations of the kind of titles that can crop up. The titles are constructed to illustrate topics and so are very boring – please feel free to think up much more exciting titles on these (and other!) topics!

1. Key themes in the historic development of thinking on technological risk: *a general survey / case study in sector X / comparison between sectors X and Y?*
2. Comparisons and contrasts between *analytic / psychological / cultural / sociological* understandings of technological risk and their practical policy value.
3. Key features in probabilistic reasoning on risk: strengths, weaknesses and implications: *a general survey / case study in sector X / comparison between sectors X and Y?*
4. Strengths, weakness and policy implications of psychometric approaches to risk management: *a general survey / case study in sector X / comparison between sectors X and Y?*
5. Strengths, weaknesses and policy implications of the risk amplification paradigm: *a general survey / case study in sector X / comparison between sectors X and Y?*
6. What changes have taken place over recent years in the treatment of risk communication in publications of official risk management bodies: *a general survey / case study in sector X / comparison between sectors X and Y?*
7. Key features in cultural approaches to understanding technological risk: strengths, weaknesses and implications: *a general survey / case study in sector X / comparison between sectors X and Y?*
8. What is the relative importance of social shaping and deterministic forces in understanding the relationship between technology and society: *a general survey / case study in Sector X / comparison between sectors X and Y?*
9. What are the arguments for and against an emphasis on blame in the social and corporate management of technological risk: *a general survey / case study in Sector X / comparison between sectors X and Y?*
10. What are the strengths and weaknesses of an emphasis on trust in the social management of technological risk: *a general survey / case study in sector X / comparison between sectors X and Y?*
11. How do social, historical, philosophical and economic perspectives on the relationship between technology and society contrast and reinforce each other: *a general survey / case study in sector X / comparison between sectors X and Y?*
12. What is the role of technological risk in understanding social transitions from classical modernity and reflexive modernity?

13. How do notions of ecological modernisation and the risk society affect our understanding of technological risk: *a general survey / case study in Sector X / comparison between sectors X and Y*?
14. What are the strengths and weaknesses of the social construction paradigm and what are the implications for our understandings of technological risk: *a general survey / case study in sector X / comparison between sectors X and Y* ?
15. What key themes in theoretical debates over democracy, communication and social choice provide helpful ways of understanding current transformations in the risk management field?
16. What can we say about the differences and common properties of different types of technological risk and what are the implications for risk management: *a general survey / case study in sector X / comparison between sectors X and Y.*
17. Comparison and contrast *two* / *three* / *four* different concrete approaches to social deliberation over technological risk and discuss their relative merits and areas of applicability?
18. A critical review of some recent exercises in citizen participation in technological risk management decisions and their conformity with the theoretical and evaluation literature
19. The relevance of the theoretical literature on risk discourses and social learning to the evaluation of different methods of social deliberation.
20. The relative strengths and weakness of expert analytic methods of risk management, compared with inclusive deliberative approaches: a critical review
21. Managing Risk in Complex Systems: A Critical Review of Key Issues and Developments and Their Practical Implications
22. Normal Accidents versus High Reliability in *Sector X*: a Case Study in the Control of Technological Risk
23. Strengths and Weaknesses in the Concept of Regulatory Capture: a Critical Review with Respect to *Technology* / *Investment* / *Policy X*
24. The precautionary approach to risk management: a Critical Review with Respect to *Technology* / *Investment* / *Policy X*
25. The key contrasts between traditional and emerging precautionary approaches to the management of technological risk
26. Constructive technological assessment – a novel approach to the management of technological risk: *a general survey / case study in sector X / comparison between sectors X and Y.*
27. "The management of technological risk is best based on sound science": *a general survey / case study in sector X / comparison between sectors X and Y.*

Andy welcomes discussion of any further permutations on these themes or more specific, general or weird and wonderful ideas…

The only requirement is that everyone please inform Andy of the proposed topic area and/or title before the end of the Spring Term.

**12: PROVISIONAL TIMETABLE 2006** (NB: detail depends on class numbers)

| WEEK<br>DATE | FIRST SESSION<br>1400-1530 | Freeman Centre G24-5<br>Break 1530-1600 | SECOND SESSION<br>1600-1730 |
|---|---|---|---|
| | **PART ONE: BACKGROUND PERSPECTIVES** | | |
| **1** | Tuesday 10/1/6 | **1**: Historical Introduction – What are technological risks? *(AS)* | **2**: Probabilities and Magnitudes: the analytical approach *(AS)* |
| **2** | Tuesday 17/1/6 | **A**: Perspectives on technological Risk *(students)* ① | **3**: Problems with analytic approaches: impossibility and ignorance *(AS)* |
| **3** | Tuesday 24/1/6 | **B**: Gremlins in the works -problems and case studies *(students)* ②③ | **4**: Perceptions, prejudice and power: grappling with technological risk *(AS)* |
| **4** | Tuesday 31/1/6 | **C**: Different approaches to technological risk *(students)* ④ | **5**: The bigger picture: risk, technology and society *(AS)* |
| **5** | Tuesday 7/2/6 | **D**: Perspectives on risk, technology & society *(students)* ⑤ | **6**: Democracy, Discourse and Deliberation *(AS)* |
| | **PART TWO: TOOLS, TECHNIQUES, STRATEGIES** | | |
| **6** | Tuesday 14/2/6 | **I: Debate**: Science in Risk Management (*students)* ①②③⑤⑥ | **7**: Risk and the Appraisal of Options *(AS)* |
| **7** | Tuesday 21/2/6 | **II: Citizen's Panel** on subject(s) to be determined *(students)* ⑥⑦ | |
| **8** | Tuesday 28/2/6 | **E**: 'Fairness' and 'Competence' in risk management *(students)* ⑥ | **8**: Risk, Control and Complex Systems *(PN)* |
| **9** | Tuesday 7/3/6 | **F**: The Dilemmas of Risk Management *(students)* ⑧⑨ | **10**: Putting it all together: new agendas in risk management *(AS)* |
| **10** | Tuesday 14/3/6 | **III: Multi-criteria Appraisal** subjects TBD *(students)* ⑥⑦ | **G**: Reflections on Risk *(students)* ①②③④⑤⑥⑦⑧⑨⑩ |

Lecture and short discussion (themes numbered 1-10)

Seminar (sessions A-G)

Workshop (sessions: I: debate, II: citizen's panel, III: multicriteria mapping)

①②③④⑤⑥⑦⑧⑨⑩ Links to lecture themes (for seminars and workshops)

*(AS)* Andy Stirling *(PN)* Paul Nightingale

## 13: LECTURE THEMES, READING LISTS AND SEMINAR TOPICS

**Key**

To help you know where you are in the course, what is expected of you and what is due to happen at any given point, the following outline employs a few simple graphic conventions.

These link to the course timetable in section 12 on the previous page. Each of the two key parts of the course begins with a black-filled box, like so:

**PART NINETY SEVEN: BLAH, BLAH, BLAH**

The course material is divided up into 9 'lecture themes' (shown by numbers in black circles in the above timetable). These are numbered 1 – 10 (with theme 9 omitted in the current term). Each is indicated with a shaded box like so:

**LECTURE THEME 0**

The specific dates and times for each lecture are given in the course timetable in section 12 on the previous page.

The topics, structures and tasks for the participatory sessions (seminars A-G and workshops I-III) are each indicated with a clear box. This clearly shows the lecture theme to which this session relates, indicating the appropriate background reading. This also includes detailed instructions for each of the tasks associated with that session and may include some additional or optional case study materials.

**Seminar X: What's it all about?** Links to Lecture Theme 0

The specific dates and times for each seminar or workshop are given in the course timetable in section 12 on the previous page.

The main readings and resources (library and web-based material) are listed under the lecture theme to which they relate and indicated with bold italic headings, like so:

***Readings for Lecture Theme 0***

Readings are divided into a few 'essential' materials which should be read in their entirety ***before*** the lecture and a larger number of 'background' materials, from which you can choose which to read before the various sessions, as indicated. Most of this material is available in the SPRU library and the course readings. Each is given an index number for ease of reference.

The seminar resources are also there to support those making presentations, with guidance on this given in the description of the seminar session concerned. Most of this material is available in the SPRU library and the course readings or on the web.

This should make the business of following what is going on pretty straightforward. But if things don't seem clear, or if you have any queries, please do not hesitate to ask Andy.

## PART ONE: BACKGROUND PERSPECTIVES

### Introduction to the Course

*(brief presentation by Andy Stirling and short discussion)*

This will deal with administrative and background issues relating to the course, including those covered in this Course Outline. There will be an opportunity to introduce each other and discuss individual perspectives, queries and expectations.

## LECTURE THEME 1

### Setting the Scene – What is technological risk? Where are we? How did we get here?

*(presentation by Andy Stirling and general discussion among students)*

This will briefly review the history of thinking of risk and uncertainty, documenting its increasing importance to questions of technology choice and flagging up some key issues. It will provide an overview of the relationship between the different approaches to technological risk touched on in this course. Finally, it surveys current thinking on issues of technological risk from government, industry and public interest perspectives.

***Readings for Lecture Theme 1*** (further materials under Seminar A)

*Essential* *(please be sure to read **all** of this material before the lecture)*

1.1 Ragnar Lofstedt, Lynn Frewer, *Risk and Modern Society*, Earthscan, 1998 ***Introduction*** [SPRU Library 07F LOF and course readings]

1.2 Baruch Fischoff, Risk Perception and Communication Unplugged: Twenty Years of Progress, *Risk Analysis*, **15**, 2, 1995, pp137-145 [***chapter 6 in*** SPRU Library 07F LOF and course readings]

*Background* *(please read at least 1 before the lecture and **another 1** before the seminar)*

*Historic Overviews*:

1.3 Ortwin Renn, Three Decades of Risk Research: accomplishments and new challenges, *J. Risk Research*, **1**, 1, 1998, pp49-72 [SPRU course readings]

1.4 Peter L. Bernstein, *Against the Gods: the remarkable story of risk*, Wiley, 1996 ***chapters 13, 14, 16, 19*** [SPRU Library course readings]

*Policy:*

1.5 Harvey V. Fineberg, *Understanding Risk: informing decisions in a democratic society*, National Research Council Committee on Risk Characterisation, National Academy Press, Washington, 1996 ***summary*** [SPRU Library 06G STE and course readings]

1.6 Royal Commission on Environmental Pollution, *Stetting Environmental Standards,* Twenty First Report, Cm 4055, HMSO, London, 1998 ***Chapter 9 Conclusions*** [SPRU Library 06G GRE and course readings]

1.7 Gilbert S. Omen, Alan C. Kessler, Norman T. Anderson, et al, *Framework for Environmental Health Risk Management*, US Presidential/Congressional Commission

on Risk Assessment and Risk Management, final report Volume 1, EPA, Washington, 1997 ***pp.49-54 on Implementing the Framework*** [SPRU Library 06G PRE and course readings]

1.8 National Audit Office report on governance of risk
http://www.nao.gov.uk/publications/nao_reports/9900864es.pdf

1.9 International Association for the Study of Insurance Economics
http://www.genevaassociation.org/

**Seminar A: Perspectives on Risk** Links to Lecture Theme 1

Depending on the size of the class, this seminar will comprise up to four pre-allocated seminar discussion groups, each with a student facilitator and rapporteur assigned by Andy. Each group will spend 40 minutes discussing the arguments for and against each of the following two statements:

a: "irrational public anxieties on risk have lead to over-regulation and the stifling of innovation".

b: "exclusion of reasonable public concerns on risk have led to the causing of unnecessary harm"

The common task of all groups will be to pool the main arguments for and against each position, using resources drawn from the list identified below.

The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).

The role of the rapporteur will be to record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

Each student should select at least one reading from among those in each of the lists below. This idea behind providing so many references is to allow students to choose an issue of interest and give a diversity of inputs to the discussion:

Arguments in favour of the statement (a) can be drawn from the one or more of the following references, depending on the students own interest.

1.10 J.D.Rimington, *Coping with Technological Risk: a 21st Century Problem*, Royal Academy of Engineering, 1993 [SPRU course readings]

1.11 Chauncey Starr, 'Social Benefit versus Technological Risk' *Science*, **165**, pp1232-1238, 1969 [SPRU course readings]

1.12 Adam Lieberman, '*Facts versus Fears: a review of the twenty greatest unfounded health scares of recent times*', American Council on Science and Health, Washington, 1997 ***choose one of the case studies*** [SPRU course readings]

1.13 Frederick Warner, *What if? Versus, if it ain't broke, don't fix it* * [SPRU course readings]

1.14 Gerhard Heilig, Sustainable Development – ten arguments against a biologistic 'slow-down' philosophy of social and economic development, *International Journal of Sustainable Development*, **4**, 1-14 [SPRU course readings]

1.15 Ayola Ochert, It's a Question of Balance, *Times Higher Education Supplement,* 11 February 2000 [SPRU course readings]

1.16 Ortwin Renn, Implications of the Hormesis Hypothesis for Risk Perception and Communication, *BELLE Newsletter*, **7**(1) 2-9 1998 [SPRU course readings]

1.17 Aaron Wildavsky, Trial and Error Versus Trial Without Error, in Julian Morris (ed), *Rethinking Risk and the Precautionary Principle*, Butterworth Heinemann, 2000 [SPRU Library 07F MOR and SPRU course readings]

1.18 Robert Matthews, Facts Versus Factions: the use and abuse of subjectivity in scientific research, in Julian Morris (ed), *Rethinking Risk and the Precautionary Principle*, Butterworth Heinemann, 2000 [SPRU Library 07F MOR and SPRU course readings]

1.19 J. Krebs, A. Kacelnik, Risk: a scientific view, in J. Ashworth (ed), *Science, Policy and Risk*, Royal Society, 1997 [SPRU course readings]

Arguments in favour of the statement (b) can be drawn from the one or more of the following references, depending on the students own interest.

1.20 ESRC Global Environmental Change Programme, *Risky Choices, Soft Disasters: environmental decision-making under uncertainty*, University of Sussex, June 2000 [SPRU course readings]

1.21 Consumer's Association, Sainsbury's, Unilever, *Confronting Risk: finding new approaches to risk*, Consumer's Association, London, 1998 [SPRU course readings]

1.22 ESRC Global Environmental Change Programme, *The Politics of GM Food: risk, science and public trust*, University of Sussex, Special Briefing No.5, October 1999 [SPRU course readings]

1.23 Brian Wynne, Patronising Joe Public, *Times Higher Education Supplement*, London, 12th April 1996, p13 [SPRU course readings]

1.24 Ayala Ochert, It's a Question of Balance, *Times Higher Education Supplement,* 11 February 2000 [SPRU course readings]

1.25 R. Grove-White, Science, Trust and Social Change, in J. Ashworth (ed), *Science, Policy and Risk*, Royal Society, 1997 [SPRU course readings]

1.26 M. O'Brien, *Making Better Environmental Decisions: an alternative to risk assessment*, MIT, Cambridge, 2000 ***especially chapters 4, 5 and 6*** [06G OBR and SPRU course readings]

1.27 ESRC Global Environmental Change Programme, *Steps into Uncertainty: handling risk and uncertainty in environmental policy making*, Specual Briefing Number 6, June 2000 [SPRU course readings] also available on the web at:

http://www.green-alliance.org.uk/publications/PubStepsIntoUncertainty/

1.28 Nature Editorial, Risk and the Inadequacy of Science, *Nature,* **385**, p1 [SPRU course readings]

In addition, where students feel more comfortable with some concrete context, these general arguments may be related to one or more of a series of brief empirical web-based 'case study' resources that are available on the following topics from the UK Parliamentary Office of Science and Technology. Again, one of these can be chosen, depending on the particular interests of the student:

1.29 nuclear power
http://www.parliament.uk/documents/upload/postpn208.pdf

1.30 GM crops
http://www.parliament.uk/documents/upload/postpn211.pdf

1.31 urban particulate air pollution
http://www.parliament.uk/post/pn188.pdf

1.32 human genetic testing
http://www.parliament.uk/post/pn139.pdf

1.33 chemical and biological weapons
http://www.parliament.uk/post/pn111.pdf

1.34 compulsory vaccination
http://www.parliament.uk/documents/upload/postpn219.pdf

1.35 mobile phone health risks
http://www.parliament.uk/post/pn109.pdf

1.36 endocrine disrupting chemicals

http://www.parliament.uk/post/pn108.pdf

1.37 gulf war syndrome
http://www.parliament.uk/post/pn107.pdf

1.38 incineration
http://www.parliament.uk/documents/upload/postpn219.pdf

1.39 mobile phone health risks
http://www.parliament.uk/post/pn149.pdf

## LECTURE THEME 2

### Probabilities and Magnitudes: the Analytical Approach

*(presentation by Andy Stirling and short discussion)*

Reviews the basis for orthodox theoretical thinking on the appraisal of technological risk in the fields of economics, decision analysis, risk analysis and environmental assessment. Introduces some fundamental concepts from probability theory, outlines the distinction between Frequentist and Bayesian approaches to probability and uncertainty. Looks at different approaches to the measurement of risk magnitudes using techniques such as cost-benefit, comparative risk and life-cycle analysis.

***Reading for Lecture Theme 2*** (further materials under Seminar B)

*Essential* *(please be sure to read **all** of this material before the lecture)*

2.1 Department of Environment, *A Guide to Risk Assessment and Risk Management for Environmental Protection*, HMSO, London, June 1995 ***chapters 1, 2, 3 and 4*** [Main Library Documents Section (under DETR) and SPRU Library course readings]

*Background* *(please read at least **two** before lecture and another one before the seminar)*

*Overview:*

1.4 Peter L. Bernstein, *Against the Gods: the remarkable story of risk*, Wiley, 1996 ***chapters 13, 14, 16, 19*** [SPRU Library course readings]

2.3 Parliamentary Office of Science and Technology, *Safety in Numbers? - risk assessment in environmental protection*, POST, London, June 1996 ***chapter 3*** [SPRU course readings]

*Texts*:

2.4 Chris Starmer, '*The Economics of Risk*' chapter 12 in Peter Calow (ed), *Handbook of Environmental Risk Assessment and Management*, Blackwell, London, 1998 [Main Library TD 194.5 HAN and SPRU Library course readings]

2.5 David Pearce, Colin Nash, *The Social Appraisal of Projects: a text in cost-benefit analysis*, Macmillan, London, 1981 SPRU ***chapter 5*** [SPRU Library course readings]

|2.6 Daniel Byrd, C. Richard Cothern, *Introduction to Risk Analysis: a systematic approach to science based regulation*, Government Institutions, Rockville, 2000 ***chapters 1 and 2*** [SPRU Library course readings]

2.7 David Pearce, *Valuing Risks,* in P. Calow (ed), '*Handbook of Environmental Risk Assessment and Management*', Blackwell, London, 1998 [SPRU Library course readings]

2.8 Zurich Risk Engineering, Hazard Analysis Methodologies: a selection guide, Zurich Re, Geneva, 2000 [SPRU Library course readings]

2.9 William Jefferys, James Berger, Ockham's Razor and Bayesian Analysis, *American Scientist*, **80** 64-72 [SPRU Library course readings]

## LECTURE THEME 3

### Problems with the Analytic Approach: Impossibility and Ignorance

*(presentation by Andy Stirling and short discussion)*

Returns to the topic of orthodox theoretical thinking on the appraisal of technological risk in order to explore the implications of some fundamental practical and theoretical problems. These include the large discrepancies that are typically displayed between the values (and ranking orders) obtained for the risks of different technological options by different appraisal studies using techniques such as cost-benefit, comparative risk and life-cycle analysis. Examines the reasons for these discrepancies – in particular, the dilemmas posed by the condition of 'ignorance' in probability theory and 'impossibility' in social choice theory. Reviews the practical implications.

***Reading for Lecture Theme 3*** (further materials under Seminar B)

*Essential* *(please be sure to read all of this material before the lecture)*

3.1 Andrew Stirling, Risk at a Turning Point?, *Journal of Risk Resarch*, **1**, 2, 1998, pp97-110 [SPRU Library course readings]

3.2 H. Brooks, *The Typology of Surprises in Technology, Institutions and Development*, chapter in W. Clark, C. Munn '*Sustainable Development of the Biosphere*', CUP, Cambridge, 1986 [SPRU Library course readings]

*Background* *(please read at least 1 before the lecture and another 1 before the seminar)*

*Values*

3.3 Thomas Bezembinder, *Social Choice Theory and Practice*, in Vlek and Cvetkovitch (eds), *Social Decision Methodology for Technological Projects*, Kluwer, Dordrecht, 1989 [SPRU Library course readings]

3.4 Arild Vatn, Daniel W. Bromley, Choices without Prices without Apologies, *J. Environment Economics and Management*, **26**, 1994 [SPRU Library course readings]

3.5 John O'Neill, Pluralism, Incommensurability, Judgement, chapter 7 in J. O'Neill, '*Ecology, Policy and Politics: human well-being and the natural world*', Routledge, London, 1993 [SPRU Library 06B ONE and SPRU Library course readings]

*Uncertainty*

3.6 Malte Faber, John Proops, 'An Anatomy of Surprise and Ignorance' chapter 7 in M. Faber, J. Proops, '*Evolution, Time Production and the Environment*', Springer, Berlin, 1994 [SPRU Library 06G FAB and SPRU Library course readings]

3.7 William Rowe, Understanding Uncertainty, *Risk Analysis*, **14**(5), 1994 [SPRU Library course readings]

3.8 J. Ravetz, Usable Knowledge, usable ignorance: incomplete science with policy implications in in W. Clark, C. Munn '*Sustainable Development of the Biosphere*', CUP, Cambridge, 1986 [SPRU Library course readings]

3.9 S. Funtowicz, J. Ravetz, *A New Scientific Methodology for Global Environmental Issues,* in R. Costanza (ed), *Ecological Economics,* 1992* [SPRU Library course readings]

**Seminar B: Gremlins in the Works** Links to Lecture Themes 2 and 3

Each seminar group will undertake a discussion for 1 hour concerning the strengths and weakness of quantitative approaches to risk assessment, as applied for instance, in one of two particular fields: nuclear and genomics. The task of each group will be to come to a common position on the particular strengths and weaknesses of the quantitative approaches, focusing in particular on one of these particular fields.

Each group will volunteer – or be assigned – in advance one of these fields. The group should then briefly meet beforehand (ideally at the preceding lecture) to divide among themselves the literature provided below for the field covered by their group, at least one reading for each person. Each person will then be expected to contribute actively to the discussion, drawing especially on their allocated reading. The idea behind providing so many references is that different people in the team will look at different readings, taking at least one each according to their interest.

Each group will have a facilitator and a rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves). In particular, the facilitator should ensure that an equal time is spent discussing the strengths as well as the weakness of both quantitative and qualitative approaches.
- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

The point of allocating a particular field to each group is to provide some form of focus, but it is okay for discussion to refer to fields other than the field assigned to the group.

*Nuclear*

3.10 ExternE Project, *Externalities of Energy*, Volume I: Summary, European Commission, Brussels, 1995 ***sections on methodology and nuclear assessment*** [SPRU Library course readings]

3.11 Rainer Friedrich, Alfred Voss, External Costs of Electricity Generation, *Energy Policy*, February 1993 [SPRU Library course readings]

3.12 Health and Safety Executive, *Quantified Risk Assessment: it's input to decision-making*, HMSO, London, 1989 [SPRU Library course readings]

3.13 Health and Safety Executive, *Safety Assessment Principles for Nuclear Plants*, HMSO, London, 1992 ***introduction and fundamental principles*** [SPRU Library course readings]

3.14 J. H. Fremlin, *Power Production: what are the risks*, Oxford, 1985, ***chapter 8***, [SPRU Library course readings]

3.15 H. Hirsch, T. Einfalt, O. Schumacher, G. Thompson, *IAEA Safety Targets and Probabilistic Risk Assessment*, Greenpeace International, Amsterdam, 1989 [SPRU Library course readings]

3.16 Greenpeace, *Ten Questions and Answers on Nuclear Power*, Greenpeace, London, 1990 [SPRU Library course readings]

3.17 A. Stirling, Limits to the Value of External Costs, *Energy Policy*, **25**, 5, pp517-540, 1997 [SPRU Library course readings]

3.18 Stephen R. Watson, The Meaning of Probability in Probabilistic Safety Analysis, *Reliability Engineering and System Safety*, **45**, 1994, pp261-9 [SPRU Library course readings]

*Genomics*

3.19 House of Commons Select Committee on Science and Technology, *Report on the Science Advisory System on Genetically Modified Foods*, Volume I, HMSO, London, 1999 ***chapter 2*** [SPRU Library course readings]

3.20 Agriculture and Environment Biotechnology Commission, *Crops on Trial*, Department of Environment, Food and Rural Affairs, London, available on the web at: <http://www.aebc.gov.uk/aebc/pdf/crops.pdf>

3.21 Henry Miller, Gregory Conko, Genetically Modified Fear and the international regulation of biotechnology, in J. Morris (ed), '*Rethinking Risk and the Precautionary Principle*', Butterworth Heinemann, London, 2000 [SPRU Library 07F MOR and SPRU Library course readings]

3.22 Edmonds Institute, *Manual for Assessing Ecological and Human Health Effects of Genetically Engineered Organisms,* Washington, available on the web at: <http://www.edmonds-institute.org/manual.html>

3.23 Nuffield Council on Bioethics, *Genetically Modified Crops: the ethical and social issues,* London, 1999, available on the web at: < http://www.nuffieldbioethics.org/fileLibrary/pdf/gmcrop.pdf >

3.24 Food Ethics Council, *Novel Foods: Beyond Nuffield*, Nottingham, 1999, available on the web at: < http://www.foodethicscouncil.org/library/reportspdf/novelfoods.pdf>

3.25 European Environment Agency, *Genetically Modified Organisms*, 1999 [SPRU Library course readings]

3.26 L. Levidow, S. Carr, D. Wield, R. von Schomberg, European Biotechnology Regulation: framing the risk assessment of a herbicide tolerant crop, *Science Technology and Human Values*, **22**(4), 472-505, 1997 [SPRU Library course readings]

## LECTURE THEME 4

**Perceptions, Prejudice and Power: grappling with technological risk**

*(presentation by Andy Stirling and short discussion)*

This provides an introduction to a series of alternative perspectives on technological risks based on perspectives from psychology, communication and cultural theory. The empirical patterns observed in perceptions of technological risks among specialist groups and lay publics will be surveyed. The relationships between private industry, the media, regulatory bodies and pressure groups will be reviewed. Insights from the various theories will be discussed and their strengths and weaknesses critically examined.

***Reading for Lecture Theme 4***

*Essential* *(please be sure to read all of this material before the lecture)*

4.1 N. Pidgeon, Jane Beattie, *The Psychology of Risk and Uncertainty*, in P. Calow (ed), '*Handbook of Environmental Risk Assessment and Management*', Blackwell, London, 1998 [SPRU Library course readings]

4.2 Harry Otway, Brian Wynne, Risk Communication: paradigm and paradox, *Risk Analysis*, **9**, 2, 1989 [SPRU Library course readings]

*Background* *(please read at least 1 before the lecture and another 1 before the seminar)*

*Overview*

4.3 J. Adams, A 'Richter Scale of Risk'?, *Interdisciplinary Science Reviews*, **23**, 2, 1998, pp145-155 [SPRU Library course readings]

4.4 William Freudenburg, 'Heuristics, Biases and the Not-so-General Publics: expertise and error in the assessment of risks' chaper 10 in S. Krimsky, D. Golding (eds), "*Social Theories of Risk*", Praeger, Westport, 1992 [SPRU Library course readings]

*Communication*

4.5 Vincent T. Covello, *Risk Communication*, in Calow (ed), '*Handbook of Environmental Risk Assessment and Management*', Blackwell, London, 1998 [SPRU Library course readings]

4.6 Agency for Toxic Substances and Disease Registry, A Primer on Health Risk Communication Principles and Practices, ATSDR, http://www.atsdr.cdc.gov/HEC/primer.html

4.7 P. Bennett, Communicating about Risks to Public Health: pointers to good practice, Department of Health, London, 1998, available on the web at: http://www.dh.gov.uk/assetRoot/04/03/96/70/04039670.pdf

*Amplification*

4.8 Arie Rip, Should Social Amplification of Risk be Counteracted?, *Risk Analysis*, **8**, 2, 1988, [SPRU Library course readings]

4.9 O. Renn, P. Slovic, et al, The Social Amplification of Risk: a conceptual framework, *Risk Analysis*, **8**, 2, 1993, pp177-187 [in SPRU Library 07F LOF and SPRU Library course readings]

*Psychology*

4.10 Paul Slovic, *Trust, Emotion, Sex, Politics and Science: surveying the risk assessment battlefield*, University of Chicago Legal Forum, 1997 [SPRU Library course readings]

*Culture*

4.11 Steve Rayner, Robin Cantor, How Fair is Safe Enough? The Cultural Approach to Societal Technology Choice, *Risk Analysis*, **10**, 3, 1987 pp375-387 [in SPRU Library 07F LOF and SPRU Library course readings]

4.12 L. Sjoberg, Explaining Risk Perception: an empirical evaluation of cultural theory, *Risk Decision and Policy*, **2**, 2, 1997 pp113-130 [in SPRU Library 07F LOF]

*GM case study*

4.13 Claire Marris, Public Views on GMO's: deconstructing the myths, *EMBO Reports,* **2**(7), 2001 *European Molecular Biology Association - on the web at:* http://www.nature.com/cgi-taf/DynaPage.taf?file=/embor/journal/v2/n7/full/embor376.html&filetype=pdf

4.14 Agriculture and Environment Biotechnology Commission, *Crops on Trial*, Department of Environment, Food and Rural Affairs, London, available on the web at: <http://www.aebc.gov.uk/aebc/pdf/crops.pdf>

4.15 C. Marris, B. Wynne, P. Simmons, S. Weldon et al, *Public Perceptions of Biotechnology in Europe,* final report of the PABE project, Lancaster University, 2001 - available on the web at: <http://www.lancs.ac.uk/depts/ieppp/pabe/docs/pabe_finalreport.pdf>

4.16 MORI for the Office of Science and Technology, *The Public Consultation on Developments in the Biosciences*, Office of Science and Technology, London, 2000 available on the web at: http://www.dti.gov.uk/ost/ostbusiness/puset/bio_consult.pdf

**Seminar C: Different Approaches to Risk** Links to Lecture Theme 4

This involves each seminar group deciding which of three topics it wishes to focus on:

1 *The Pros and Cons of Psychological Approaches to Risk*

– drawing principally on the Pidgeon/Beattie and Freudenberg references in Theme 4

2 *The Pros and Cons of Risk Communication*

– drawing principally on the Covello, ATSDR and Otway/Wynne references in theme 4

3 *The Pros and Cons of Risk Amplification*

– drawing principally on the Renn/Slovic and Rip references in theme 4

Each group then hears two ***10*** minute presentations over the course of a 1 hour discussion.

One presentation will look at the 'pros' on the chosen issue, and one at the 'cons'.

Presentations should be researched and delivered by one student or by a team of two students (if you have a preference for working with a particular partner within the same seminar group, then you should inform Andy in advance).

If presentations are made by teams of two, they may divide the topic in whatever way they wish – perhaps one presenter taking each side of the argument, perhaps as a dialogue, perhaps each taking different aspects.

It is ***not*** essential that powerpoint be used, If it is, Andy ***must*** be informed at least one day in advance of the session. Either way, it is important that the presentations are no more than ***10*** minutes long.

***TIP****: Do a trial run first to make sure you don't have too much material for 10 minutes!*

Each group will also have a facilitator and a rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).

- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

## LECTURE THEME 5

### The Bigger Picture: risk, technology and society

*(presentation by Andy Stirling and short discussion)*

Here, we will take a few steps back and look at technological risk from the general viewpoint of wider changes in society. Based on recently emerging bodies of thinking on 'late modernity' and 'the risk society', some of the main themes in social theory with a bearing on the social management of technological risks will be reviewed. In particular, a close look will be taken at the insights from the social constructivist literature. The practical implications for policy and strategic decision making will be explored.

***Reading for Lecture Theme 5***

*Essential* *(please be sure to read all of this material before the lecture)*

5.1 Maurie J. Cohen, Risk Society and Ecological Modernisation: alternative visions for post-industrial nations, *Futures*, **29**, 2, 1997, pp105-119 {SPRU Library journals collection and SPRU Library course readings]

5.2 Deborah Lupton, Risk and Culture, chapter 3 in *Risk,* Routledge, London, 1999 [SPRU Library course readings]

*Background* *(please read at least 1 before the lecture and another 1 before the seminar)*

*Social Theory*

5.3 Kristin Shrader-Frechette, Scientific Method, Anti-Foundationalism and Public Decision-Making, *Risk: Health, Safety and Environment*, **1**, 1, 1990, pp23-4 [in SPRU Library 07F LOF and SPRU Library course readings]

5.4 Maarten A. Hajer, *Ecological Modernisation as Cultural Politics*, chapter in Lash, Szerszynski, Wynne (eds), *'Risk, Environment and Modernity'*, Sage, London, 1996 [SPRU Library course readings]

5.5 Ulrich Beck, *World Risk Society as Cosmopolitan Society: ecological questions in a framework of manufectured uncertainties*, *Theory, Culture and Society*, **13**, 4, 1996 p1 [SPRU Library course readings]

5.6 Anthony Giddens, *Living in a Post Traditional Society*, chapter in Beck, Giddens, Lash (eds), *'Reflexive Modernisation: politics, tradition and Aesthetics in the Modern Social Order'*, Polity, London, 1994 [SPRU Library course readings]

*Construction*

5.7 Brian Wynne, *May the Sheep Safely Graze? a reflexive view of the expert-lay knowledge divide*, in Lash, Szerszynski, Wynne, 'Risk, Environment and Modernity', Sage, London, 1996 [SPRU Library course readings]

5.8 Arie Rip, Siebe Talma, *Antagonistic Patterns and New Technologies*, chapter in Cornelis Disco, Barend van der Meulen (eds), 'Getting *New Technologies Together: studies in making sociotechnical order*, Walter de Gruyter, Berlin, 1998 [SPRU Library course readings]

5.9 Sheila Jasanoff, 'Beyond Epistemology: Relativism and Engagement in the Politics of Science', Social Studies of Science, **26**, 393-418, 1996 [SPRU Library course readings]

5.10 Langdon Winner, Do Artefacts Have Politics?, *Daedalus*, Winter 1980 [SPRU Library course readings]

5.11 Robin Williams, David Edge, The Social Shaping of Technology*, Research Policy*, **25**, 865-899, 1996

*Trust and Blame*

5.12 Tom Horlick-Jones, *The Problem of Blame*, in C. Hood, D. Jones (eds) , *'Accident and Design: contemporary debates in risk management'*, UCL, London, 1996 [SPRU Library course readings]

5.13 National Audit Office (NAO) report on governance of risk http://www.nao.gov.uk/publications/nao_reports/9900864es.pdf

**Seminar D: Perspectives on Risk, Technology and Society** Links to Lecture Theme 5

This will involve each seminar group deciding to address one of the two pairs of topics identified below. In assigning topics, priority will be placed on a group where there are volunteers to make a presentation.

First pair of topics

***T*** *Risk, Technology and Society* – drawing mainly on the Winner, Williams and Wynne references above

***E*** *Risk Society & Ecological Modernisation* – drawing mainly on the Cohen, Giddens, Beck and Hajer references above

Second pair of topics

***C*** *Cultural Approaches to Risk* – drawing mainly on the Lupton, Rayner and Sjoberg references above

***B*** *Trust and Blame in Risk Management* – drawing mainly on the Horlick-Jones and NAO report above

Presentations should be researched and delivered by one student or by a team of two students (if you have a preference for working with a particular partner within the same seminar group, then you should inform Andy in advance).

If presentations are made by teams of two, they may divide the topic in whatever way they wish – perhaps one presenter taking each side of the argument, perhaps as a dialogue, perhaps each taking different aspects.

It is ***not*** essential that powerpoint be used, If it is, Andy ***must*** be informed at least one day in advance of the session. Either way, it is important that the presentations are no more than ***10*** minutes long.

The task of each presentation will be to draw out the main features, pros and cons of one of each of the two approaches to technological risk covered in this topic.

The task of the group as a whole is then to discuss these points and arrive at three bullet points characterising each approach for presenting to a half hour plenary session of the whole class which will follow.

Again, each group will have a facilitator and a rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).

- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

## PART TWO: TOOLS, TECHNIQUES AND STRATEGIES

### LECTURE THEME 6

**Democracy, Discourse and Deliberation**

*(presentation by Andy Stirling and short discussion)*

Based on thinking arising in 'critical' and 'discourse' theory, a number of practical decision-aiding procedures have arisen in northern Europe and North America over the past few years, including focus groups, citizens panels, deliberative polls and consensus conferences. Some of the main 'participatory and deliberative techniques will be surveyed and their key distinguishing features, strengths and weaknesses examined in the light of practical examples drawn from areas such as energy and food policy.

**Reading for Lecture Theme 6** (further materials under Seminar E)

*Essential* *(please be sure to read all of this material before the lecture)*

6.1 Ortwin Renn, Birgit Blaettel-Mink, Hans Kastenholz, Discursive Methods in Environmental Decision Making, *Business Strategy and the Environment*, **6**, 1997 pp218-231 [SPRU Library course readings]

*Background* *(please read at least 1 before the lecture and another 1 before the seminar)*

*Overview*:

6.2 Ortwin Renn, Thomas Webler, Peter Wiedemann, 'The pursuit of Fair and Competent Citizen Participation', chapter 20 in Renn, Webler and Wiedemann (eds), 'Fairness and Competence in Citizen Participation: evaluating models for environmental discourse, book, Intro and index, Kluwer, Dordrecht, 1995 [SPRU Library course readings]

6.3 Thomas Webler, Ortwin Renn, ' A Brief Primer on Participation: Philosophy and Practice', chapter 2 in Renn, Webler and Wiedemann (eds), 'Fairness and Competence in Citizen Participation: evaluating models for environmental discourse, book, Intro and index, Kluwer, Dordrecht, 1995 [SPRU Library course readings]

6.4 Daniel J. Fiorino, Technical and Democratic Values in Risk Assessment, *Risk Analysis*, **9**, 3, 1998, pp293-9 [SPRU Library course readings]

6.5 Daniel J. Fiorino, Citizen Participation and Environmental Risk: a survey of institutional mechanisms, *Science, Technology and Human Values,* **15**, 2, 1990, pp226-243 [SPRU Library course readings]

6.6 Parliamentary Office of Science and Technology, *Open Channels: public dialogue in science and technology,* POST Report 153, POST, March 2001
summary available at: http://www.parliament.uk/post/nfr/pn153.pdf

full report at: http://www.parliament.uk/post/pr153.pdf

*Discourse*

6.7 Arie Rip, Siebe Talma, *Antagonistic Patterns and New Technologies*, chapter in Cornelis Disco, Barend van der Meulen (eds), 'Getting *New Technologies Together: studies in making sociotechnical order*, Walter de Gruyter, Berlin, 1998 [SPRU Library course readings]

6.8 Alan Irwin, Constructing the Scientific Citizen: science and democracy in the biosciences, *Public Understanding of Science*, **10**, 2001: 10-18 [SPRU Library course readings]

*Case Study Participatory Exercises* (critiques are available under readings for Seminar E)

6.9 UK National Consensus Conference on Plant Biotechnology, *Final Report*, Science Museum. London, 1994 [*SPRU Library course readings] also on the web at: http://www.ncbe.reading.ac.uk/NCBE/GMFOOD/conference.html

6.12 UK National Consensus Conference on Radioactive Waste Management, Final Report, UK CEED, Cambridge, 1999 [*SPRU Library course readings] also available on the web at: http://www.ukceed.org/consensus-conference/contents.htm

6.13* UK Public Debate Steering Board, *GM Nation: the public debate*, UK Department of Environment, Food and Rural Affairs, December 2003 [*SPRU Library course readings] also available on the web at: http://www.gmnation.org.uk/ut_09/ut_9_6.htm#download

6.14* M. Pimbert, T. Wakeford, *Prajateerpu: A Citizens Jury / Scenario Workshop on Food and Farming Futures for Andhra Pradesh, India*, IIED, London, 2002 [*SPRU Library course readings] also available on the web at: http://www.iied.org/pdf/Prajateerpu.pdf

**++**
<http://www.iied.org/NR/agbioliv/pla_notes/pla_backissues/40.html>

**Workshop I: Debate on Science in Risk Management** Links to Lecture Themes 1-6

The debate is a role-playing exercise for all students in the class. Where the class is too large, it may be divided into two, each sitting on a different day (see timetable). It is based around an adversarial discussion of a particular motion, in this case that "*the management of technological risk is best based on 'sound science'*". The aim is to further familiarise the class with the issues and arguments arising in considering the use and role of science in risk management. At the same time, this exercise aims to highlight through direct experience some of the strategic, interactive and rhetorical processes associated with adversarial discourse on risk.

The debate will take place over a session of one and a half hours in length. It will be chaired by Andy and begin and end with a vote on the motion by all present. It will involve two teams of students, one proposing the motion, one opposing the motion. Each team will comprise four people: an introducer, a witness, a questioner and a summariser. Each team should prepare together as a group, with each holding the following individual tasks:

- the *introducer* will make a ***3 minute*** presentation, prepared in advance, of the main arguments of their team
- the *witness* will give a ***3 minute*** illustration of these arguments by reference to a particular case study
- the *questioner* will open the wider debate by kicking off with a ***brief*** question of the introducer and/or witness of the opposing team
- the *summariser* will close the debate with a ***3 minute*** presentation, drawing on issues raised in discussion, which rounds up the key issues before the final vote

The sequence of events will be as follows:

1 Introductions and anonymous prior vote on the motion
2 Presentation in favour of the motion
3 Presentation against the motion
4 Witness in favour of the motion
5 Witness against the motion
6 Questioner in favour of the motion
7 Questioner against the motion
8 Open discussion
9 Summary in favour of the motion
10 Summary against the motion
11 Closing vote on the motion

The team proposing the motion can draw on literature provided in the reading list for lecture themes 1, 2 and 4, along with other material as appropriate

The team opposing the motion can draw on literature provided in the reading list for lecture theme 1, 3, 5 and 6, along with other material as appropriate.

Case study literature on either side may be found throughout these readings, or in the material provided at: 1.29 – 1.39 or 3.10 – 3.26.

## LECTURE THEME 7

### Technological Risks and the Appraisal of Options

*(presentation by Andy Stirling and short discussion)*

Drawing on the account in previous lectures of the strengths and weakness of the various analytical and deliberative key features and conditions for applicability of analytic approaches to technology appraisal such as life cycle-, cost-benefit, multi-criteria, probabilistic and scenario analysis - examples from fields such as energy, agriculture and waste management.

***Reading for Lecture Theme 7*** (additional material under Workshop III)

*Essential* *(please be sure to read all of this material before the lecture)*

*Overview*

7.1 Robin Gregory, Paul Slovic, A Constructive Approach to Environmental Valuation, *Ecological Economics*, **21**, 1997, pp175-181 [SPRU Library course readings]

7.2 John Dodgson, Michael Spackman, Alan Pearman, Larry Phillips, Sections 1, 2, 3 and 4 in '*Multi-Criteria Analysis: a manual*, DETR, London, 2001 [SPRU Library course readings]

*Background* *(please read at least one before lecture and a further two before the seminar)*

*Overview*

7.3 Andrew Stirling, *Multi-criteria Mapping: mitigating the problems of environmental valuation*, in John Foster (ed), Valuing Nature', Routledge, London, 1997 [SPRU Library course readings]

7.4 Brian Wynne, *Methodology and Institutions: value as seen from the risk field*, in John Foster (ed), Valuing Nature', Routledge, London, 1997 [SPRU Library course readings]

*Case*

7.5 G. Vines (ed), *Rethinking Risk*, SPRU, 1999 [SPRU Library course readings]

**Workshop II: Citizens' Panel Role-Play** Links to Lecture Themes 6 and 7

The citizens' panel is a role-playing exercise for the whole class. It is based around a 'deliberative and participatory' discussion oriented towards a shared conclusion and expressed as a detailed consensus statement. The precise topic of the deliberation will need to be chosen in advance from among the case study topics provided for the course. The aim is to provide a contrast to the adversarial discourse experienced in the debate conducted in Workshop I. At the same time, this exercise aims to highlight through direct experience some of the strategic, interactive and rhetorical processes associated with deliberate orientations towards consensus in risk management.

The debate will take place over the two afternoon sessions, allowing (with a break) more than two hours of discussion. In the first part, the whole Panel will hear from pairs of witnesses representing academic, industry and NGO perspectives. In the second part, four closely-facilitated drafting groups will focus on developing draft consensus statements on one each of the following four separate topics:

- what are the key potential risks and benefits of the technology in question?
- what are the main features of effective risk assessment in this field?
- what are the appropriate roles of government, stakeholders and public engagement?
- what are the most reasonable risk management measures?

In the final part, the whole Panel will reconvene to deliberate over the final wording of a consensus statement on each of these four themes.

Student assignments for this session will comprise the following:

- Two witnesses, each making a ***3 minute*** presentation expressing a 'risk-based' or industry/business view of the issue in question. The presentations should each conclude with ***one*** proposed sentence on ***each*** of the four topics detailed above. The two industry witnesses should confer so that their proposed sentences work together.
- Two witnesses, each making a ***3 minute*** presentation expressing an 'uncertainty-based or 'academic' view of the issue in question. The presentations should each conclude with ***one*** proposed sentence on ***each*** of the four topics detailed above. The two academic witnesses should confer so that their proposed sentences work together.
- Two witnesses, each making a ***3 minute*** presentation expressing contrasting 'value based' or 'pressure group' views of the issue in question. The presentations should each conclude with ***one*** proposed sentence on ***each*** of the four topics detailed above. The two NGO witnesses should confer so that their proposed sentences work together.
- The session will be 'observed' by the two 'participant observers' identified for Workshop I, who will note the dynamics of discussion and any points of interest in the drafting of the consensus statement. In particular, this should be contrasted with the experience gained in the Debate. This will form the basis for a short presentation in Seminar E.
- Each drafting group will need to nominate at the outset a Facilitator and a Rapporteur. The facilitator will ensure presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves). Rapporteurs will record the consensus statement as it evolves in drafting and present this to the whole Panel.

Depending on the chosen topic, empirical case study literature for all three pairs of witnesses may be found in the material provided at: 1.29 – 1.39 or 3.10 – 3.26. Conceptual material for constructing the presentations by the three pairs of witnesses may be found in Lecture Themes 1, 2 and 3.

**Seminar E: Fairness and Competence in Risk Management** Links to Lecture Theme 6

This session will initially convene as a plenary and hear a ***3 minute*** report back from each of the two 'participant observers' concerning the dynamics of the process undertaken in the class' own Citizens' Panel exercise (Workshop II). After a short discussion of the points arising, the plenary will break into the pre-arranged seminar groups.

Each seminar group will then hear and discuss four different presentations over a period of 45 minutes, each presentation of ***5 minutes*** in length addressing one item drawn from among the critiques of participatory exercises given below. The task of each presentation will be to summarise some key ways in which the particular case study exemplifies, contradicts or ignores the key conceptual issues raised in the Lecture (theme 6) and the class' own practical experience in Workshop II. The task of the group as a whole is to discuss these points and arrive at a short series of bullet points characterising the main lessons that can be drawn both for the theory and practice of participatory deliberation in general.

Again, each group will have a facilitator and a rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).
- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

The plenary session will then be 30 minutes in length. This will hear the ***3 minute*** report backs from each of the seminar groups.

*Case Study Critiques*

6.15* H. Wallace, The Issue of Framing and Consensus Conferences', *PLA Notes*, **40**, February 2001 pp.61-3 [*SPRU Library course readings] also available on the web at: http://www.iied.org/NR/agbioliv/pla_notes/pla_backissues/documents/plan_04015.pdf

a critical review of the exercise reported in reference 6.12

6.16* S. Mayer, GM Nation? Engaging People in Real Debate?, a Genewatch UK report on the conduct of the UK's public debate on GM crops and food, Genewatch, October 2003 [*SPRU Library course readings] also available on the web at: http://www.genewatch.org/CropsAndFood/Reports/GM_Nation_Report.pdf

a critical review of the exercise reported in reference 6.13

6.17* N.Pidgeon *et al*, A Deliberative Future? An independent evaluation of the GM Nation public debate about the possible commercialisation of transgenic crops in Britain, 2003, University of East Anglia, February 2004 [*SPRU Library course readings] also available on the web at: http://www.uea.ac.uk/env/pur/gm_future_top_copy_12_feb_04.pdf

a critical review of the exercise reported in reference 6.13

6.18* I. Scoones, J. Thompson, 'Participatory Processes for Policy Change: reflections on the Prajateerpu E-forum', *PLA Notes*, **46**, pp.51-7 [*SPRU Library course readings] also available on the web at: http://www.iied.org/NR/agbioliv/pla_notes/documents/plan_04610.pdf

a critical review of the exercise reported in reference 6.14

## LECTURE THEME 8

### Risk, Control and Complex Systems

*(presentation by Paul Nightingale and short discussion)*

This lecture will examine the management of risks in large technical systems (eg: telecommunications networks, air traffic control systems, chemical plants, defense systems and railways). Large technical systems can improve their productivity by becoming larger, more energy intensive, faster and more complex. By doing so they become more susceptible to system accidents and the consequences of failure increase. There is therefore a trade off between productivity and risk. Beniger (1986) argues that control technologies and techniques can be used to ensure that systems operate efficiently and reliably. Nightingale et al (2000) argue that innovations in control allow systems to grow and thereby increase the consequences and pervasiveness of risk. By allowing systems to become more complex they also make them harder to understand and control, thereby increasing the likelihood of surprises. This is a particular problem with software based control technologies. Normal accident theory (Perrow, 1999) argues that large systems will always be subject to major accidents because they are complex, interactive and tightly coupled. High Reliability Theory (Weick 1987) argues, on the contrary, that effective organisations can remove accidents from complex systems.

***Indicative Seminar Topics for Lecture Theme 8*** *(other topics subject to discussion with Paul Nightingale)*

Managing Risk in Complex Systems: A Critical Review of Key Issues and Developments and Their Practical Implications

Normal Accidents versus High Reliability in *Sector X*: a Case Study in the Control of Technological Risk

How do Software Based Control Technologies influence the trade off between Risk and Efficiency? Explore the Key Issues

***Reading for Lecture Theme 8***

*Essential* *(please be sure to read all of this material before the lecture)*

*Control*:

8.1 J.R. Beniger, 'The Control Revolution: technological and economic origins of the information society', Harvard, 1989 ***Introduction*** [SPRU Library course readings]

*Accidents*:

8.2 C. Perrow, *Normal Accidents: living with high risk technologies*, Princeton University Press, 1999 ***Chapters 3 and 5*** [SPRU Library course readings]

*Reliability*:

8.3 K. Weick, ‘Organizational Culture as a Source of High Reliability’, *California Management Review*, **29**, 2, 1987 [SPRU Library course readings]

*<u>Background</u> (please read at least one before lecture and a further two before the seminar)*

*Control*:

8.4 J.R. Beniger, ‘The Control Revolution: technological and economic origins of the information society’, Harvard, 1989 ***Chapters 6 and 7*** [SPRU Library course readings]

8.5 P. Nightingale et al ‘Control Systems: How Technology Improves Capacity Utilisation’, *CoPS Working Paper* [SPRU Library course readings]

*Software*

8.6 N. Leveson ‘Safeware: system safety and computers’ Addison Wesley, ***Chapters 1 and 2*** [SPRU Library course readings]

*Case:*

8.7 D. Vaughan, ‘The Trickle Down Effect: policy decisions, risky work and the Challenger Tragedy’, *California Management Review*, **39**, 2, 1997 [SPRU Library course readings]

+ sort out references

+ see revised slide on format

**Seminar F: The Dilemmas of Risk Management** Links to Lecture Theme 8

Each seminar group will convenes for 1 hour to heart three ***8*** minute presentations on key issues from the literature covered in Lecture Theme 8.

Each presentation will be by one student, or a team of 2 students. If a paired presentation, the pair should liaise closely to ensure that the presentation is coherent and to-the-point. In such cases, the time may be divided as seems fit, eg by: different readings; different aspects; different cases; or combined pros and cons of the approach).

The presentation topics are as follows:

1 Managing Risk in Complex Systems: critical review of key issues and developments and practical implications. Refs: 8.1, 8.6, 8.7

2 Normal Accidents versus High Reliability: contending approaches to controlling technological risk. Refs: 8.1, 8.2, 8.3

3 How do Software-Based and Astronautic Control Technologies influence trade offs between Risk & Efficiency? Refs: 8.1, 8.4, 8.5

As usual, each group will have a facilitator and a rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).

- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

| **Workshop III: Multi-Criteria 'Poster Session'** | Links to Lecture Theme 7 |
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The Multi-Criteria Mapping (MCM) computer tool (called 'MC-Mapper') is installed on all machines in the SPRU Cluster Room. It can be accessed under 'all programs' from the 'start' menu. A CD will also be left with Carmen Long in the Teaching Office and can be borrowed by any student for a maximum of one day/night in order to install MC-Mapper on their own laptop or home computer. In order to do this, the appropriate version of Java Runtime Environment will first need to be loaded onto this computer or laptop. This can easily be done by following the instructions at the website: http://java.sun.com/j2se

Working in groups, this MC-Mapper tool can then be used outside class time to appraise a chosen technological risk management case study. In order to do this, students will be asked at Workshop II to form groups of two or more people who share an interest in a particular case study area. Over the following weeks, each member of the group will be interviewed by, and will themselves interview, at least one other member of their group using MCM. Each interview will require between half and one and a half hours.

One person from each group will be the 'convenor' for the group. The convenor will organise a 'kick-off meeting' at which the group will identify a common set of four 'core options' for addressing their chosen risk management issue. These may be technologies or policy options and defined as the group wishes. ***The final core option definitions should be confirmed with Andy in advance of interviews***. The 'kick-off meeting' will also elect a rapporteur and an observer for the group. The convenor will make sure that all members meet up to conduct the interviews and liaise with Andy on progress and any problems.

Simple instructions on the conduct of interviews using MC-Mapper will be posted on the course website and included on the CD available from Carmen. The process involves just four stages, that are also covered in Lecture Theme 7. The main requirement is that group members make efforts to use the available literature to give their appraisal as much grounding as possible. Individual members of the group may also include their own 'additional options', beyond the four that are appraised by the whole group. Each member may define their own appraisal criteria – there is no need for these to be agreed by all.

One person from each group will be the 'rapporteur' and will collect the results of the MCM appraisals from all members of the group. In co-operation with fellow group-members, the rapporteur will prepare a set of print-outs of the results obtained by their group. These will be displayed as part of a 'poster session' in Workshop III, involving a short ***5*** minute presentation addressing the following questions:

1) How much overlap did each individual find between the performance of different options (ie: how much uncertainty)?

2) To what extent did the group as a whole agree on the ranking orders for different options (ie: how much ambiguity)?

3) What can we say about the reasons for differences between options and individuals?

One person from each group will be the 'observer' and will collect the views of different members of the group to inform a short ***3*** minute presentation at the end of the poster session addressing the following queries:

4) What can we say about the strengths and weaknesses of MCM as an appraisal tool in relation to other methods reviewed?

5) What does MCM tell us about the key issues addressed in the 'Risk Course'?

The rest of Workshop III, will take the form of a plenary discussion among all students of the lessons learned about (and from) the MCM exercise and its subjects.

**LECTURE THEME 9**

## Putting it all together: new agendas in risk management

*(presentation by Andy Stirling and short discussion)*

Drawing on all the themes raised in the course, this final lecture will tie together the different strands and point towards the practical implications and the likely future trends. Particular attention will be paid to emerging thinking in the areas of flexible strategic management, precautionary strategies and constructive technology assessment. Complementarities and synergies between institutions and techniques will be explored, highlighting the increasingly important roles of diversity and pluralism and the potential for broad interdisciplinary approaches integrating new social, analytical and procedural innovations such as those reviewed in this course.

**Reading for Lecture Theme 9** *(additional literature is available from Andy in support of seminar papers)*

*Essential* *(please be sure to read all of this material before the lecture)*

*Overview*

9.1 A. Rip, T. Misa, J. Schot, 'Constuctive Technology Assessment: a New Paradigm for Managing Technology in Society', in A. Rip, T. Misa, J. Schot (eds), '*Managing Technology in Society*', Pinter, London, 1995 [SPRU Library course readings]

9.2 A. Stirling, S. Mayer, 'Precautionary Approaches to the Appraisal of Risk: a case study of a genetically modified crop', *International Journal of Occupational and Environmental Health*, **6**(4), pp296-311, 2000 [SPRU Library course readings]

*Background* *(please read at least one before lecture and a further two before the seminar)*

*Appraisal*

9.3 Johan Schot, Arie Rip, The Past and Future of Constructive Technology Assessment, *Technology Forecasting and Social Change*, **54**, 1997 pp251-268 [SPRU Library course readings]

*Precaution*

9.4 Brian Wynne, Uncertainty and Environmental Learning: reconceiving science and policy in the preventive paradigm, *Global Environmental Change*, June 1992 p111-127 [SPRU Library course readings]

9.6 Julie Hill, Robin Grove-White, Brian Wynne, Sue Mayer, *Uncertainty, Precaution and Decision Making: the release of genetically modified organisms into the environment*, GEC Briefing 8, GEC, Sussex, June 1996 [SPRU Library course readings]

9.7 Tim O'Riordan, James Cameron, Chapter 1: The History and Contemporary Significance of the Precautionary Principle, in *Interpreting the Precautionary Principle*, Earthscan, London, 1994 [SPRU Library course readings]

9.8 Ronnie Harding, Elizabeth Fisher, Chapter 1: Introducing the Precautionary Principle, in *Perspectives on the Precautionary Principle***,** Federation Press, Sydney, 1999 [SPRU Library course readings]

9.9 Joel Tickner, Carolyn Raffensperger, Nancy Myers, *The Precautionary Principle in Action: a Handbook,* Science and Environmental Health Network, Windsor, 1999 [SPRU Library course readings]

9.10 Joel Tickner (editor), *Precaution: environmental science and preventive public policy*, Island Press, New York, 2003 [SPRU Library reserve section]

9.11 A. Stirling, *Risk, Science and Precaution; some instrumental implications from the social sciences* in F. Berkhout, M. Leach, I. Scoones (eds), *Negotiating Change*, Elgar, London, 2003 [SPRU Library course readings]

*Strategy*

9.12 Harvey Brooks, The Problem of Attention Management in Innovation for Sustainability, *Technology Forecasting and Social Change*, **53**, 1996 p21-6, Elsevier, USA [SPRU Library course readings]

*Diversity*

9.13 Andy Stirling, On the Economics and Analysis of Diversity, SPRU Electronic Working paper 28, SPRU, Sussex University [available at: <http://www.sussex.ac.uk/spru/publications/imprint/sewps/sewp28/sewp28.pdf >]

| **Seminar G: Reflections on Risk** | Links to Lecture Theme 9 |
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In advance of this session, all students should go back to the problems discussed at the beginning of the course (especially lectures 3 and 4) and identify at least one key lesson that emerges for them from the course.

Each seminar group will then convene for 1 hour, during which they will hear two ***5*** minute presentations.

- One student will to give a 5 minute talk on the practical implications of the 'precautionary principle' for the appraisal of risk.

- One student to give 5 minute talk on the practical implications of constructive technology assessment for the social management of technological risk.

As usual, one person in each seminar group will serve as facilitator and one as rapporteur.

- The role of the facilitator is to ensure that presenters keep to time, that the group focuses on the task, that the rapporteur records key points and that all members of the group contribute (being careful not to dominate too much themselves).

- Rapporteurs will record key points during the seminar group discussion and make a ***3*** minute presentation back to a plenary session immediately afterwards, covering all the main 'bullets' arising from discussion of the presentations, also setting out any questions that may have arisen, which need clarification.

Informed by these contributions, the ensuing discussion will range freely over the extent to which these methods – and particular tools like MCM discussed in the earlier workshop session III – address the full scope of the challenges identified in the course as a whole.