WORKING PAPER 480

CHILD LEUKAEMIA AROUND SELLAFIELD: WHAT SEASCALE SAID ABOUT THE BLACK REPORT

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January 1986,
revised July 1986

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ABSTRACT

The paper investigates reaction to the Black Report by the inhabitants of Seascale, the community whose situation - in terms of leukaemia incidence and proximity to Sellafield - was the focus of interest of that Report. The paper draws on an original interview-based social survey among the inhabitants of Seascale. As well as routine examination of response frequencies, a new methodological tool for reconstructing aggregate patterns of a large number of multiple character responses (from the Galois connections between response categories) is used as a primary basis for interpretative analysis. It is found that the Black Report was received in Seascale with a mixture of confusion, satisfaction, deferred judgement and sharp criticism, and implications of this finding for the risk perception research field, as well as for policy makers, are brought out.

ACKNOWLEDGEMENTS; To Frans Berkhout for his work as research assistant during the survey period, and in compiling the statement and topic categories. To Trevor Springer for developing the computer algorithm. The research reported in this paper was partly supported by grants (nos D00232055 and D0025011) from the Economic and Social Research Council.

Child leukaemia around Sellafield: what Seascale said about the Black Report.

1. INTRODUCTION

Expert tribunals are increasingly called on to assess cases of the apparent imposition of serious pollution effects on local populations. Such tribunals are widespread phenomena in the USA, and prominent recent examples in the UK include the Committee of Inquiry under Professor Lenihan into morbidity in the Bonnybridge-Denny area of Scotland (Scottish Office 1984) and (the case considered in the present paper) that under Sir Douglas Black into the possible increased incidence of cancer in West Cumbria (Black 1984). The purpose of such inquiries is widely interpreted as being threefold: partly to "find out the facts" about local morbitity and mortality effects, along with judgement as to possible causes (often also confirming or refuting allegations of linkage with locally suspected potential hazard sources); partly to yield guidance to policy makers (perhaps recommending that particular sorts of research studies should be set in train, or additional controls should be enforced on local potential hazard sources); and partly to assuage public opinion (offering reassurance to those concerned about possible health hazards). In an earlier paper (Macgill, Ravetz and Funtowicz 1985) consideration was given to the Black Inquiry's fulfilment of the first two of these three roles. In the present paper the third is considered: specifically the extent to which the inhabitants of Seascale (the village whose child cancer incidence statistics and proximity to the nearby BNF spent fuel reprocessing operations at Sellafield were the focal pre-occupation of the Black Report) were reassured by the findings of the Black Report and, prior to that, in need of reassurance.

It is taken to be a research question of some significance, though interestingly, one that is generally not pursued, to assess the position of expert tribunals (in the present case the Black Inquiry) in the eyes of the communities whose situation they primarily address and to whom to a large extent they ostensibly speak. Two reasons will be identified as to why this research question is important. First, in a public policy perspective, if such inquiries are to attain legitimacy, and not merely to stand as acts of political expediency, or to interest only rather elite communities, then the question of the wider social relevance of officially appointed expert tribunals is of direct importance. In this respect, the position of the Black Inquiry as a mechanism for handling questions of societal risk acceptability bears interesting comparison with alternative institutionalk means, for example the quasi judicial public inquiry. (An earlier paper in this Journal - O'Riordan, Kemp and Purdue 1985 - found the public inquiry into the proposed PWR nuclear power station at Sizewell in Suffolk to be over dependent upon scientific and professional judgement as to what should constitute acceptable levels of danger from a nuclear installation.) Second, reliable and trusted information (such as can be expected to be forthcoming from expert tribunals) has been identified as an important factor in alleviating or limiting concern for risk, or otherwise affecting public risk attitudes. For example, a recent Report from the Royal Society (1983) discusses the importance of information, and Lee (1984) prescribes the provision of additional information as a possible means of increasing risk acceptability. Elsewhere Renn (1985) observes that credibility in the source of information is a crucial factor, and Otway and Thomas (1982) Wynne (1983) and Thompson (1980) give primacy to the position of socially negotiated trust as a pre-condition for "risk acceptability". Perhaps most significantly, a recent report from the House of Commons Environment Committee (1986) remarks on the importance

of having experts who are independent of the nuclear industry to offer advice and reassurance to members of the public. It is with some significance, then, that Sir Douglas Black's status can be noted - an eminent medical scientist and somewhat anti-establishment figure, with no connection whatever with the nuclear industry.

A recently undertaken interview-based household survey among the inhabitants of Seascale provides the data base for the examination in this paper of the social relevance of the Black Inquiry in Seascale. As well as routine examination of frequencies of response categories, a new methodological tool for reconstructing the aggregate patterns of a large number of multiple character responses (tracing both the frequencies of particular types of remark, and also their frequency of association with other types of remark) is employed. This method, entailing examination of what are technically calledthe Galois connections of the relation between respondents and the remarks they make, is described in the Appendix to this paper. The paper takes as one of its explicit (though subsidiary) purposes the presentation of a substantial empirical interpretative analysis undertaken on the basis of this method.

2. CONTEXT

The Black Committee was established in the wake of a highly controversial and unusually widely publicised television programme broadcast in November 1983 alleging there to be a connection between discharges of radioactivity from British Nuclear Fuels (BNF) spent fuel reprocessing operations at Sellafield in Cumbria (otherwise known as Windscale) and an unusually high incidence of leukaemia among children in the vicinity - ten times the national average for under fifteen year olds in Seascale, the nearest

village. Radiation is the only known cause of leukaemia within the limits of present knowledge, and Sellafield discharges greater quantities of radioactivity than any other installation in the UK.

Government responded to the television programme with significant speed in announcing within twenty-four hours that a committee of inquiry under the chairmanship of Sir Douglas Black had been appointed to investigate matters that had been highlighted. This inquiry was the most significant yet undertaken into possible public health effects of the nuclear power programme in Britain. Its report, published within nine months of its commissioning, stood as the foremost expert statement on the highly sensitive issue of whether children near Sellafield were environmental victims of nuclear power (Black 1984). Though tempered with the recognition of various uncertainties and identifying a need (with corresponding recommendations) for more research into the issues that had been investigated, the overall conclusion of the Black Report was that a "qualified reassurance" could be given to people who are concerned about a possible health hazard in the neighbourhood of Sellafield. The message of reassurance was repeatedly stressed by Sir Douglas in a large number of mass media statements following the publication of the report (Walker and Macgill 1985).

In assessing the social relevance of the Black Report below, it is not being assumed that members of the public have necessarily read the report (though some had); the event of its publication and its subsequent dissemination is merely being acknowledged so that, through whatever means (direct, mass media, social network, or whatever), it could potentially have influenced local 'risk attitudes'. It is not within the scope of this paper, nor immediately relevant to the question of the Black Report's social significance, to comment on or seek to remove the various

distortions that different means of dissemination will have had.

3. CASE STUDY RESEARCH

The recently undertaken interview-based household survey which provides the data base for the analysis in this paper involved a 1 in 14 randomly selected sample of the adult population of the village of Seascale (135 respondents). Seascale (see figure 1) was designated as a centre of attention in the television documentary due to the relatively high number of cases of leukaemia and other cancers found among its young inhabitants, with its proximity to the Sellafield site giving these particular significance.

Seascale (a village of rather more than 2,000 inhabitants) has a very distinctive social composition and history. It is a works village, built in the 1950's by the then Ministry of Supply to house its staff before and at the time that the Windscale piles were under construction. BNF, the present operators at the site (since re-named Sellafield), continue to own a significant proportion of the houses, and almost every family in the village has at least one Sellafield worker. This means not only that the village is almost entirely dependent on BNF for its livelihood, but also that Sellafield is the primary focus of village life. What is particularly significant from the point of view of "risk perception" orientated social survey work there is that conversation, dialogue and discourse among ordinary people about Sellafield is at the same time an every day part of life, and a rich and well developed part of local social fabric. The roots of concern for possible malign effects stemming from Sellafield's operations, or of active rejection of any basis for concern over issues highlighted in the television programme and investigated by Sir Douglas Black, are very deeply embedded, and typically bound up with

peoples different experiences of Sellafield.

Table 1 provides a summary of some key biographical features of the group of Seascale villagers who were interviewed. The "place of work" frequencies highlight the high degree of dependence of Sellafield (most of those who work "at home" are wives of Sellafield employees, and many "retireds" previously worked there). The "social class" frequencies indicate a relatively heavy preponderance of higher social classes, reflecting the high level of technical expertise and training required of many staff employed in Sellafield's reprocessing operations. These frequencies suggest also that the Seascale "public" should not casually be thought of as being an ordinary (or typical) "lay" public.

The key (free response) question of interest in this paper is the following:

> "What did you think of the presentation and findings of the Black Report?"

This was set within a wider, open-ended questionnaire drawing respondents into a structured conversation about the effect of Sellafield in their lives, their positions in relation to disputed health risks, their views about recent controversial events and activities centred on Sellafield, and their attitudes towards various individuals and organisations actively involved in monitoring, control and lobbying on related fronts. Their responses to the key Black report question, then, were contextualised within their responses to these other related issues.

Very few people (less than 10% of those approached in the village declined to participate in the survey. The high response rate can perhaps be interpreted to be a reflection of people's interest and involvement in the subject of the questionnaire; and their perception of the legitimacy and

impartiality of the survey (seen by some as an unusual, possibly unique, opportunity for participating in a public debate which was very much about their own situation but from which they had been excluded).

Conceptually, the emphasis in the present paper on responses to an open-ended survey question is in keeping with an argument, set out at greater length elsewhere (Macgill and Berkhout 1986a), that in seeking to understand "risk perception" primacy should be given to the way individuals choose to invoke the available material of what can be called "risk discourse". This theoretical perspective provides the scope for protraying a greater richness and diversity of risk attitudes and, in turn a greater depth of understanding than is possible through pre-formatted "ticks in boxes" sorts of questions or those which are quantitatively graded. The latter can, however, conveniently reflect the general complexion of people's positions in a relatively concise way, and some key graded questions were accordingly included in the survey. In Table 2, aggregate frequencies of response to two such questions are given, providing a background to the more specific analysis of later sections below.

What is immediately evident is the non-homogeneity of risk positions among Seascale inhabitants. Some people speak of concern for radiation-induced health risks as a result of Sellafield's operations (indicating a failure of the Black Report to assuage their concerns - an observation to be elaborated below). Others reject any basis for concern.

4. SEASCALE REACTION TO THE BLACK REPORT: REPRESENTATION OF RESPONSES

4.1 A preliminary to formal stages of analysis

A selection of complete responses to the question "What did you think of

the presentation and of the findings of the Black Report?" is reproduced in Table 3. The fullness of some of these responses reflects the awareness of many local people of the Black Report and their positions of having been drawn into related discussion and debate. The diversity of positions reflects the diversity of local attitudes to the Black Inquiry and the issues by which it was surrounded. The complexity of certain individual responses reflects a state of suspension, uncertainty or doubt about the issues on the part of some people. In order to analyse the complete set of responses as a whole a number of different stages of analysis will be given.

4.2 Stage 1: Identifying categories of remark

4.2.1 A detailed schedule of statements

In the first stage of analysis each individual response was divided into constituent statements, and statements (from different individuals) that were deemed to be similar to each other were grouped together in a given category. It cannot be claimed that there is a uniquely correct way of doing this; all that can be done is to discriminate one statement from another according to pre-conceptions (which in this case were partly intuitive, and partly informed by a prior knowledge or awareness of characteristics, general and particular, about the Black Report, the nuclear industry in West Cumbria, media reportage, government reaction, environmental politics and so on) of what constitutes sensible discrimination of one type of comment from another. Other analysts may well discriminate differently: all that can be attempted is to project an interpretation which is considered faithfully to portray the sentiments

and attitudes being expressed by the survey respondents, and reflect a familiarity with local conditions and the main arguments around the events covered in the question.

The finest level of resolution that was chosen in discriminating among responses to the key question produced the 66 different types of statement listed in Table 4. What emerges is a spectrum from "very favourable" to "very unfavourable", though the grading between these extremes is by no means simple and linear. This is given further comment below.

The responses of almost everyone who answered the question consisted of several of the remarks discriminated in Table 4, so the processing of the complete set of responses in the compilation of this table, whereby full responses have been dissected into a series of constituent phrases (semantic units), represents a degree of disruption of peoples actual utterances; and different parts of what was originally a single response now appear in different parts of the Table. Problems and paradoxes are unavoidable in the process of categorisation of a large number of semantic units - see Macgill and Berkhout (1986b) for a fuller appraisal of certain aspects. In particular, a reader should be aware that the units in Table 4 appear in a somewhat de-contextualised state, since they have been torn from their original positions within actual conversations. Placing them in the table, in effect, brings new meaning to them. In this form they can only be assessed as generalised, socially produced and reproduced arguments and propositions, not as particular phrases, embedded in and deriving meaning out of a conversation or speech act. In a later stage of analysis, however, a re-construction of how often particular types of statement occurred by themselves, and how often with other statements of various kinds will be given. Due to the size of data set this cannot be managed at the a detailed level of resolution of 66 statement types.

Instead, a further stage of analysis is first conducted, aggregating the 66 types of statement to 20 'topics' at a coarser level of resolution. This will enable a comprehensivity and level of generality not previously possible to be reached.

4.2.2 An aggregate schedule of topics

A reduced schedule of 20 topics (from the previous 66 statements) is given in Table 5. The reduction is primarily concerned with grouping together similar statements, thereby extending and deepening the process of interpretation begun at the first stage of analysis. Statements uttered with low frequencies were not grouped into topics, because the concern was with a comprehensive overview of core arguments and ideas.

Two further principles guided the process by which a list of topics was constructed from the list of statements, in addition to the basic goal of discerning similarity in an adequately open fashion.

(a) Statements of a similar level of specificity/generality were grouped together, ie "Acceptable findings" and "Adequate report" were deemed to be similar to each other, and different from statements such as "You can't prove a negative" or "There was a lack of evidence/No one knows everything".

(b) Key phrases or arguments which appeared in previously distinct statements were grouped together, eg "People should look at other causes" and "Made me aware we need to know other causes of cancer in the area" would be grouped.

The breadth of meaning for each of the resulting 20 topic categories is

not equivalent. Some are more complex and ambiguous than others and appear to have a wider span of meaning. Again, all that can be done is to provide suitable groupings with a "reasonable" interpretaion of their meanings.

Particularly noteworthy in Table 5 is the relatively large number of categories that might be described as "unfavourable"; what must be understood in this connection is that the categories in themselves do not constitute a monitoring of opinion - they are not in themselves frequencies or counts - but, rather, a scale of measurement in terms of which "opinion" can be measured. (Comment on frequencies per category is made later). It is deemed particularly important that the primary scales of measurement - the different categories of topic - are determined largely by the people whose positions the analysis seeks to reflect and comprehend, and not be pre-imposed by the analyst. In this respect this work seeks to retrieve risk perception research back from analysts (and often industry's or authority's) frames of reference and put it back in the hands (words) of the public themselves. This entails, amongst other things, constructing measures appropriate to that which is being measured and takes further the call made, for example, by Earl and Cretcovich (1983) for a "brave new age" for risk perception research. The extensive use of open questions for the survey interviews was an essential aspect of this; the manner in which responses are then analysied is a further crucial aspect.

In the next subsection the meanings understood to be contained within each of the 20 topic categories identified in Table 5 are summarised, elaborating on their additional significance as core lines of argument that people invoke in collecting, rationalising and justifying their own positions.

4.2.3 A Schedule of key topics

Topic A. This is a commendation of the Report and its findings in general terms and an expression of agreement with its conclusion. It is not necessarily an agreement based on the data and scientific method of the Report but an agreement based on more general grounds and often, it turns out, on opinions already held.

Topic B. These are comments about the Report as good, comprehensive science. They might refer to the high quality of data used, the systematic method, the objective reasoning, and the search for truth.

Topic C. These comments acknowledge that there is a local excess of leukaemia, that Sellafield is not the cause, and that there is a need for research into other possible causes (not a recommendation made by Black).

Topic D. These are comments to the effect that the Report was reassuring to the respondent a community - any doubts which were held during the YTV programme controversy have been assuaged (partially or completely) by the Report. For these respondents the Report achieved what Black had set out to do.

Topic E. These are comments commending the good, clear presentation of evidence, argument and conclusions in the Report, by Black and other parties involved.

Topic F. These comments recognise that the Black Committee was limited by the time available to prepare the Report. Comparisons might be drawn between this investigation of cancer rates and long-time horizons of

cancer research in general.

Topic G. These comments refer to problems of evidence, burden of proof and theorising in an ambiguous area of science, and how these problems (which have previously only been available to professional science) can be negotiated to a non-scientific lay public.

Topic H. These are comments on the style of the Report and its reception by the media and interest groups. They remark of the Report being written so even-handedly that instead of bringing an end to the arguments it actually generated more argument.

Topic J. These comments criticise the Report's presentation. (Not very clever presentation, Poor presentation, Black did not seem to be able to put things well). For these respondents, the public performance of the Report by its authors and other institutions was seemingly not equal to the performance of the critical view (YTV, Greenpeace, the "media" in general).

Topic K. These are criticisms of the content of the Report (vague, inconclusive and confusing). The Report has too many qualified statements and conclusions which are not helpful to the advance of the debate, or as an instrument of public policy or to the final meeting of uncertainty with certainty.

Topic L. No comment/Not interested/No knowledge - self-explanatory remarks.

Topic M. These comments remark that the report contained no new evidence or revelations, no new solutions, no new explanations or proofs.

There was no persuasive elaboration of the debate as it was understood by the public.

Topic N. These are generalised criticisms of the credentials, goals and persuasiveness of the Black Report's conclusions, expressing disappointment with the report and the manifest problem of legitimation.

Topic P. These points constitute a specific charge that the Black Committee manipulated statistics to prove its own case - in the same way, perhaps, that the producer of the crucial television documentary had manipulated his.

Topic Q. These remarks signify criticism of the underlying drift or style of the Report (its investigation and its text) as too deferential or sympathetic to BNFL's case of non-culpability. They relate to Black's spoken intention to "reassure public opinion".

Topic R. These are remarks critical of the Report as deliberate, covert misinformation, alleging Black's complicity in allowing it to become another organ of the nuclear industry's own publicity "whitewash", "cover-up" - the general perception of the industry as secret, self-interested, and powerful enough to maintain this self-interested secrecy (including the silencing of apparently impartial government inquiries like Black).

Topic S. This topic heading represents a number of different comments connected by a basically critical attitude. (i) Report as "alarming" (comparable with YTV programme). (ii) The Report contained contradictions/ its conclusions didn't match up with the evidence it reported. The report was defective as scientific inquiry.

Topic T. These comments remark that more research is needed; the Black Report is only the beginning. Such remarks have linkages with F. "They did the best they could".

Topic V. These are comments to the effect that the Report was difficult to understand for the lay-man. They portrays a lay-man's alienation from technical languages - a common theme in sociological work on professionalism and the exclusivity of technical languages.

Topic W. These remarks describe the Report as Adequate and Acceptable: that it was good enough as a piece of public policy, but not very interesting or relevant to the public.

Topic X. Other statements - not coded as topics.

4.3 Stage 2: Frequencies and the structure of connections

4.3.1 Overview of method

A faithful characterisation of responses requires not only an appropriate categorisation of types of remarks, but also a reflection of (a) their popularity, and (b) their juxtaposition alongside others of various kinds, thus throwing particular comments into relief against others and putting individual frequencies into perspective by taking account of other remarks by which they were qualified. Topic frequencies are displayed in Table 6 and (following the methodology described in the Appendix to this paper) the frequencies with which, in the original responses, particular topics were uttered alongside others were reconstructed. The main connections are

indicated in Table 7. Findings are discussed in the following paragraphs.

4.3.2 Three classes of remark

In reading through the range of topics identified in Table 5 three broad classes of comment can be discerned, namely, broadly favourable, broadly uncertain and broadly unfavourable. These classes are indicated by the symbols, - , ? and X, respectively, in table 6, where the topic schedule is re-ordered according to rank frequencies of occurence (beginning with the most popular). The frequencies of each of the three classes are 119, 128 and 104, portraying the Black Report as having had something of a mixed reception within Seascale village.

The initial portrayal is very much corroborated in a detailed examination of the aggregate pattern of responses. In presenting this more detailed examination, each of the broad classes of comment is considered in turn: broadly favourable, broadly uncertain then broadly unfavourable. Each individual type of topic within each class is then discussed in turn, beginning with the most popular, and commenting on the types of other remark that accompanied these remarks in people's original responses.

4.3.3 Broadly Favourable Remarks

Favourable reaction to the Black Report among Seascale inhabitants, as detected by the questionnaire and organised at the derived level of 'topic' discrimination, falls into five dominant groups, given below in order of their popularity of occurrence:

E The report was well presented

D It was reassuring

B It was fair and accurate

A It was well done and satisfying

W It was a credible government report

The most popular favourable remark is topic E (well presented) which ranks fourth in the schedule of topics overall (Table 6 and line 1 in Table 7). It is a simple and direct response to the first component of the question that was put (presentation). As remarked earlier, presentation is not specifically about the substantive content, findings or recommendations of the report, but about its overall appearance and legitimacy.

Of the 35 respondents who made this remark (and reading from level 2, Table 7), 15 qualified it with topic T (open for more research), 10 with topic F (did the best they could) and 11 with topic K (vague, inconclusive). Taking account of the number of people who included two or more of these additional topics in their responses (to avoid double counting) as evident from higher levels in Table 7, over half of the 35 people who said "well presented" qualified their apparently commendatory remark (topic E) with more uncertain T and/or F, and a further third qualified it with the rather more critical topic K. So, the initial broad labelling of topic E as commendatory needs significant further qualification.

Ranked 6 is the first substantively favourable statement, topic D (report reassuring); proof that the report had achieved what Black had stated initially was amongst its aims - to reassure local opinion. For these respondents not only had the report been prepared in the proper manner but the results and recommendations had assuaged any doubts which they may have held after November 1983. The report had actually changed their minds, or perhaps more accurately, confirmed to them that there was no

reason to be uncertain about local health issues.

Of the 27 respondents who made this remark, 11 qualified it by the further favourable remark E (well presented), 9 with B (good comprehensive science) and 6 with W (acceptable, adequate). These are the highest frequencies with which topic D was complemented (ie generally with further favourable remarks). In some cases, however, respondents suggestions of having been reassured were more hedged (see level 3, where D and E appear with T 5 times, and D and V with T 4 times).

Ranked seventh are remarks (topic B) concerning the fairness (the Justice) and accuracy (the Science) of the report. Obviously any document of this type must be assessed according to these criteria, but in this case the significance of these statements is that they were usually uttered in the form of a refutation of the Justice and Science of the YTV programme.

As with D, topic B is qualified mainly by other favourable remarks or remarks which, in keeping with a "scientifically" couched view, identified uncertainties of a specific kind.

The next positive comment about the content of the report is topic W (adequate report) ranked 11 with a frequency of 22. It is a fairly non-committal, favourable but slightly disinterested general remark about the report and its findings, conveying an impression that the investigation and report were soberly and uncontroversially conducted and written but that in reality, the fact of its being done or its conclusions, little affected local and national debates - it was "mildly reassuring" and "sensible". A fairly distant government report, spoken about in generalities, relevant to (more specialised) argument going on elsewhere.

Comment W occurs most frequently with topics T (?open for more research) and E (report well presented, see Table 9 level 2) - a frequency of 10 in each case - each in their turn broadly compatible with the generally positive but non-committal W.

Ranked 14 comes topic A, a collection of more general comments praising the report (a weaker statement of topic B). Topic A has an overall frequency of just 9, 7 of which (see level 2) are respondents who also included topic B (more specifically commendatory) and 3 of these in turn (from level 3) perhaps more paradoxically, included V (difficult to understand) as well.

4.3.4 Broadly uncertain remarks

The group of opinions designated "Uncertain" can be characterised as consisting mainly of:

T More research is required to clarify remaining ambiguities in the evidence.

F The Report contained no more or less than I expected, it did not prove to be the advance other people might have been hoping for.

M The report contained little or nothing new.

The top ranked of all comments, given by 46 respondents, is T (open for more research). It seems particularly aimed at the "qualified" aspect of Black's much repeated message "qualified reassurance". Positions remain

in a degree of suspension while additional research is undertaken, the time frame for which is unknown. While this view corresponds closely with Black's recommendations for more research, it often refuses to accept as adequate the "reassurance". In responses as a whole the remark is accompanied by the criticism that the report was vague (topic K, 17 times), difficult to understand (V, 9 times) and of dubious substantive merit (N, 8 times). However, it is also accompanied by more positive remarks, notably E (well presented) 15 times, B (good comprehensive science - almost a contradiction in terms) 12 times and W (acceptable enough) 10 times; also by the more hedged 'time limited' comment (topic F 12 times). Overall then, topic T is a remark embedded in many and varied other qualifications.

Topic F ("time limited", "did the best they could", and "all I expected"), generally referring to the long time frames of cancer research, was said by 36 people. It is another type of "suspended" comment, though (from Table 9) can be seen to be more frequently accompanied by favourable or uncertain, rather than unfavourable comments.

Ranked 9 is topic M (the report contains nothing new). It typically occurs alongside other uncertain remarks: F ("did the best they could", 7 times) and T (more research is needed, 5 times); and of broadly critical remarks: K (general criticsm of the content of the report, 8 times), V (difficult to understand, 8 times) and J (criticism of presentation, 5 times). It scarcely ever arises alongside commendatory remarks, and as such its broad labelling as "uncertain" should be further qualified in terms of negative, not positive associations.

Other 'broadly uncertain' remarks were made with lower frequency.

4.3.5 Broadly unfavourable remarks

Statements designated "unfavourable" are grouped into the following topic categories:

K vagueness and inconclusivity of report

V difficult to understand

N explicity criticism of the report

J criticism of presentation

Ranked equal second with a frequency of 36 is topic K: general criticsm about the confusing and ambiguous nature of the report. The respondents may also, of course be intimating that ambiguity is often intended not simply read. Nearly half of its occurences are alongside topic T (open for more research, 17 times) and, more curiously, (though perhaps at least partly explained by some respondents taking presentation to refer to the way the report had been projected by various media, and not simply the report itself) it occurs 11 times alongside topic E (well presented).

Ranked 8 is topic V (remarks to the effect that the report was difficult to understand). This was said by 24 people. These remarks were made alongside a range of others (see Table 7), some apparently contradictory (for example B good comprehensive science; D reassuring; W acceptable, adequate - for some respondents, the report's difficulty seems to have contributed to its overall authority.) Overall then, its initial designation as unfavourable should be qualified in diverse ways.

Ranked 12, said by 14 people, are a range of more explicit criticisms of the report (topic N). Other than being accompanied by each other (which,

in this analysis, would not be double counted), they are accompanied typically by other unfavourable, or by uncertain remarks, most frequently (8 times) by topic T (open for more research) and (6 times) by topic V (difficult to understand), and (5 times) by topic J (criticism of presentation). This is much as would be expected for such manifestly critical comments: they virtually never appear with comments designated "favourable".

Also ranked 12 (topic J) are criticisms about the report's presentation. Just as "well presented" is a simple term that might signify perhaps immediately inexpressible cognitions, so criticism of presentation may signify much deeper rooted doubts. However, its most frequently associated remarks are F (did the best they could, 6 times) and M (nothing new, 5 times). So it is rather suspended comment.

Other broadly unfavourable remarks occur with lower frequency, and they will be given no further comment here.

4.3.6 No comment

As well as the range of substantive comments considered above it remains, for completeness, to note the frequency of 'no comment' (30 respondents), and also the existenceof a diverse range of statement types (23 in all) each individually of too low a frequency to warrant categorisation into topic categories.

5. EVALUATION

It would be wrong to priviledge the methodological approach adopted in stage 2 of the analysis above as being uniquely comprehensive or

exhaustive. It can simply be said that the scrutiny of topic connections has undoubtedly proved to be an effective addition to more familiar procedures for the analysis of survey data. Some readers may prefer to see particular significance attached to the position of individual remarks within people's full response, implying that a first comment, for example is more significant than a second, third or fourth. Having examined a larger data set from this perspective (in fact, the full spatial survey coverage, of which the Seascale responses reported in this paper are but a subset) however, little of significance emerged (see Macgill and Berkhout 1986b). Others may seek to investigate the possibility of statistically significant correlations between, say, topic categories and respondents' biographical characteristics. This again has been investigated elsewhere (Macgill and Berkhout 1986b), and is beyond the scope of the present paper. The present paper has been concerned instead to characterise the reaction as a whole to the Black Report that is found among Seascale inhabitants. It is beyond the scope this paper to attempt a serious review of alternative possible analytical approaches.

It cannot be helped that respondents may not actually have said everything they might have said in responding to the key question analysed above, and on another occasion may respond somewhat differently. Had the above analysis been based on a relatively small (less than 50, say) sample size, or given some absolute status to the frequency response counts in themselves this may have been quite a serious reservation. What is more important in the analysis as given is to appreciate the richness and diversity of local reaction to the Black Report among the Seascale inhabitants, acknowledging the broad popularity and interjuxtaposition of different arguments.

It is recognised that since some responses are longer than others, they

will carry a disproportionate weight in the findings and introduce certain kinds of bias. To seek to rid the analysis of such characteristics would be to subscribe to a view that surveys can achieve a "democratic" representation of opinion. Although it is sometimes pretended that this can be achieved, it may be truer to suggest that the way in which dominant responses "bias" the survey analysis reflects the way in which dominant individuals "lead" local opinion anyway.

It is also worth repeating that the force of the analysis given above does not depend on respondents having read the Black Report at first hand. Its publication is merely taken as an event which occurred, which was projected through various channels (mass media, special meetings, public commentary by certain spokespersons, or more informal social networks) and which, to a greater or lesser extent, could be received by the local population. From the point of view of addressing the research questions posed at the beginning of this paper, to attempt to neutralise the effects of different channels and distortions in the above research would be neither desirable nor possible. Correspondingly, to inquire into ways of lessening the distortion and getting the Black Report's message over more adequately would demand a different focus than the one actually chosen.

6. CONCLUSIONS

The Black Report was received in Seascale with a mixture of disinterest, confusion, deferred judgement, satisfaction and criticism. The general attitude polls (Table 2) reflect continued concern among large sections of the Seascale population, though at the same time a significant number of people reject any basis for concern.

The Black Report seems to have been assimilated into an already developed spectrum of risk attitudes in ways which generally seems to have confirmed or deepened people's original positions. It rarely seems to have been a catalyst for revision of position, but was rather, either unimportant to people or, more often, was used to reinforce or extend particular arguments: extending justifications for concern (a hedge, a cover up); extending justifications for the rejection of concern (proving to some that Sellafield was not to blame).

For many who harbour continued concerns, the reassurance offered by Sir Douglas Black was clearly wanting in effect. People were not reassured by an externally appointed, albeit independent, specialist offering expert reassurance. This very limited effectiveness of the Black Report in assuaging risk concerns is uncomfortable news for anyone who would want and expect such an outwardly distinguished public policy initiative (and argument of reassurance) to have greater social relevance. Independence of expertise is nowhere nearly enough (cf the argument of the House of Commons Environment Committee referred to in the introduction to this paper); and a procedural mechanism removed from the ordinary experience of everyday life is again largely impotent for handling questions of societal risk acceptability (cf O'Riordan et al's 1985 broadly analogous comment in respect of the Sizewell public inquiry).

The limited effectiveness of the message of reassurance emerging from Sir Douglas Black's Inquiry in assuaging people's concern for possible health risks from Sellafield can perhaps be more closely considered by discriminating between two (linked) aspects - the social and the scientific.

In social terms, limitations arose due to stronger forces acting at

interpretational, psychological, cultural, institutional and experiential levels for the Seascale population. These are the sorts of influences already identified in the risk perception research literature (Otway and Thomas 1982; Wynne 1983). An important implication is that the establishment of trust between, on the one hand, concerned populations and, on the other, institutions in a position to offer reassurance, cannot be secured by a one-off initiative by externally appointed specialists offering expert reassurance. It would be necessary to engage much more adequately with the deeply rooted vectors of interest and human reality that are found in Seascale. Given the contrasting and often contradictory risk positions there, this in turn is a goal of perhaps impossible magnitude.

To these 'social' limitations can be added those of a second kind, by acknowledging that a significant number of Seascale inhabitants recognised many points of entry to dispute the integrity of the science contained in the Black Report - because of immaturities, imperfections and uncertainties in the science of low level radiobiological health effects; and the long time horizons over which cancer research operates. (In parallel with this observation, it may be noted that the Black Report also became subject of controversy in scientific communities, with a sequence of follow-up articles appearing in such outlets as Nature, New Scientist, the Lancet and the Guardian.)

All in all the rich complexion of risk positions in Seascale must be recognised: at a general level in terms of the manifest diversity of attitudes (as indicated in Table 2); and more specifically in terms of the different kinds of arguments that people draw on when being invited to talk about their positions in relation to the Black Report. There is a well of agreement argument, resistance and reflection which cannot easily

be changed, shaped or broken down.

Finally to place the above analysis in a wider setting of political economy, it can beobserved that the Black Inquiry was established as a political response to a panic evoked by a television documentary. This programme was a threat to national confidence in the nuclear industry, and a challenge to the basis of official discharge authorisations. In commissioning Sir Douglas Black's Inquiry , government was responding to these sorts of national issues. Government did not engage with the people who lived in the targeted area - Seascale, or West Cumbria more generally - in setting up the Inquiry. It was not a response to concern there, for positions there were unknown. Neither did the Inquiry's report engage very fully with local people. They remained on the periphery to a centre with more powerful interests and concerns. If this interpretation of the political economy of the Inquiry portrays it as a somewhat hollow act, then further qualification is called for. For, as argued elsewhere (Macgill, Ravetz and Funtowicz 1985) the new medical and scientific studies that were recommended as a result of Sir Douglas Black's Inquiry, and which have now been set in train, along with tighter statutory controls on BNF's operations herald at least some advance in the overall knowledge base for risk management at Sellafield.

Table 1. Biographical characteristics of Seascale respondents

136 respondents. 62 male
74 female

% by class

class	1	2	3	4	5	6
	20%	32%	18%	15%	13%	-

% by place of work

Sellafield	Pub admin etc	Home	Retired	Other
36%	12.5%	23.5%	15%	13%

Table 2.

2a Aggregate Seascale attitudes towards possible radiation induced health risks to children as a result of BNF's operations.

Not worried	Concerned	Anxious	Cannot Say
38.5%	50.4%	7.5%	3.6%

2b Aggregate Seascale attitudes about beach radiation levels.

Not worried	Concerned	Anxious	Cannot Say
51%	40.7%	4.4%	3.8%

Table 3. Some complete responses to the key Black Report question.

1. In the circumstances, time limited, he did good job. I'm still not happy about it. If there is a bigger risk of leukaemia in this area it might not be Windscale but whatever it is should be found out.

2. Very technical in a lot of aspects. Very good. Pleased that he didn't state a definite connection with the works and pleased that further research continues.

3. From all the things we know there's nothing to worry about. Very difficult to prove or disprove. It's like a court case. Black set up as a defence. Given a task with no conclusive answers. Was an accurate and meaningful as he could make it.

4. Not clear enough - confusing - going round and round the subject. But best they could do in the circumstances.

5. Accept everything Black said. Waiting for more work. Expected more investigations - never ending. You can always carry on digging.

6. Black received well in the local area. Inconclusive - it needs another in depth inquiry. What was done was as much as possible. - still left a doubt. - We hoped there would be conclusive answer.

7. Not a lot, didn't have enough time - it hasn't made a difference to local attitudes.

8. Absolute waste of time. Nothing will be done about it. We've had many reports. Mallory Report about Rugby - nothing has been done - there are still arguments. The powers that be should know what their doing.

9. Black was nice enough man. Weren't much good - didn't fill me with confidence. And needs to be looked into further. Didn't give a positive answer. Didn't say BNF is not responsible for these leukaemias. Not direct.

10. Black, steady, genuine approach - right man for the job. A lot of it was good information. But an air of doubt and started further studies, further research, started the ball rolling. Clusters in different parts

Table 3 cont'd

of the country - wanted reasons for these - wanted more comparison of environments.

11. Not readable, could have been clearer presentation - should have been summary report for local people, lay people couldn't make much sense. Poor report, in the course of my work I read many reports, reviewed medical statistics already available, NRPB work more thorough. I would have liked to identify common causes - did all the cases live on farms, near the sea, fathers who worked in the same building. Limited time but no headway.

12. They ought to have someone looking at it to see what facts are really true.

13. Taken no interest in what it was saying.

14. It answered all the questions for me.

15. Don't think he really settled it one way or the other - it still left you guessing.

16. Wasn't publicized enough to the rest of the country. People wouldn't have taken any notice - people think there's something terribly wrong up here.

Table 4. Black Report statements as discriminated at finest level of resolution

	Topic Code	
General evaluation	A	Very good report/Very well done
	A	I agree with the report's findings
	A	Satisfied/Happy with report/Findings/Report was helpful
	B	Accurate/Detailed/Scientific report
Specific evaluation	B	Fair/Unbiased/Genuine report
	B	Conclusive report/Sellafield is not the cause of cancer
	C	People should look at other causes
	C	Made me aware we need to know the causes of cancer in this area
Effect	D	It set my mind at rest/Reassuring
	D	Reassuring for the community. I'm confident in Douglas Black
Present-ation	E	Well presented/Pretty good presentation
	E	Easily understandable/Well written too
		Pleased with the recommendations
	W	Acceptable findings/Adequate report/Mildly reassuring/Sensible
	F	They did the best they could with time and resources they had/ Can't determine the cause of cancer so quickly
General evaluation	F	All I expected/Much as I expected/Predictable/Not surprised
		He knows more than me/You have to believe the experts
		Happy that something is being done/And that we're being told
		It gave evidence of high incidence of child leukaemia
	G	The numbers were too small to come to a conclusion
	G	The public can't understand the concept of uncertainty in science
Specific evaluation	F	It was done in a hurry/There wasn't enough time
	G	No-one knows everything/There was a lack of evidence
	G	You can't prove a negative - that it isn't caused by Sellafield Report showed there's no more risk living here than anywhere else/All comparative risk arguments
	B	I was happy that no connection was made with the factory
	H	Report attracted a lot of controversy
	H	Report was trying to please everybody
Effect	H	Report interpreted differently by different people/groups
	H	The media treated the report badly/In an anti-way
		Report hasn't made any difference to local attitudes

Table 4 cont'd

		Report was presented all right/They seemed capable people
Present-ation	J	Report could have been put over better/Boring report
	J	Not a very clever presentation/I was not confident about the presentation/Poor presentation
	J	A shortened version would have been useful for the man-in-the-stree
		Black was trying to reassure the public (rather than find the truth
	T	Open for more research/More research needed/This is only beginning
	K	Inconclusive/Not Definite/Inadequate/Left a doubt
General evaluation	K	Vague report/Woolly
	K	Confusing/Didn't come out one way or the other/Said so little/ Ambiguous
	V	Rather thick/Too long/Drawn out/Heavy going
	M	It didn't find anything new/Didn't tell us anything new
	L	I didn't think anything about it/I don't know/I've forgotten
Claim of ignorance	L	I can't say/Can't comment
	L	Didn't hear about the findings
	L	Not interested in the findings
	N	Report was a hedge/I8m suspicious of the report
	N	I wanted to believe the report but couldn't"Unreassuring
General evaluation	N	Disappointed/Not impressed/Unconvincing
	N.	Unconvincing for the general public
		Mixed feelings
	P	Figures can be manipulated to say what you want them to
Specific evaluation	V	I couldn't understand the report/Too technical for the layman
	Q	Biased towards BNFL/Report too cautious
	P	Incomprehensive/Limited/Unscientific
	M	Didn't get to the bottom of it/Not in enough depth/Didn't tell enough
Present-ation	Q	Disclosure couldn't be too risky/Politically worded report
	Q	He said what they wanted him to say/I think he'd been bought
General comment	R	Not happy with the report/Whitewash/Cover up
	R	Things are still being covered up in the interests of BNFL
	M	It didn't help anyone by being undecided
	R	I wasn't happy with Douglas Black/He didn't seem to be able to put things very well
	S	Alarming report/Upsetting/Proved we were at risk
Criticism	S	Contradictory report/Conclusions incompatible with the data
		Waste of money/Useless exercise/Load of rubbish

Table 5. Alphabetical coding of topics

A Commendation of report and findings in general terms.

B More explicit commendation of report's science and conclusiveness.

C Observations of the need to research into other causes.

D Report reassuring to respondent/community.

E Commendation of presentation.

F Limited time/ did the best they could/ all I expected

G Uncertainties in report science.

H Hedged comment about the style of the report.

J Criticism of the presentation.

K General criticism of the content - vague, inconclusive, confusing.

L No comment/not interested/ No knowledge.

M Observations that the report didn't get anywhere.

N General criticism of the Report's credentials and conclusions.

P Specific criticism of Report's science and statistics.

Q Critical of the underlying drift of the Report.

R Critical of Black's deliberate misinformation.

S Other comments connected by a basically critical attitude.

T More research is needed.

V The Report was difficult to understand for the layman.

W Report as adequate and acceptable, though of little interest.

X Other statements, not coded as topics.

Table 6.

Topic Code	Freq	Rank	Type	Description
T	46	1	?	More research is needed.
K	36	2	X	General criticism of content of report - vague, inconclusive, confusing.
F	36	2	?	'Did the best they could in the time available'.
E	35	4	✓	Report well presented, both in itself and by the media ie general commendation.
L	30	5	-	No comment/no interest/no knowledge.
D	27	6	✓	Report reassuring, both to the respondent and the community.
B	26	7	✓	Specific commendation of report; report as good, comprehensive science; conclusive.
V	24	8	X	Report difficult for lay person to understand.
M	23	9	?	Report contained nothing new; didn't get anywhere.
X	23	9	-	(other comments, not coded as topics).
W	22	11	✓	Report as adequte and acceptable, though of little interest.
N	14	12	X	Generalised criticism of credentials and conclusions of report.
J	14	12	X	Criticism of presentation.
A	9	14	✓	Commendation of report in general terms.
G	8	15	?	Problems of evidence and burdens of proof and their public negotiation.
C	8	15	?	Observations of the need to research into other causes (other than Sellafield).
H	7	17	?	Hedged comment about the style of the report.
Q	7	17	X	Critical of underlying drift of report.
P	4	19	X	Specific criticism of reports science and manipulation of statistics.

Table 6 cont'd

Topic Code	Freq	Rank	Type	Description
S	4	19	X	Other comments connected by a basically critical attitude.
R	1	21	X	Unhappy with Black and his report as deliberate misinformation.
Total number of remarks	404			

Total	✓	119
Total	X	104
Total	?	128
-		53

Table 7 Abbreviated representation of topic connections *

	?	X	?	✓	-	✓	✓
Level 1	(T,46)	(K,36)	(F,36)	(E,35)	(L,30)	(D,27)	(B,26)
	X	?	-	✓	X	X	✓
	(V,24)	(M,23)	(X,23)	(W,22)	(N,14)	(J,14)	(A,9)
	?	?	?	X	X	X	
	(G,8)	(C,8)	(H,7)	(Q,7)	(P,4)	(S,4)	

Level 2 (KT,17) (ET,15) (FT,12) (BT,12) (DE,11) (EK,11)
(TW,10) (EW,10) (EF,10) (DF,9) (DT,9) BD,9) (TV,9)
(TX,9) (KX,9) (NT,8) (FV,8) (MV,8) (KM,8) (BF,7)
(BV,7) (FM,7) (AB,7) (NV,6) (FJ,6) (DW,6) (KV,6)
(DV,6) (FK,6) (KN,5) (BW,5) (CT,5) (MT,5) (BQ,5)
(VX,5) (FL,5) (VW,5) (JM,5) . . . other pairs at lower frequency.

Level 3 (KTX,6) (ETW,5) (DET,5) (EKT,5) (DTV,4) (BDF,4)
(KNT,4) (EFT,4) (BKT,4) (KTV,4) (TVW,4) (FTV,4)
(DFT,4) (ABV,3) (ETV,3) (BET,3) (BFT,3) (FJM,3)
(JMV,3) (KMV,3) (BDQ,3) . . . other triples at lower frequency.

Level 4 (EKTW,3) (KNTX,3) (DTVW,3) (DETV,2) (DEKT,2)
(ENTW,2) (BDET,2) (BFTV,2) (KMVX,2) (DFTV,2)
(BDFG,2) (ABVX,2) (FJMV,2) (GRJX,2) . . . other groups of four at lower frequency.

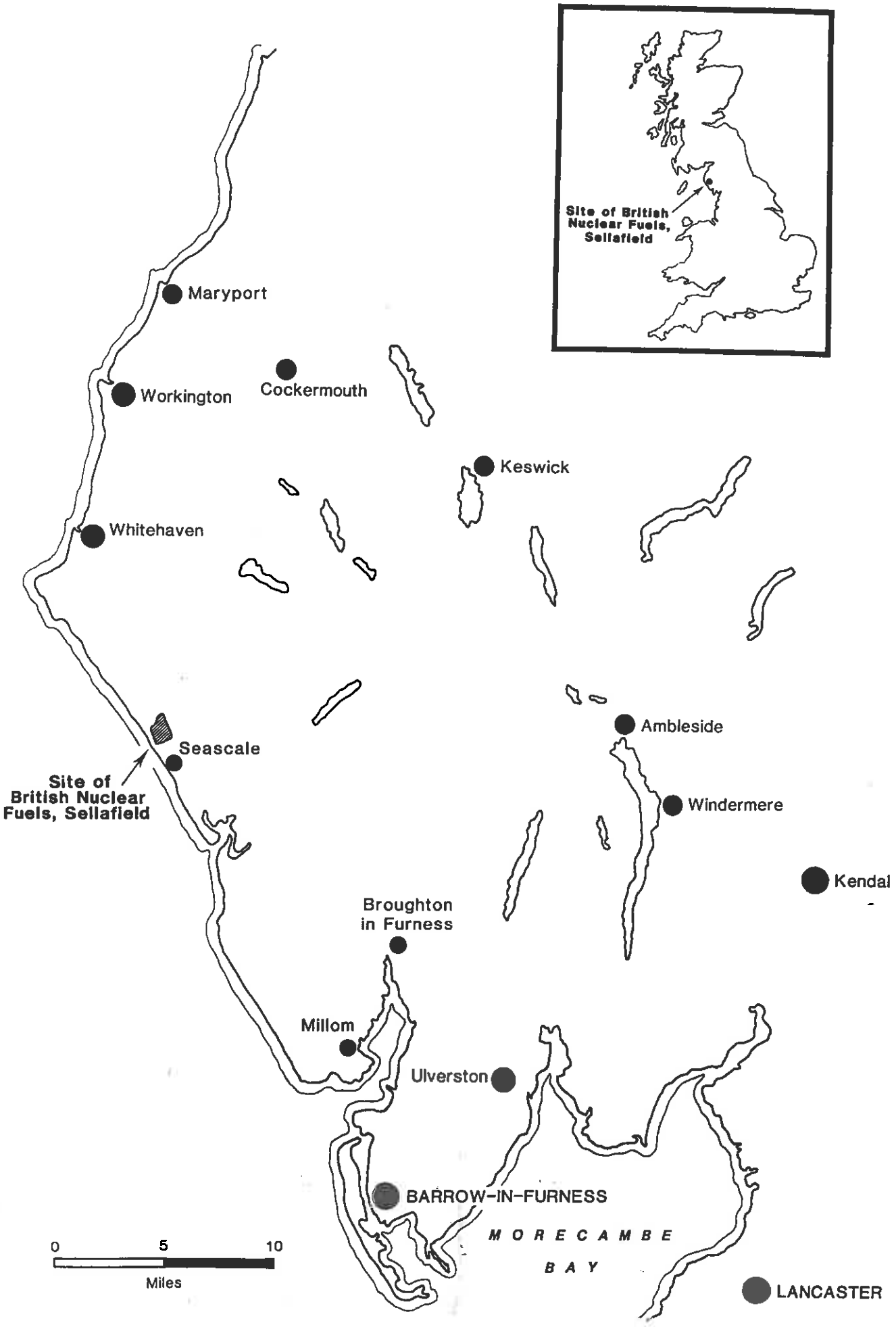
Level 5 (EKTVW,2) . . . other groups of five at frequency of 1.

---

* (L,30) denotes that topic L was said by 30 people
(CT,5) denotes that topics C and T arose together in the responses of 5 people.
See Appendix for further guidance in the interpretation of this table.

Figure 1

Location map : Seascale, Sellafield and main towns in Cumbria.



Appendix The derivation and significance of Galois connections

The paper utilises a novel methodological perspective for reconstructing the aggregate patterns of a large number of multiple character responses to a particular survey question, by tracing the frequencies with which particular categories of remark were associated with others. The methodology has its origins in the mathematical theory of galois connections (Ho 1982; see Macgill 1985 for a simplified account) and is used in the paper as a preferred alternative tool to the use of "nearest neighbour" or "smallest space" methods which might alternatively have been adopted for the processing and interpretation of multidimensional categories of risk survey data. (Slovic et al (1980); Lee (1984); Earl and Cretkovich (1983). The latter are not favoured in the present paper due to their characteristic of transforming, over generalising, and partially masking actual survey responses in producing interpretative categories. The chosen approach does not have these qualities. As the approach is understood to be new to the risk perception research field, it is outlined in this appendix.

Given 136 respondents and 20 categories of response, the set of responses as a whole can be represented as a 136 x 20 binary rectangular array. Its general form would be the same as that of the hypothetical 6 x 7 array in Table A1, where a 1 in the ith row and jth column represents the fact that the jth topic arose within the response of the ith person (the content of the ith person's complete response can be deduced from the positions of the 1's in the ith row). For convenience, this hypothetical array will be the basis for the following outline of the methodology.

Reconstructing the frequency with which particular topics occurred with others entails calculating the frequency of occurrence of all possible pairs of topics (ie how many people said a and b, a and c, a and d, etc for all other pairs), calculating the frequency of occurrence of all possible triples of topics (ie how many people said a and b and c, a and b and d, etc for all possible triples of topics), and, correspondingly, calculating the frequency of occurrence of all possible groups of four, five, six and seven topics. (Seven was a set upper limit on the number of topics allowed per respondent in processing the data; hardly anyone said more than this).

The result of calculating all such frequencies would constitute a definitive reconstruction of all original topic conjunctions and associations, in as much as such a reconstruction can be realised on the basis of the topic

categorisation (7 topics in this hypothetical data: 20 for the actual survey question). They are given in Table A2. It can be readily seen that some components in Table A2 are wholly included within others, and in that sense are redundant. They are marked with an "X"; the information they depict is fully contained in other components, and can therefore be deleted from any further analysis. In fact, 8 of the 19 components can be deleted in this way - a considerable reduction. Technically, what would then be produced could be called the galois connections of the relation represented in the original binary array. For the array given in Table 7 they are arranged in the form of the lattice given in Figure 2. Reading successive levels from the foot of the lattice upwards runs as follows.

level 1 - this identifies each of the topics discernable at that level. The total frequency of occurrence of each topic which respondents included in their responses follows simply from a count of the respective number of people: 3 for topic a, 4 for b, and so on. (The reason why topics e and f are omitted from this level is due to their redundancy was explained above.)

level 2 - this identifies which respondents included each of the given pairs of topics in their responses. The total frequency of occurrence of each pair of topics follows simply from a count of the number of people for each respective pair: 2 people for the pair a, b; 3 people for the pair b, c; and so on. Only those pairs of topics which actually arose within responses are included in the lattice. No useful purpose would be served by cluttering the lattice with fictitious pairs: pairs that did not, in reality arise.

level 3 - this identifies which respondents included each of the given triples of topics in their responses. The total frequency of occurrence of each triple of topics follows, as before, simply from a count of the number of people for each triple. As before, fictitious triples are not included in the lattice.

level 4 - this identifies a respondent who uttered four topics within his or her response.

The lattice (more specifically, the galois connections out of which it is constructed) constitutes a definitive isolation and organisation of all the topic associations and conjunctions from the original set of question responses. It gives a holistic view of topic popularity (frequency of occurrence), and associativity. As we ascend the lattice individual topics

are set into relief in terms of other topics through which, to varying extents, respondents extended, elaborated or qualified particular phrases or semantic utterances, to produce their complete responses to the question.

Pragmatically the galois lattice procedure is more efficient than a more conventional, routine count of frequencies of topics, topic pairings, topic triples and so on, both because of its neglect of redundant components (as already noted) and because of the possibility (via an underlying mathematical theory) of devising an efficient computational algorithm for deriving the galois connections of a binary relation, with minimum time spent searching through "fictitious" possibilities. Conceptually, the galois approach is attractive through its depiction of a comprehensive pattern of dialogue: individual components are seen to be part of a holistic structure, deriving significance from their place within the structure, and not as isolated entities. As a methodology, its advantage over nearest neighbour or smallest space methods lies in its adherence to topic categories rooted in actual utterances, not in interpretative categories further removed. Any particular topic can, moreover, immediately be linked to the individuals within whose response it arose. The approach though, demands more of the analyst in terms of painstaking combing in the case of a data set of any size.

Table A1

objects \ features	1	2	3	4	5	6	7
a	0	1	1	0	0	1	0
b	1	1	1	0	0	0	1
c	1	1	0	0	1	0	1
d	1	0	0	1	1	0	0
e	1	0	0	1	0	0	0
f	0	0	1	0	0	0	0

Table A2a Indicating which topics were said by whom

(a,236)
(b,1237)
(c,1257)
(d,145)
(e,14) x
(f,3) x

Table A2b Pairs of topics, and the individual's who said them

(ab,23)		(be,1)	x
(ac,2)	x	(bf,3)	x
(af,3)	x	(cd,15)	
(bc,127)		(ce,1)	x
(bd,1)	x	(de,14)	

Table A2c Triples of topics, and the individual's who said them

(abc,2)
(abf,3)

Table A2d A four-topic individual response

(bcde,1)

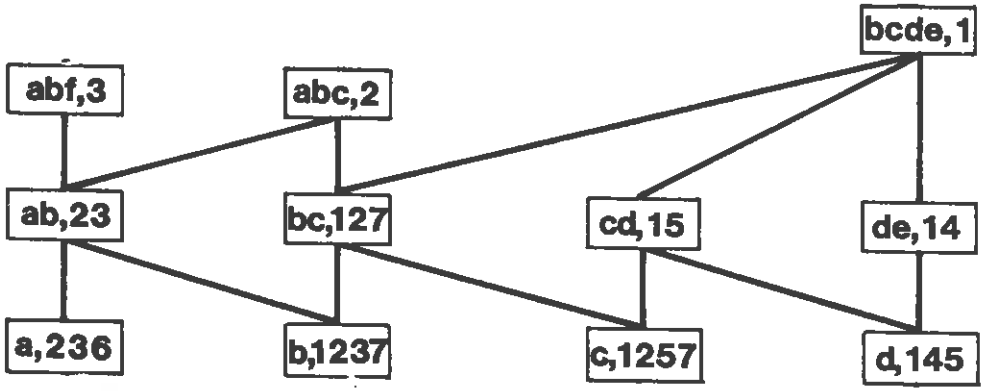
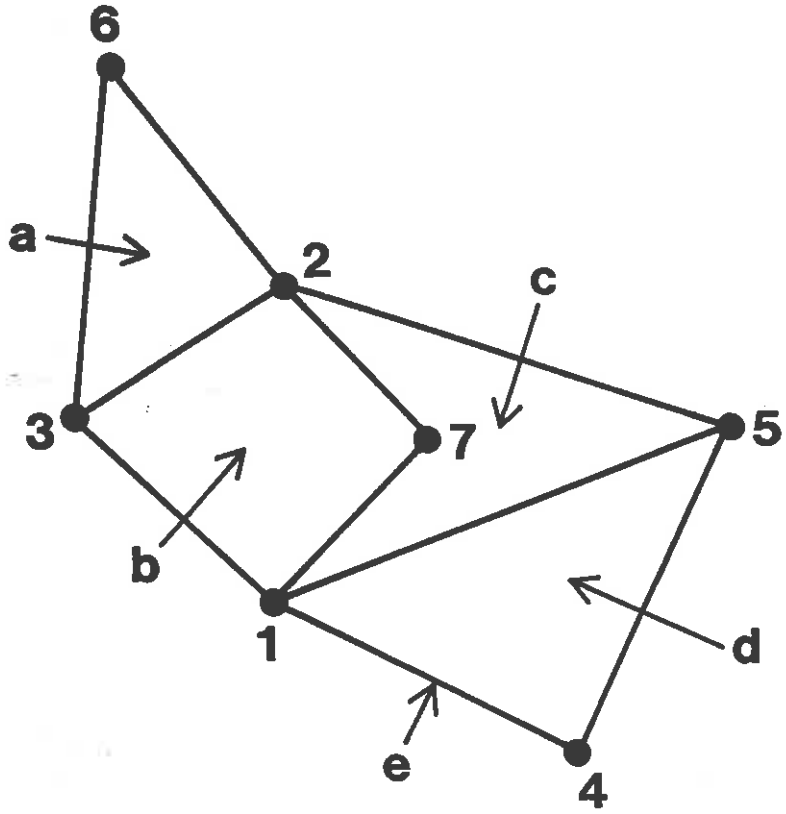
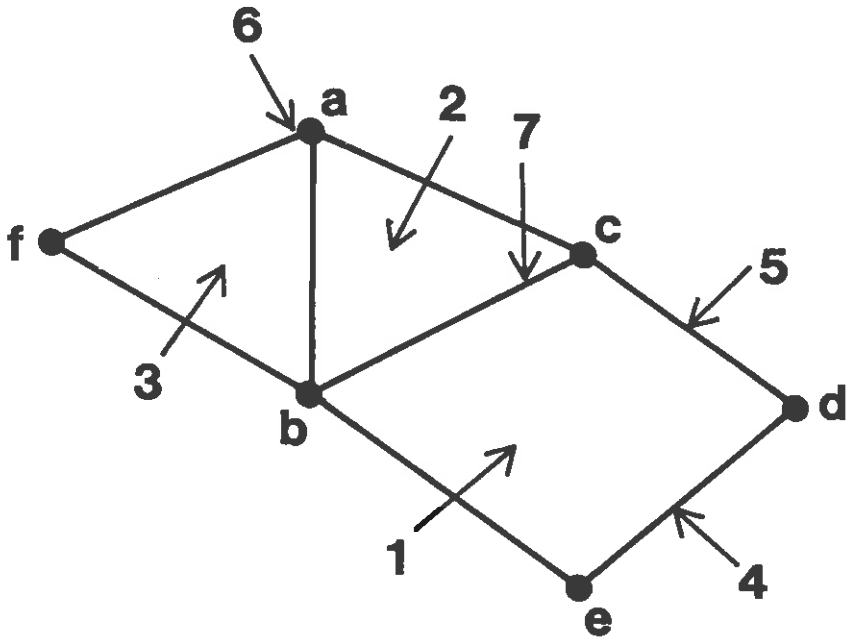


Figure A1 Lattice derived from hypothetical data, table 7

Figure A2. Geometrical views of the relation between people and topics.





References

R H Atkin (1974), Mathematical structure in human affairs, Heinemann, London.

D Black (1984), Investigation of possible increased incidence of cancer in West Cumbria, Report of an advisory group, HMSO, London.

T C Earle and G Cvetkovich (1983), Risk Judgement and the Communication of Hazard Information: Toward a New Look in the study of risk perception, Battelle Human Affairs Research Centers, Seattle, Washington.

Y S Ho (1982), The structure of verbal descriptions, Environment and Planning B 9, 397-420.

House of Commons Environment Committee (1986) Radioactive waste Session 1985-86, First Report, House of Commons Paper 253; i-xvii HMSO London.

T R Lee (1984), Perceptions of and attitudes towards risk, Paper presented to "Technological Risk" conference, University of Manchester, July.

S M Macgill (1985), Structural analysis of social data: a guide to Ho's galois lattice approach and a partial respecification of Q-analysis, Environment and Planning A 17, 1089-1109.

S M Macgill and F G Berkhout (1986 a), Understanding 'risk perception': conceptual foundations for survey-based research, WP 453, School of Geography, University of Leeds.

S M Macgill and F G Berkhout (1986 b), Child leukaemia around Sellafield: local community reaction to the Black Report, WP 350, School of Geography, University of Leeds.

S M Macgill, J R Ravetz and S O Funtowicz (1985), Scientific reassurance as public policy: the logic of the Black Report, Nature (forthcoming).

T O'Riordan, R Kemp, and M Purdue (1985) How the Sizewell B Inquiry is grappling with the concept of acceptable risk Journal of Environmental Psychology 5 69-85.

H Otway and K Thomas (1982), Reflections on risk perception and policy, Risk Analysis 2, 147-159.

O Renn (1985), Risk perception - a systematic review of concepts and research results Risk Analysis seminar, IIASA, Laxemburg, Austria, November.

Royal Society (1983), The assessment of risk, A study group report, Royal Society, London.

Scottish Office (1984), Bonnybridge-Denny morbidity review, Report of Independent Review Group, Scottish Home and Health Department, New St Andrew's House, Edinburgh.

P Slovic et al (1980), Facts and fears: understanding perceived risk in Societal Risk Assessment, R C Schwing and W A Albers (Pleuum, New York) pp 187-213.

M Thompson (1980), Political culture: an introduction, IIASA, WP-80-175, Laxenburg, Austria.

G P Walker and S M Macgill (1985), The Black Inquiry and the media, WP 449, School of Geography, University of Leeds.

B Wynne (1983), Public perception of risk - interpreting the "objective versus perceived risk" dichotomy, IIASA, WP-85-117, Laxenburg, Austria.