Review of the risk assessment process used for the 2008 LHC safety study

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Many safety questions raised in recent years about the CERN LHC have been addressed in the risk assessment released in June 2008. But though improved, is it adequate?

1. Introduction

The new report into the safety of the Large Hadron Collider released in June 2008 was conducted, as the report itself [1] states:
"…to review the arguments presented in (a) 2003 report and previous studies of the possible production of new particles, and to update them in light of experimental results from the Brookhaven relativistic heavy-ion collider (RHIC), in particular, as well as of recent theoretical speculations about new phenomena…that have been discussed in the scientific literature and raise potential safety issues."

On the face of it, such an update can only be good. The report, by the Large Hadron Collider safety Assessment Group (LSAG) [1] makes a number of arguments that appear reasonable. The authors have addressed the full range of risks which have been raised, and if we allow that they know what they are doing, they have come up with empirically-based evidence as to why the risk is zero or low enough. The LSAG report looks like a good faith attempt to determine the probability of disaster.

Nonetheless, this paper attempts to assess more systematically the quality and therefore reliability of the report.

A standard way to do this is to benchmark, against authoritative best practice, the scope, design and structure of the report and its use in decision-making about the LHC.

Seeking best practice in what has been termed "risk-informed decision-making" [2] is a non-trivial question. Consider the case of the bovine spongiform encephalopathy (BSE) crisis, which arose in the 1980s [3].

“In the United Kingdom, the country worst affected by BSE, 4.4 million cattle were slaughtered during the BSE eradication programme. It is believed by most scientists that the disease may be transmitted to human beings who eat the brain or spinal cord of infected carcasses. In humans, it is known as new variant Creutzfeldt-Jakob disease, and by April 2008, it had killed 163 people in Britain.”

According to [4] “The (BSE) crisis in the United Kingdom has led to radical changes in both regulatory structures and changed the "rules of the game" by which they operate.”

In these changes, the then UK regulator, the Ministry of Agriculture, Fisheries and Food (MAFF) was no less than abolished, and [4]:

“…replaced by the Food Standards Agency (FSA), an independent body established to explicitly protect the public. The Phillips inquiry into BSE and the May review into the handing of risk in scientific advisory committees both made recommendations ... They focused in particular on the *separation of risk assessment and management*; being clear about the evidence reviewed and using peer-review comments in reports; *the importance of lay voices*; *selection of reviewers*; and *the disclosure of interests*."

Lord Phillips, BSE inquiry chairman, said [5]:

"There was a false impression that humans faced no risk. If action could have been taken earlier then scope for infection could have been reduced."

What, then, would the key features of a best practice process for assessing the potential risks from the LHC look like? It is noted that what is sought here are not all features of best practice , but those which, if missing, would leave the process open to omitting something important.

As Ersdal and Aven 2007 [2] point out in their review of what they term “risk-informed decision-making”:

“In today’s society, risk-based or risk-informed decisions are made in design and operation of most technical systems. The idea of using such an approach is to ensure that the ‘‘right’’ decisions are made by addressing the overall performance of the system using the proper concept, namely risk. However, a risk approach does not provide answers on what is a good or right decision—risk just describes the possible consequences and associated uncertainties. Clearly, there are dimensions of the decision-making that go beyond risk, for example ethical and political issues.”

This article, then:

(i) From recent authoritative reviews of approaches to, or guidelines for, addressing this particular category of risk, extracts a set of features of best practice including the dimension of risk assessment as well as those of ethics and politics.

(ii) Assesses to what extent the best practices embodied in the above-cited risk guidelines were reflected in the LHC risk study.

2. Best practice

From recent authoritative reviews of approaches to addressing, or guidelines for addressing, this particular category of risk, the following section extracts a set of key features of best practice

The reviews or guidelines accessed are as follows:

Recent overall review: Gerhard Ersdal, Terje Aven: Risk informed decision-making and its ethical basis Reliability Engineering and System Safety 93 (2008) 197–205 [2]

Policy advice: Elliot and Taig: ETHICAL BASIS OF RAIL SAFETY DECISIONS, UK Rail Safety and Standards Board 2005 [6]

Guidelines resulting from major EC-level review: Communication from the commission on the collection and use of expertise by the Commission: Principles and Guidelines: "Improving the knowledge base for better policies (2002) [7]

Global-level guidelines for nuclear power station safety (the risk from both a nuclear power station and the LHC is the release of radiological material)**:** IAEA SAFETY STANDARDS SERIES No. SF-1: FUNDAMENTAL SAFETY PRINCIPLES - SAFETY FUNDAMENTALS. November 2006 [8]

Country-level guidelines for nuclear power station safety: UK Health & Safety Executive 1992: The tolerability of risk from nuclear power stations [9]

From these sources, the key features of a modern best practice risk-informed decision process are built up under these headings:

(i) Who should be involved in the assessment?
(ii) What should be assessed?
(iii) Who should decide?

At each stage, what has been done in the LSAG report or concerning decision-making arising from it is also presented. A summary conclusion of extent of match with key features of best practice is then made, and the results discussed.

Who should be involved in the assessment?

The public

Elliot and Taig (2005) [4] observe the following:

"What has happened in recent decades is that there has been a shift of public expectations on their place in important decisions about public policy, from:

- "They" will take care of it and I don't need to know, via
- "Tell me" what's going on, to
- "Show me" the evidence this is what's best, and now
- "Involve me" and let me have a say.

"What ethics (tells us) is that the people involved in and affected by the decisions have a right to participate in them.

"This raises the immediate questions of who and how."

"As regards who should be involved, it is clearly impractical to do this regularly in any directly democratic way. Yet relying on elected representatives to do this for us is a very blunt instrument; it buries specific issues on which people have strong views and concerns in among many others, and risks simple political polemic over-riding people's real concerns and preferences.

"Increasingly, both in government and corporate contexts, samples of the people are involved in processes of active consultation. The participants are selected statistically to be representative of general opinion but are not held to represent anybody but themselves."

"What is suggested is that major decisions, and the framework, principles and values applied in more everyday ones, should be made via a process that permits those with an interest to be involved."

There is no reference in the LSAG report [1] to public involvement in the "framework, principles and values applied" to the study.

Concerning decision-making on the report, the report would normally (see below) go to an independent regulator. According to the Swiss Federal Office of Public Health (BAG) [10] the monitoring of the radiological impact of the LHC accelerator is conducted for Switzerland, by the Federal Office of Public Health (BAG) and for France by the Authority for Nuclear Safety and Radiation Protection (ASN).

BAG and ASN did not commission the LSAG report, and, as far as can be seen, BAG and ASN have taken no role in the safety issues which LSAG has assessed concerning the LHC.

CERN Council has taken on a regulator type role, in that the LSAG report was tabled before it, and it commissioned a review of the report. CERN Council involves representatives from the 20 governments funding CERN, and hence the LHC. Attachment 1 shows the affiliations of the 28 members. Half are particle physicists, and the remainder are elected representatives or civil servants. No members of CERN Council fit the characteristics for public involvement recommended by [4] above.

Experts

Elliot and Taig (2005) [4] note that:

"…different types of experts offer conflicting views. Regulators and duty holders need a better rationale for deciding which expert recommendations to accept."

On the question of this rationale, some years ago the European Commission, so as to improve "the knowledge base for better policies" ran a major review. The results are embodied in *the Communication from the commission on the collection and use of expertise by the Commission: Principles and Guidelines:* (2002) [5].

In the communication, the EC states that one of the three determinants of quality of advice they distinguish is pluralism.

“Wherever possible, a diversity of viewpoints should be assembled. This diversity may result from differences in scientific approach, different types of expertise, different institutional affiliations, or contrasting opinions over the fundamental assumptions underlying the issue. Is it appropriate to mobilise experts beyond the scientific community? These may include, for example, lawyers, ethicists...”

Attachment 2 lists the professions of those involved in the LSAG report and decision-making on it. The list shows a large number of some 26 different people involved to the stage of tabling to CERN Council. Of the 26, all were physicists.

What should be assessed?

Method

Risk assessment

The HSE [5] recommend “techniques generally known as Probabilistic Safety Analysis (PSA)”. A PSA “of a design begins with a careful identification of so called 'initiating events', that is, the things that could fail or go wrong and lead either directly or through a succession of other events, possibly including human error….

“All the events that can be imagined and their possible consequences are plotted in the form of logical sequences called 'fault' or 'event' trees.

"Above all, the PSA process … (author’s note - including fault trees) has the benefit that it ensures a systematic process of examination of the design and its risks…"

Although not cited as the method - no safety methodology is cited - the risk assessment in the LSAG documents can be seen as a type of Probabilistic Safety Analysis. The documents do not contain fault trees, reducing their capacity to show that all the events that can be imagined and their possible consequences have been covered.

Safety management system

Controls

Principle 5 of the IAEA Safety Fundamentals [8], *Optimization of protection*, states in part: “Protection must be optimized to provide the highest level of safety that can reasonably be achieved. The safety measures that are applied to facilities and activities that give rise to radiation risks are considered optimized if they provide the highest level of safety that can reasonably be achieved throughout the lifetime of the facility or activity, without unduly limiting its utilization.”

The LSAG documents, in making a case for negligible risk, are arguing that no protection is needed.

Who should decide?

Issues with decisions

Elliot and Taig (2005) [4] note that:

"(Organisations) have no ethical duty or moral right to make judgements about what society wants."

Another of the EC's determinants of quality of advice [5] is "the extent to which experts act in an *independent* manner..." "…the aim is to minimise the ri*sk of vested interests d*istorting the advice proffered… "

As shown in Attachment 2, the LSAG report was conducted by physicists, commissioned by the LHC principal, CERN, which is headed by a physicist, and reviewed by the CERN Council Scientific Policy Committee, also composed only of physicists. This physicists-only advice is then put to CERN Council for consideration and advice to the governments. CERN Council represents the 20 governments funding the LHC. The Council therefore itself has a vested interest, and may itself feel a bias to justify its prior decisions of support.

The regulator

As set up in the UK, the UK Health & Safety Executive [5] **"**is the statutory body responsible for the administration of the Health and Safety at Work Act 1974. (The HSE) is composed of nine members representing employers, em*ployees,* lo*cal authorities, and the public…"*

According to the recommended arrangements for nuclear power stations (IAEA 2006)[6]:

"An effective legal and governmental framework for safety, including an *independent* regulatory body, must be established and sustained.

"The regulator must consult parties in the vicinity, the public and other interested parties, as appropriate, in an *open and inclusiv*e process.

"The regulatory body must be effectively independent of the licensee and of any other body, so that it is free from *any undue pressure from interested parties…"*

To the extent that CERN Council is seen as the regulator, is it argued above that it is not independent because of its prior decisions supporting funding of the LHC.

To the extent that BAG and ASN are the regulators, they have taken no part in the proceedings to date.

In any event, the current LSAG-related process has involved no consultation with "parties in the vicinity, the public and other interested parties, as appropriate, in an open and inclusive process."

Table 1 now summarises the above section.

Table 1

	Best practice process	CERN process	Pass	?	Fail
Who should be involved in the assessment?	**The public** : samples of the people, selected statistically to be representative of general opinion	Public not involved			1
	Experts: Plurality of advice, involving differences in scientific approach, different types of expertise, different institutional affiliations, or contrasting opinions over the fundamental assumptions underlying the issue. Is it appropriate to mobilise experts beyond the scientific community? These may include, for example, lawyers, ethicists..."	31 people involved in preparation of LSAG study and its review before tabling to CERN Council: all 31 were physicists			1
What should be assessed?	**Risk assessment method:** Probabilistic Safety Analysis (PSA)	A version of PSA was used	1		
	Component of risk assessment method : *'fa ult' or 'event' trees." The PSA process … (author's note - including fault trees) has the benefit that it ensures a systematic process of examination of the design and its risks..*	Fault trees not used, so it is hard to discern if there are gaps in the risk assessment			1
	Risk management : Protective actions to reduce existing or unregulated radiation risks must be justified and optimized.	One protective action for one of the four risks is hinted at in the the LSAG documents, although it is not specified as such	0.25		0.75
Who should decide - the regulator	... members representing employers, em *ployees,* lo*cal authorities, and the public…"*	Of the four categories recommended, CERN Council contains two - CERN management and employees (researchers),			
	Relying on elected representatives to (represent the public) is a very blunt instrument; it buries specific issues on which people have strong views and concerns in among many others, and risks simple political polemic over-riding people's real concerns and preferences.	Public represented by civil servants or elected representatives, not samples of the people			1
	The regulatory body must be effectively independent of the licensee and of any other body, so that it is free from *any undue pressure from interested parties …*	Of the 28 members of CERN Council, half are physicists. This may lead to undue pressure from interested parties			
	The regulator must consult parties in the vicinity, the public and other interested parties, as appropriate, in an *open and inclusiv* e process.	This has not been done. Note that the relevant vicinity is global in extent			1
			1.25	0	5.75
			18%	0%	82%

This assessment shows that the CERN process satisfied only 18 per cent of the criteria in the table.

3. Discussion

First, concerning overall mindset, Gibbons (1999)[11] in an article entitled SCIENCE'S NEW SOCIAL CONTRACT WITH SOCIETY, made a series of observations and recommendations from which the following selection is made:

He began:

"Under the prevailing contract between science and society, science has been expected to produce 'reliable' knowledge, provided *merely that it communicates its discoveries to society* (present author emphasis).

"A new contract must now ensure that scientific knowledge is 'socially robust', and that its production is seen by society to be both transparent and *participative*.

"...science can no longer be validated as reliable by *conventional discipline-bound norms*…

"...as expertise spreads throughout society… the questions asked of experts are *neither the same, nor simple extensions of, the ones that arise in their specialist fields of study.*

"Rather (socially robust knowledge) must emerge from bringing together the many different 'knowledge dimensions' involved. Its authority depends on the way in which such a collective group is linked, often in a self-organized way. Breakdowns in social authority arise when links are *inadequately established*…

"…. this validity is achieved through involving an extended group of experts, including lay 'experts'".

Looking, then, at the LSAG report, it seems to be positioned clearly under Gibbons' "old" contract with society – seen to produce 'reliable' knowledge, provided *merely that it communicates its discoveries to society*. (as LSAG has communicated its findings.); via a process within its *conventional discipline-bound norm (only physicists were involved in the production of the LSAG findings).*

Gibbons [ref] would no doubt therefore conclude that the LSAG findings "can no longer be validated as reliable"; and would recommend that the way to approach such validation (as socially robust knowledge) would be to involve not just physicists but "many different 'knowledge dimensions'" achieved by "an extended group of experts, including lay 'experts'".

Second, concerning the completeness of the risk assessment stage, the ethicist T. Ord observes[12]:

"(At the present time)… we are genuinely uncertain about our physical theories. Indeed, we are so uncertain as to spend more than 3 billion euros building the LHC in order to find out more. Moreover, we *know* that our current theories are false because they don't correctly merge Relativity Theory and Quantum Mechanics. That is, we know that we don't presently understand what happens with tiny objects that are extremely dense and/or moving near the speed of light. Since this is exactly what is occurring in the LHC, we have significant reason to distrust the probability calculations. They tell us the chance of the LHC destroying life on earth given that the underlying theory is completely correct, but what we really want to know is what the chance is given our uncertainty in the underlying theory. This is impossible to calculate precisely, but will be much higher than the stated odds. Considering the stakes, it is thus highly irresponsible for the LHC's management to give so much emphasis to these misleading probability calculations, when the real chance is clearly higher."

It is more likely the risk pointed out by Ord would not have been overlooked if a plurality of expertise had been in the LSAG team, in this case the plurality including safety experts, and ethicists.

4. Conclusion

The process used to produce and review the LSAG reports on the LHC risk can be seen to be, from a number of authoritative standpoints, out of date. Further, as the analogue of the regulator, CERN Council has a conflict of interest, and is under-constituted to assess such a novel, potentially catastrophic and therefore sensitive risk.

On this basis, a new review panel based on best practice for such panels should be set up to advise national, EU, and governments worldwide on the adequacy or otherwise of the LSAG report, and the LHC not operate until that panel has reported.

5. References

1. LHC Safety Assessment Group (Ellis J, Giudice G, Mangano ML, Tkachev I, Wiedemann U) (2008). "Review of the Safety of LHC Collisions"

2. Ersdal, G., and Aven, T., Risk-informed decision-making and its ethical basis. Reliability Engineering and System Safety 93 197–205 2008

3 Bovine spongiform encephalopathy, Wikipedia
http://en.wikipedia.org/wiki/Bovine_spongiform_encephalopathy

4. Lofstedt, R. and Fairman, R., Scientific Peer Review to Inform Regulatory Decision Making: A European Perspective. Risk Analysis **26, 25-31 2006**

5. Brown, D., The 'recipe for disaster' that killed 80 and left a £5bn bill. Daily Telegraph 19/06/2001

6. Elliot and Taig, ETHICAL BASIS OF RAIL SAFETY DECISIONS, UK Rail Safety and Standards Board 2005

7. Communication from the commission on the collection and use of expertise by the Commission: Principles and Guidelines: "Improving the knowledge base for better policies (2002).

8. IAEA SAFETY STANDARDS SERIES No. SF-1: FUNDAMENTAL SAFETY PRINCIPLES - SAFETY FUNDAMENTALS. November 2006

9. UK Health & Safety Executive, The tolerability of risk from nuclear power stations. 1992

10. CERN Monitoring Program

http://www.bag.admin.ch/themen/strahlung/02839/04088/04092/index.html?lang=de

11. Gibbons, M., SCIENCE'S NEW SOCIAL CONTRACT WITH SOCIETY Nature 402, C81-C84 (1999)

12. Ord, T., April 15, 2008 at http://www.practicalethicsnews.com/practicalethics/2008/04/these-are-not-t.html

Attachment 1: CERN Council members and affiliations

		Position, or main activity with which associated (source: Google search)	Profession			Additional information
			Particle physicist	Civil servant / politician	Other	
President :	Professor T. Åkesson	Lund University physics department "My main activity is ATLAS, a global project to build and exploit a scientific facility at the CERN Large Hadron Collider"				
AUSTRIA	Mrs C. Kokkinakis (UPDATED 02.04.2008)	Ms C. KOKKINAKIS, Minister Plenipotentiary, Permanent Mission, Geneva		1		
	Professor W. Majerotto	Univ. Prof. Dr. Walter Majerotto, Direktor, Institut für Hochenergiephysik der Österreichischen Akademie der Wissenschaften Wien, Theory Group	1			
BELGIUM	Mr P. Levaux	Past Chairman of Board of CERN pension fund			1	
	Prof. R. Gastmans	R. Gastmans Institute for Theoretical Physics, University of Leuven, B-3001 Leuven, Belgium	1			
BULGARIA	Mrs E. Vitkova	Mrs. E. Vitkova, Deputy Minister of Bulgarian Ministry of Education and Science		1		
	Professor J. Stamenov	Director Institute for Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences	1			
CZECH REPUBLIC	H.E. Amb. T. Husák	Czech Republic Ambassador and Permanent Representative, Geneva				
	Professeur J. Niederle	(Institute of Physics, Prague, Czech Republic),	1			
DENMARK	Mrs B. Sode-Mogensen	Mme Birgitte Sode-Mogensen Senior Consultant Danish Research Agency Technology and Innovation			1	
	Professor H. Boggild	Experimental Particle Physics, Nils Bohr Institute University of Copenhagen (	1			
FINLAND	Mr M.P. Pulkkinen	N.K.				
	Professor D.O. Riska	Director, Helsinki Institute of Physics ; Professor of Physics, University of Helsinki	1			
FRANCE	H.E. Amb. J.B. Mattei			1?		
	Prof. M. Spiro	At least in 2001 Chairman of the CERN LEP Experiments Committee: Professor M. Spiro	1			

GERMANY	Dr Beatrix Vierkorn-Rudolph	Federal Ministry of Education and Research [Provision for the Future – Cultural, Basic and Sustainability Research (Large Facilities, Energy, Basic Research)]		1		
	Prof. Dr G. Herten Vice-President	Teilchenphysik – Abteilung Prof. Dr. Gregor Herten Physikalische Institut Albert-Ludwigs-Universität Freiburg	1			
GREECE	H.E. Amb. F. Verros	Ambassador Franciscos Verros, Permanent Representative of Greece to the United Nations. Office and other International Organizations in Geneva		1		
	Professor D. Nanopoulos	Dimitris Nanopoulos is a Distinguished Professor of Physics and holder of the Mitchell/Heep Chair in High Energy Physics at Texas A&M University, head of the Houston Advanced Research Center (HARC) Astroparticle Physics Group, and fellow and chair of Theoretical Physics, Academy of Athens in Greece.	1			
HUNGARY	Mr F. Partos	President, National Office for Research & Technology of **Hungary**, **Mr**. Ferenc **Partos**		1		
	Professor Z. Horvath	N.K.				
ITALY	H.E. Amb. G. Caracciolo di Vietri			1		
	Professor R. Petronzio	**Professor R Petronzio**,President Instituto Nazionale di Fisica Nucleare(INFN	1			
NETHERLANDS	Mr C.J. van Riel					Main web reference is to pension fund
	Professor F.A. Bais	Sander (F.A.) Bais Professor, University of Amsterdam, Institute for Theoretical Physics; External Professor, Santa Fe Institute				
NORWAY	Professor O.H. Ellestad	N.K.				
	Professor E. Osnes	N.K.				
POLAND	Professor J. Nassalski	**J**. **Nassalski** Soltan Institute for Nuclear Studies, Warsaw	1			
	Professor J. Niewodniczanski	**Niewodniczański Jerzy**, prof. dr hab. Faculty of Physics and Applied Computer Science	1			
PORTUGAL	H.E. Amb. F. Xavier Esteves			1		
	Prof. J.M. Gago	**Prof J M Gago**, the former Portuguese minister for science and technology		1		
SLOVAK REPUBLIC	H.E. Amb. A. Pinter					
	Dr B. Sitár Vice-President	N.K.				
SPAIN	H.E.Amb. J. Garrigues (UPDATED 02.04.2008)			1		
	Dr M. Aguilar-Benitez	**AGUILAR-BENITEZ**, **M**. Affiliation, CIEMAT, Avenida Complutense 22, E-28040 Madrid, Spain.	1			
SWEDEN	Dr M. Johnsson	**M**. **Johnsson** and K. Mølmer Phys. Rev. A 70, 032320 (2004); "Nonperturbative quantum	1			
	Prof. B. Åsman	Barbro Åsman, Professor Stockholms universitet » Naturvetenskapliga fakulteten » Matematisk-fysiska sektionen » Fysikum » Elementarpartikelfysik				

SWITZERLAND	Dr J.P. Ruder (UPDATED 02.04.2008)	BBW (Swiss Federal Office for Education and Science)		1		
	Professor U. Straumann	Prof. Dr. Ulrich Straumann Physik–Institut der Universit¨at Z¨urich				
UNITED KINGDOM	Mr P. Williams				1	Main web reference is to pension fund
	Professor R. Wade	the Science and Technology Facilities Council is one of Europe's largest multidisciplinary research organisations supporting scientists and engineers world-wide. Richard Wade is STFC's Chief Operating Officer. He is responsible for the overall operational management of STFC (including the Science Programmes, Facility Development and Operations, Knowledge Exchange and Corporate Services) and for delivering the STFC's mission. Richard is a deputy chief executive and member of the STFC Council			1	
Total			14	10	4	28

Attachment 2: Process for: preparation of LHC safety report documents and their review and approval; and participants

Stage	Report / review	Report / review team	Report / review team member affiliation	Source of information on participant profession	Cumulative total of physicists without duplicates
The CERN Scientific Policy Committee (SPC) was asked by the President of the CERN Council to examine the documents produced by the LHC Safety Assessment Group (LSAG) and to provide Council with an independent opinion on the conclusions stated in those documents.		Chairman	"...the SPC CERN Council has an advisory body, the Scientific Policy Committee, SPC. The SPC is composed of world-recognized physicists"	President of CERN Council (pers. comm.)	
		Prof. E. FERNANDEZ			
		Members:			
		Prof. R. ALEKSAN			
		Prof. J. AYSTO			
		Prof. A. BLONDEL			
		Prof. A. BONDAR			
		Prof. P. BRAUN-MUNZINGER			
		Prof. M. CAVALLI-SFORZA			
		Prof. P. DORNAN			
		Prof. D. FOURNIER			
		Prof. D. HARTILL			
		Prof. T. KONDO			
		Prof. G. 't HOOFT			
		Prof. B. WEBBER			
		Prof. A. ZALEWSKA			
		Prof. F. ZWIRNER			
		Ex-Officio Members:			
		Prof. M. HUYSE			
		Prof. J. DAINTON			
		Prof. K.-H. MEIER			
		Prof. M. TIGNER			
		Prof. T. WYATT			20

A dedicated SPC panel was set up, composed of		Matteo Cavalli-Sforza,			
		Gerard 't Hooft,			
		Bryan Webber			
		Fabio Zwirner.			
		Peter Braun-Munzinger			
The documents made available to the panel were:	"Review of the Safety of LHC Collisions", by the LHC Safety Assessment Group (LSAG report);	LHC Safety Assessment Group(*)		"Review of the Safety of LHC Collisions", by the LHC Safety Assessment Group (LSAG report)	
		John Ellis	Theory Division, Physics Department, CERN		
		Gian Giudice	Theory Division, Physics Department, CERN		
		Michelangelo Mangano	Theory Division, Physics Department, CERN		
		Igor Tkachev	Institute for Nuclear Research , Russia		
		Urs Wiedemann	Theory Division, Physics Department, CERN		5
	"Astronomical Implications of Hypothetical Stable TeV-Scale Black Holes"	S.B.Giddings	Department of Physics, University of California, Santa Barbara	LSAG report	
		M.L.Mangano	Theory Division, Physics Department, CERN		1
Total without duplicates					26