University of Delaware
Disaster Research Center

PRELIMINARY PAPER
#197

DISASTERS AND CATASTROPHES: THEIR CONDITIONS IN AND CONSEQUENCES FOR SOCIAL DEVELOPMENT*

E. L. Quarantelli

1993

*This is the longer written version of the paper prepared for a shorter oral presentation at the International Seminar on SOCIETY AND DISASTER PREVENTION held in Mexico City, Mexico on February 23, 1994. Some parts of this paper have appeared in earlier and somewhat different versions; see especially Quarantelli, 1992a, 1992b, 1992c, and 1993b.

DISASTERS AND CATASTROPHES: THEIR CONDITIONS IN AND CONSEQUENCES FOR SOCIAL DEVELOPMENT*

E. L. Quarantelli
Disaster Research Center
University of Delaware, USA

ABSTRACT

Our paper is organized around three central questions: What can be conceptualized as a disaster? What are important conditions that generate these occasions? What are major consequences of disastrous occasions?

In the first part of the paper we show that from a conceptual point of view, disastrous occasions are usefully dividable into "disasters" and "catastrophes". In particular we note the quantitative and qualitative differences between both everyday emergencies and "disasters" as well as between "disasters" and "catastrophes".

In the next part of the paper we extensively discuss important social factors or conditions which facilitate or generate disasters and catastrophes. It is especially noted how disastrous occasions are rooted before impact in the ongoing social developments or the social changes and trends already existing in societies. Such projected changes almost assure that in the future we will have more and worse disastrous occasions.

This part is followed by a briefer discussion of how disasters and catastrophes affect social development, especially at the macro level of societies. We especially note that there is considerable differentiation in if, where, and how, disastrous occasions affect social change and development.

The paper concludes with a short discussion of how planning for disastrous occasions is also being positively affected by social changes.

*This is the longer written version of the paper prepared for a shorter oral presentation at the International Seminar on SOCIETY AND DISASTER PREVENTION held in Mexico City, Mexico on February 23, 1994. Some parts of this paper have appeared in earlier and somewhat different versions; see especially Quarantelli, 1992a, 1992b, 1992c, and 1993b.

INTRODUCTION

In a scientific framework any phenomena can be thought of in terms of 3Cs. They are:

(1) the basic nature or characteristics of the phenomena;
(2) the factors or conditions which bring about those characteristics; and,
(3) the results or consequences from those characteristics once they are in being.

In graphic and linear terms:

Conditions---Characteristics---Consequences

In this paper, we look at the three Cs of disastrous occasions--the conditions for, the characteristics of, and the consequences from such occasions. It is our position that while there has been some progress since the early days of research in the area, we still have a way to go in looking at disastrous occasions in a scientific framework. It is unfortunate, that there continues to be a confusing of the 3Cs in theoretical, empirical, planning and managing aspects of these kinds of social occasions. Clarification of the 3Cs is important both for research purposes and for the planning and managing of such social crises.

Studies can not produce very meaningful results if they do not proceed with some relatively clear idea of the nature or characteristics of the central phenomena being examined, that is disasters and catastrophes. Similarly, efforts to plan for and manage such occasions when they occur, can not be very effective or efficient if there is no relatively clear understanding of the nature of such social crises. Thus, what we address is both theoretically and practically important.

Unfortunately, conceptualizing what is the essence of disastrous occasions is a difficult task. Nevertheless, our discussion starts by initially considering the characteristics of disasters. It is very difficult to discuss the conditions for and the consequences of X, in this case "disasters" and "catastrophes" without first noting what the referent of X is, that is, their characteristics.

It should be noted that our prime interest is not in advancing, comparing or otherwise discussing particular or specific definitions of disasters and related phenomena. Anyone can define anything any way they want, although some views make more sense for certain purposes than others. Rather our goal is to indicate what we think are the central features or characteristics of social phenomena that we might want to call disastrous occasions and how they differ in nature from everyday emergencies or routine accidents. In short, our primary examination here is of what one might emphasize in conceptualizing disastrous occasions and not how

one could or should particularly define such occasions.

While most researchers have not paid major attention to the problem of the conceptualization of disastrous occasions, there has been a small but steady stream since work started in the area (e.g., Carr, 1932; Endleman, 1952; Moore, 1956; Fritz, 1961; Stoddard, 1968; Barton, 1970; Kinston and Rosser, 1974; Westgate and O'Keefe, 1976; Berren, Beigel and Ghertner, 1980, Hewitt, 1983; Britton, 1987; Schorr, 1987). But for the most part we draw from the most recent although mostly unpublished writings on the topic (Kreps, 1985, 1989, 1993; Pelanda, 1982; Drabek, 1989; Dynes, 1989, 1992; Dombrowsky, 1993; Gilbert, 1993; and Horlick-Jones, 1993), as well as our earlier writings (e.g., Quarantelli, 1985)

In the main, we will be discussing disasters and catastrophes, those crisis occasions generated by the threat of or the actual impact of relatively sudden natural and technological disaster agents (such as earthquakes, toxic chemical spills, floods, radiation fallouts, hurricanes, forest and brush fires, landslides, transportation wrecks and crashes, volcanic eruptions, structural failures, tornadoes, explosions, avalanches, etc.). To a lesser extent our comments are also applicable to more slow moving and/or very diffuse agents such as are involved in famines, droughts, epidemics, toxic poisonings through hazardous wastes, radiation and biological contaminations, air and water pollution episodes, etc.

We leave aside here discussing the applicability of our observations to other even more different kinds of crises, especially the ones involving social conflicts such as in civil strife, revolutions, riots, wars, terrorist attacks, acts of sabotage, product tampering, etc. (see Quarantelli, 1993b). Although there have been occasional claims that they are the same as disasters and catastrophes (see Meyers, 1991), many such conflict situations tend to last much longer and affect a much wider scale than the typical disaster or catastrophe. Even more important, such occasions are driven by an explicit intention of one or all parties involved to do harm to others.

CHARACTERISTICS

Some researchers have long argued in the literature that disasters are quantatively and qualitatively different from everyday or routine crises and accidents (see Quarantelli, 1988: 49-52). For example, there are the following differences in the two occasions insofar as individual and organizational behavior is concerned:

1. The need to relate to far more and different kinds of groups operating at the height of the crisis.

There is an organizational convergence that is simply part of the massive inflow of people, communications, goods, etc. that is distinctive of the crisis time period of disasters but not of

routine emergencies. A disaster generates a "mass assault" on the impacted area from within the local community. Accidents or everyday emergencies do not. Thus, persons and organizations in disasters have to interact with far more and unfamiliar kinds of responding groups and agencies than they have to on an everyday basis or in routine emergencies.

2. The limitations on the degree of freedom of action and autonomy possible.

In disasters all lose some of their usual independence and freedom of action. Community and crisis time needs and values take precedence over everyday ones (e.g. individuals and organizations may be monitored and ordered about by social entities that may not even exist in routine times). Everyone and any group in an impacted area and often even just outside of it becomes more directly dependent and responsive to others in a disaster setting, unlike in an accident situation or routine emergency.

3. Different norms for behavior become operative.

New social norms emerge regarding what is acceptable and non-acceptable at the height of the crisis. Performance standards for organizations often change (e.g., in the medical area the speed of response in handling casualties is superseded by a need to more equitably distribute victims in the available medical facilities). Expectations of persons can also be radically altered (e.g., destruction of property is very allowable to save lives in search and rescue efforts). Emergent new norms are rare in accidents or routine emergencies, almost inevitable in disasters.

4. The blurring of the usual line between the public and private sector.

In a disaster the lines and boundaries that normally separate the public and the private spheres become quite blurred. Thus, in a disaster the need for the quick mobilization of resources for overall community crisis purposes often preempts everyday individual and organizational rights and domains (e.g., goods, equipment and facilities are without due process requisitioned for the common good from everywhere and everyone, be they persons or groups). Such legal and group boundaries and borders are seldom crossed over massively in accidents or everyday emergencies.

Therefor, our position is that a disaster is not simply a bigger accident as some police officers sometime assert. There is more than a difference in degree. The social behavior that appears is qualitatively different as well from everyday behaviors.

In this paper we also want to stress that a similar kind of distinction needs to be drawn between phenomena that might be called <u>catastrophes</u> and called <u>disasters</u>. For long we have said

that catastrophes are both quantatively and qualitatively different from disasters. Hurricane Andrew is a recent concrete example in the United States that illustrates the more general point.

In catastrophic occasions compared to disasters, there are at least the following differences.

1. Most or all of the total residential community is impacted.

In a number of the impacted localities such as Homestead in Florida, the vast majority of all houses were damaged or destroyed making it impossible, for instance, for displaced victims to seek shelter with nearby relatives and friends as is typical in disasters. In the typical disaster, only some neighborhoods or parts of a community are badly impacted. In a catastrophe not only is most of a community affected but a number of nearby localities will also be similarly stricken as can be seen in the typhoons that hit southwestern Asia such as in the Philippines, and as occurred in areas around Chernobyl after the nuclear plant accident.

2. The facilities and operational bases of almost all emergency organizations are themselves directly hit.

In southern Florida, for instance, many of the buildings housing police, fire, welfare and local medical centers were seriously impacted making their work operations all but impossible. While in a disaster some such facilities may be impacted, the great majority usually survive with little or no damage. Thus, the first organizational responders that mobilize in disasters generally can not do so in catastrophes because they often have no place from which to operate. This happened in devastated Darwin, Australia after Cyclone Tracy, in the massive flooding in Bangladesh a few years ago as well as in the Tangshan earthquake in China in 1976.

3. Local officials often are unable to undertake their usual work roles, and this extends into the recovery period.

Related to the two observations just made, is that in catastrophic situations local personnel are often unable for some time both right after impact and into the recovery period to carry out their formal and organizational work roles. This is because the local workers are either dead or injured, and/or are unable to communicate with or be contacted by their usual clients or customers, and/or are unable to provide whatever information, knowledge, skills, etc. they can usually provide. For instance, in some recent catastrophes in developing countries practically all the medical or police personnel in some towns were fatalities. In impacted Florida communities, many social workers had no good way of communicating with or being reached by past and/or new users of their services. This general inability to provide usual services happens, if at all, only on a very minute scale in disasters, and

if it does endures only for relatively short periods of time.

4. Finally, most of the normal everyday community functions are sharply and simultaneously interrupted.

Thus, places of work, recreation, worship and education such as schools totally shut down, and the lifeline infrastructure badly disrupted results in stoppages or major shortages of electricity, water, mail or phone services as well as other means of communication and transportation. For example, this could be seen in many communities after Hurricane Andrew. This also occurred in the very widespread Armenian earthquake. In disasters, there is no such massive across-the-board disruption of community life, even if particular neighborhoods may be devastated as happened in the Mexico City earthquake of 1985 but with life in a number of areas proceeding almost normally (Dynes, Quarantelli and Wenger, 1990).

Now the distinction just drawn between catastrophes and disasters is not important in itself. The importance is that catastrophes require some different kinds of planning than do disasters. This is true whether the focus is on planning mitigation, preparedness, response or recovery measures. We noted above possible problems in sheltering victims or mobilizing organizations. This does not mean that everything is different; in fact, what needs to be further clarified is exactly what are the significant differences.

Similarly, planning and managing principles that hold for disasters are not necessarily totally invalid for catastrophes. For example, it is probably still true that the crisis time planning for even a catastrophe should be as close as possible to everyday, traditional ways of doing things. On the other hand, it is also probable that more innovation and emergent behaviors will be needed for coping with a catastrophe than with a disaster. The research and the operational problem is to establish the best balance between building on old patterns and creating new ones (Kreps, 1991a).

CONDITIONS

On the global scene we are inevitably faced with more and worse disasters and catastrophes in the future. Irrespective of whether the agents involved be natural or technological, there will be both quantative and qualitative increases in the negative direction. This will result from two current social trends---industrialization and urbanization---inherent in the very dynamics of current social life. The first development almost insures that disastrous agents and occasions will increase. The second trend is raising the risks and vulnerabilities of possibly impacted populations and societies.

Current Social Trends

These happenings around the world will affect the appearance, characteristics and dynamics of disasters and catastrophes, and the

planning and managing of them everywhere. While these two trends are not new, they are both massive in their social effects and accelerating in their recent manifestations.

Industry with its accompanying distinctive kind of technology is spreading everywhere. For example, while in 1888 the five most highly industrialized societies were responsible for 83% of the world's industrial production, a century later the output of the top five was only 57% reflecting the continuing diffusion of industrial technology throughout the world (Lenski, Lenski and Nolan, 1991). This trend has been paralleled by an ever swelling involvement of populations in an urban way of life concentrated in constantly enlarging metropolitan areas. Thus by the year 2010, there will be 511 cities exceeding a million inhabitants each and for the first time in history the world population will be predominantly urban, 51.8%; 15 years later, there will be 639 metropolises of over a million persons (Jones, 1992).

These two related trends or processes of industrialization and of urbanization have consequences for disastrous occasions. They insure that we will have both more and worst disasters and catastrophes. Built into the very dynamics of social life as they are, industrialization and urbanization will of necessity quantatively increase and qualitatively worsen the disastrous occasions of the 21st Century.

In the next two section of the paper we want to illustrate and explain why this will happen and some consequences. The evidence and data base we use do not come from any specific study. Instead they are derived from the corpus of the social science literature on disasters (for summaries see Lagadec, 1982, 1990; Drabek, 1986; Dynes, De Marchi and Pelanda, 1987; Auf der Heide, 1989; Drabek and Hoetmer, 1991; Kreps, 1991b; Britton and Oliver, 1993), as well as general sociological analyses of social change and trends (Bell, 1973; Harrison, 1988; Lenski, Lenski and Nolan, 1991; Perrow, 1991; Smelser, 1991, 1994; Sztompka, 1993).

Increases in Disaster Agents and Occasions

1. There are escalating kinds of technological accidents and mishaps that were relatively non-existent prior to World War II and that will increasingly result in disastrous occasions.

To the risk of natural hazards the human race has been adding at an accelerating rate a relatively newer risk, those stemming from technological accidents and mishaps (for annotated bibliographies on see Herring, 1989; Hughes, 1992). The latter happenings will increasingly contribute to the appearance of disastrous occasions. We are faced with ever more disasters in the technological area resulting from human errors and collective mistakes of groups (Perrow, 1984). To the "Acts of God", we have been adding at any escalating rate the "Acts of Men and Women" or "Society".

Technological hazards are a relatively newer class of danger which the contemporary world is only beginning to fully recognize. Disastrous occasions brought about by the unintended consequences of technology has largely been a product of the large-scale development of industry initiated by the 19th century European industrial revolution. Of course, what has been in being in developed societies for some decades now, is rapidly occurring at present also in developing social systems. To be sure, mishaps associated with technology have occurred since the first tool was produced by a human being. However, in terms of social disruption and the endangering of the social infrastructure, the scale of consequences only began to reach significant proportions with the development of large industrial complexes to mass produce myriad goods (Britton, 1991: 1-2).

The major technological threats are currently in the chemical and the nuclear area. The manufacture, processing, transportation or distribution, storage, and the use of many products of these two areas are inherently hazardous. They almost insure quantatively more and qualitative worse future disastrous occasions.

a. The chemical area.

Chemicals have truly transformed the world and modern societies are impossible without them; their use reflects a widespread desire to have higher standards of living and lifestyles which otherwise could not be achieved. The technology of chemistry has consciously been cultivated and applied because of the benefits involved. This is true not only in developed but also developing societies, as indicated by the fact that in India the chemical industry is a 20 billion dollar a year industry that accounts for 10% of the gross national product and 40% of the nation's gross industrial output (Ramasubramanian, Mitra and Bandopadhyay, 1987: 180).

But as Bhopal showed, there are multiple risks associated with the production, transportation, storage and use of dangerous chemicals for there are multiple ways in which human and other organisms, plant life and fauna, and physical material objects can be destroyed, damaged or directly negatively affected by a dangerous chemical. A chemical emergency or disaster can involve many perilous happenings unlike the typical earthquake or volcanic eruption. The referents of the term "chemical hazard" are many.

Especially important is that even localities which in the past had none or few risks from natural disaster agents, are <u>now</u> vulnerable if they have any roads, railways or waterways near toxic chemical spills, explosions, or fires. In a sense, the creation of major transportation infrastructures has reduced the geographic selectivity of possible disastrous impacts. All inhabited areas have now become vulnerable to threats from hazardous chemicals even though there be no manufacturing, storage or use facilities in the

vicinity. Not all communities are subject to major natural hazard threats; but now almost all are at risk as they are increasingly subject to dangerous chemicals being more and more moved around.

Furthermore, the threat of greater disasters of this kind is spiraling because of the greater amounts of dangerous material involved. For instance, from 1960 to 1980, not only has the number of seagoing tankers carrying petrochemicals doubled, but their shipping tonnage has expanded sevenfold! Economic considerations are leading to the use of ever larger tankers. So increasingly, there is something bigger to spill, explode or burn on waterways as illustrated by the Amoco-Cadiz oil spill off the French coast, the famous Exxon Valdez oil spill off Alaska, and more recently the Aegean Sea tanker oil spill and fire in December 1992 at the harbor of La Courna, Spain, a city of about 250,000 people.

In addition, to the in-plant and transportation kinds of acute chemical hazards types of disastrous occasions, we have also been adding the more slowly developing and diffuse types associated with hazardous waste sites. Love Canal and Times Beach in the United States as well as Seveso in Italy are examples of what we may expect more in the future. In fact, the Seveso Directive issued by the Council of European Communities accepts the probability of such future disasters by setting forth as legal policy the idea that citizens must be adequately informed of the nature of and extent of existing hazards, the planning measures being undertaken, and what might be expected of a disastrous occasion. In the former Soviet Union it is estimated over a million residents live in contaminated areas, in the 300 towns and cities where chemical weapons were once produced, stored, tested or destroyed (Shargorodsky, 1993).

b. The nuclear area.

Another increasing source of danger is the nuclear power industry. It has less than a half century existence. But it was developed because it initially seemed to offer a relatively dependable and relatively inexpensive source of energy especially for industrial expansion, compared with other energy sources such as oil which was seen as eventually depletable and increasingly costly to obtain. A move in the direction followed made much economic sense.

However, the risks associated with the development of nuclear power has been exemplified first by Three Mile Island, then Chernobyl. We may expect more along those lines given that there are over 435 commercial nuclear plants in existence at present, and about 100 more under construction. In fact, in October, 1992 in a nuclear plant in Japan at Mihama, 70 miles from Tokyo, a reactor core meltdown was only aborted by the last emergency shutdown mechanism in place. It should be noted that such a happening would pale the negative effects of Chernobyl, which contrary to much popular and even official thinking was far from a worst case scenario.

Apart from in-plant nuclear plant problems there are the risks associated with the transport of nuclear wastes over long distances. In the United States alone, by the year 2000, there will be about 47,900 metric tons of spent fuel, compared to 12,900 tones in 1985, to be shipped to some deposit somewhere. Also in the long run the dozens of societies that presently have nuclear plants will eventually be faced with the problems stemming from their necessary shutting down (and there were 435 commercial plants in existence at the start of this decade, see Meshkati, 1991). The large volumes of radioactive wastes resulting from the dismantling of such nuclear facilities will pose problems of disposal.

That this is not a purely academic issue is indicated by the recent disclosure of a not widely known explosion in the former Soviet Union in 1957. That year, a tank of radioactive waste exploded at a weapons plant near Chelyabinsk, spewing 70-89 tons of waste. At least 270,000 people are estimated to have been exposed to the cloud. While even now few of the negative consequences are known, it has been reported that as a result of the ensuing contamination, 23 villages were razed, over 10,000 residents were permanently resettled, and 17,000 acres of farm land were turned into a nature preserve (Monroe, 1992: 535-6; see also, Medvedev, 1979)

Eventually too, the presently stored material is going to have to be transported from many places to some chosen sites, and naturally that raises the probability of some accident in all countries involved in such transportation (this is complicated by the fact that some European nations, ship their nuclear waste overseas). In addition, there is the added military related problem in some countries of dealing with the highly radioactive materials that have to be handled and that also accumulate from the increasing decommissioning of nuclear submarines, the dismantling of nuclear weapons, and the closing of nuclear weapon plants.

2. There are technological advances that reduce some hazards but add complexity to old threats.

Of course modern technology can be used to try to eliminate or reduce some risks. The medical health area is marked by any number of such successful efforts. Unfortunately, sometime positive consequences from technological applications are accompanied by negative effects. There are two aspects to this: (1) preventive or protective measures which indirectly can lead to other kinds of disastrous occasions, and, (2) the scale of chain reactions possible in modern societies which as a result of network linkages can turn a minor emergency into a major disastrous occasion.

An example of the first is fires in high rise buildings. In combination with the highly combustible and toxic construction and furnishing materials presently used, they have brought an additional threat dimension to the situation. Buildings are prevented from being burned by raising the probability of their

inhabitants being asphyxiated.

Even plane crashes are interesting along this line. Research has generally shown that the ensuing fires kill more passengers than the crash itself. Eighty percent of those that do die from the fire actually succumb to the gas and smoke from the lightweight burning cabin material! It makes a plane safer along certain lines if less heavy material is used; however for economic reasons such material is seldom fire proof.

Technology sometimes is directly used in efforts to improve safety and reduce the possibilities of accidents and mishaps. This is a laudable effort but not necessarily always achieved. This can partly be seen in the following quotation from Lee Thomas, a one time head of the US Environmental Protection Agency. He said:

> It is entirely possible that somewhere in the country toxic metals are being removed from the air, transferred to a waste water stream, removed again by water pollution controls, converted to a sludge, shipped to an incinerator and returned to the air (New York Times, May 11, 1986).

He is pointing to the fact that some technologies that reduce or prevent the development of certain kinds of risk or environmental threats do so by solutions that can generate their own dangers.

But the linkages between happenings which may have ultimate negative effects, can be even more direct. This is because as technologies are elaborated and enlarged to meet the economics of scale, a small mishap at one point can bring down the total network or system. For example, there have always been electric power system failures; in fact, outages occur on a small scale almost every day even in developed societies. They are recognized as such and coped with as normal emergencies by the public utilities. But not only can something in a far distant place have local effects, but the elaborate linkages almost insure that even in societies where the power supply is normally dependable eventually there will be large scale effects as in the widespread blackout in 1965 which occurred in southern Canada and the northwest United Sates, and in France in 1978 and the province of Brittany in 1987 (Lagadec, 1990: 107). In fact, in October 1992, eight of the eleven states in Malaysia and a third of Singapore concurrently lost electricity in an interrelated massive power failure in the two Asian countries.

Massive glitches that impair telephone systems are also becoming increasingly common in many societies. In 1984, such a system outage in Tokyo, Japan affected 89,000 subscribers and cost around 300 million dollars. In 1991, eleven major phone system outages affecting metropolitan areas occurred just in the United States alone. In the report accompanying those figures it is noted:

> modern fiber optics carry 10,000 time more calls than the old copper cables they replace. An accidental cut of a single fiber optics can cut off entire metropolitan areas (Lee, 1992: 8).

As an example we might cite figures from a recent incident in Hinsdale, Illinois where a fire disabled a major Bell Telephone switching center in the Chicago area. This telephone outage as a result of its links to computers affected both voice and data communications for more than a half million residents and business customers in six metropolitan suburbs for periods ranging between two days to three weeks. In addition, local and long distance communications for both telephone and computer networks were also severely affected since the Hinsdale center affected was an aggregation point for major telecommunications links. The outage:

> affected the normal operations of dozens of banks, hundreds of restaurants dependent on reservations, three large catalogue sales companies headquartered in the Chicago area, about 150 travel agencies, most of the paging systems and cellular telephones in the affected area, and hundreds of businesses located in the area or others not located in the affected area but conducting business with those that were...At present, a conservative estimate for the business losses and the repair costs of the accident are set at $200-300 million (Pauchant, Mitroff, Weldon and Ventolo, 1990: 244).

3. New versions have developed of old or past dangers.

Certain dangers that take particular forms have been around for centuries. But in the modern world, the versions of the risks involved have taken new forms especially as large scale cities have come into being. Inevitably these kinds of communities require elaborate lifeline systems that literally are the physical or mechanical infrastructures on which they rest. For a small village, a well or two can provide the necessary water; for metropolitan areas, distant reservoirs, dams, pumping stations, pipelines and gauges, monitoring points, etc. linked together in complicated ways are needed to generate and distribute the water. This can create new versions of old or past dangers.

For instance, increasing chronic water shortages are affecting many societies, including developing ones. This is partly related to the great need for water to support the process of industrialization. A recent report of the Worldwatch Institute noted that besides parts of the western United States:

> Many areas could enter a period of chronic shortage during the 90s, including northern China, virtually all of northern Africa, pockets of India, Mexico, much of the Middle East...Where scarcities loom, cities an farms are beginning to compete for available water (Postel, 1989: 1)

Droughts used to be mostly a rural problem. This is no longer the case. In November, 1993 the water supply of Athens, Greece had fallen so low that severe rationing would have had to be quickly imposed if rainfall did not soon increase (Quinn, 1993). In different parts of the world, urbanized localities are finding themselves faced with shortages or reduced water supplies.

Moreover, in the future there will be an acute disastrous occasion if a an urban area runs out of water or has enough only for the most vital of water needs. This is most likely to occur in combination with the collapse of a major tunnel, pumping station or other critical facilities of a water supply system.

This last probability is escalating because of a deteriorating public works infrastructure of lifeline systems in a large number of older cities in the Western world. The prevalence of decaying bridge and tunnel structures, crumbling highways, obsolete and overloaded waste water and sewerage treatment plants, worn out sewer and water mains, aging subway systems and pipelines, suggest many potential disastrous possibilities beyond the isolated and occasional accidents of the past. A flood in the downtown area of Chicago in 1992 as a result of the collapse of a 100 year old underground freight tunnel is a specific case in point. It resulted in a major electric power cutoff shutting down the Board of Trade with a resulting loss of 25 billion dollars in trading, and leading to the evacuation of department stores and hotels, and disrupted businesses for weeks.

Put another way, these problems are appearing because the physical infrastructure involved is reaching the end of its normal lifetime. One can project that this also will become a problem for urban areas in developing countries compounded by the fact that there is reason to believe there is even less maintenance and accident prevention measures for the urban lifelines in them than exist in developed societies. This is illustrated by the major failure in 1989 of a pipeline in Russia which killed at least 575 persons, as well as the explosion of a natural gas pipeline in 1984 in Gahri Ohoda, Pakistan which killed 60 people, and the explosion at the liquid petroleum gas plant at San Juan Ixhuatepec near Mexico City in the same year which forced several hundred thousand of nearby residents to evacuate and may have killed several thousand people.

None of the disasters likely to occur from these factors are totally new in the geophysical or physical sense, but they

instance, this led to the collapse of a dam, the emptying of the Baldwin Hills Reservoir and some deaths and property loss in metropolitan Los Angeles (Hamilton and Meechan, 1971: 333). Or just the building of dams for the purpose of creating reservoirs to impound water for residential or industrial uses may also set off earth tremors. In one of the least seismic areas of the world, a reservoir behind Koyna Dam appears to have triggered a series of shocks that devastated Koyna Naga, India in 1967 killing 177 residents, injuring around 2,300 and damaging or destroying most of the buildings in the community (Earthquake, 1972).

Enlargement of Social Risks and Vulnerabilities

Parallel to the increase or negative changes in agents for disastrous occasions, are transformation in the populations which can be impacted. The end result of these trends, mostly stemming from the urbanization process, is an enlargement of social risks and vulnerabilities for all societies, in particular for developing ones. Thus, even if there had been absolutely no change in agents or occasions, we could still expect more and worse disastrous occasions just from the changes that are occurring in the social entities that are potential candidates for future impact.

1. **Both natural and technological disaster agents will simply have more to hit and along some lines will have greater impact.**

Disastrous occasions are social happenings involving some vulnerable entity; they are not merely the presence of some risk or hazard in some physical sense. Thus, natural hazards will only remain hazards and can not become disasters unless there is some effect on social life. An earthquake hitting a totally uninhabited area is simply an earthquake. The same is true with respect to technological agents.

As we discussed earlier such agents definitely are on the increase. Now the occurrence of physical hazard agents are probably not increasing per se, at least on any observable short range human time scale, even though it is known that some like hurricanes can fluctuate considerably over time. But we do know even now that what any physical agent can socially impact has and is changing.

Many different regions of many countries, both developed and developing, are being subjected to unprecedented population growth, building of structures, and economic development. For a variety of social reasons mentioned at the start of the paper, many areas are being built up. This means that more than ever before there are greater number of people and greater amount of property vulnerable to the risks of different disaster agents. For example, there are more people and settlements than ever before in riverine flood plains. Because of social factors, where in the past there was marsh or swampy areas, there are now housing complexes and

industrial parks. The same picture could be drawn for earthquakes. For example, 15 of the 20 most seismic countries have high population growth, and 64 of the world's 90 largest cities are located in seismic zones (Coburn and Spence, 1992). There is simply more of a built environment they can impact. Where empty or very sparsely populated space might have been hit in the past, in the future many people and their build environments will be hit. The property destruction wrought by Hurricane Andrew earlier this year in Florida would have been considerably less just a decade ago because there was much less of a built environment to impact.

It is not only that there is more to impact. It is also that the very process of urbanization in itself increases the physical vulnerabilities of all built up localities, and adds additional risks. They do so, for example in the instance of flooding, in that natural drainage areas are reduced or eliminated, in that dams and levees are built that lead to vast pools of water accumulating far beyond that which would normally occur. The 1993 floods in the midwest United States and those in northwest Europe in Germany, the Netherlands and France which were the worse in more than half a century, partly resulted from flood protection mitigation measures that had been put in place, and partly from the elimination of natural drainage areas and wetlands. Thus, in Germany the flooding was attributed to too many dikes, concrete embankments and artificial channels built along the Rhine River and its tributaries, and it was argued that low lying lands should be allowed to return to their natural state (Whiteny, 1993: 4). The same has been stated about the recent Mississippi River flooding.

To the extent that developing countries industrialize and concentrate much of that process in urban localities, the more also a target they will present for all kinds of hazards. The result could be a natural or technological disaster, the latter being illustrated by the hydrocarbons explosions which occurred in Tacso, Venezuela in 1982 which killed 145 persons (Cutter, 1991: 277).

We can not only be certain of the happenings of certain kinds of technological disastrous occasions, but they too can result in qualitatively worse effects than certain other kinds of impacts. For example, chemical poisonings and radiation contaminations often require complex, sophisticated and labor intensive kinds of medical treatment. They can and do put much more of a strain on emergency medical services than the "ordinary" disaster. For example, in Bhopal, the local emergency health system was overwhelmed both by the numbers and by the kinds of medical problems faced. The city's biggest hospital, the 760 bed Hamidia, admitted 1,900 seriously ill patients the first day and eventually treated more than 70,000 victims (Bowonder, Kasperson and Kasperson, 1985: 32).

2. More vulnerable kinds of population will be impacted than in the past.

Populations in future disastrous occasions, because of social changes--some of lifestyle, others of a demographic nature--will be more vulnerable to negative effects.

Changes in lifestyles can increase vulnerabilities. For example, notions of leisure times and vacations have become very widespread in developed societies. This in turn leads to the creation of certain kinds of resort areas which are particularly vulnerable. Such changes in lifestyles are leading more people to be tourists in localities at risk from such happenings. For example, the weekend, seasonal and holiday population in the tourist resort areas on the eastern the United States is usually 10 to 100 times more than the permanent coastal residents. A similar change in population patterns is true in Europe with respect to avalanches in ski resort villages. Also, increasingly families are building vacation homes in wildlands that are vulnerable to brush fires.

Then there are other even more fundamental changes in family patterns; the form of the family has been changing. For example, more and more, the recent traditional type of the family in the Western World known as the nuclear one, a husband and wife with children, is less and less the dominant form. Households are increasingly made up of members that consist of single people, childless couples, both male and female single parents, unmarried same or different couples such as heterosexual partners and gay couples, as well as unrelated roommates (this is increasingly also the patterns starting to appear in cities in developing countries). Much disaster planning at least in the West implicitly assumes that most households will be made up of nuclear families. But this is a diminishing social pattern. Furthermore, the other types of growing kinds of households all present different kinds of issues and problems for disaster planning and managing. For example, the homeless presented unexpected major relief problems after the Loma Prieta earthquake and Hurricane Hugo in the United States.

Then there have been and are changes occurring in the demographic characteristics of populations in current societies. These can result in qualitative changes in vulnerability. As an example we are increasingly getting an older population in at least the majority of developed countries around the world such as France and Japan. For various reasons older persons tend to live in areas which are more subject to risks such as the state of Florida in the United States. But irrespective of where they live, it is known that older people among other things are proportionately more likely to be injured in disasters. In addition, older victims find it more difficult to make up for property losses; in fact, the elder usually have proportionately more to lose.

In developing countries, the problem is just the reverse since they usually have very young populations. In the Bangladesh Cyclone of 1991, which killed an estimated 130,000 people, 63% of the deaths were in the under 10 age category even though this category

represented only 35% of the pre-cyclone population (Mushtaque, Chowdhury, Bhuyia, Choudhury and Sen, 1993: 301). But along with the elderly it is also the very young who are more likely to be casualties in disastrous occasions.

There will also be expanding risk for those already at social disadvantage in a community. The poor are the most vulnerable in several ways. They generally live in more dangerous locations such as flood plains or around chemical plants. It was not the well off who lived in Guadalajara the Reforma district around the PEMEX gasoline distribution center, when a series of sewer-drainage explosions along an 18 kilometer course ripped through 13 square kilometers of the area killing several hundred, injuring around 1,500, damaging at least 1,100 residences, and doing an estimated 300 million dollars of property damage. In fact, cities in developing societies typically have huge slums. Natural disasters such as floods and typhoons which have hit Rio De Janeiro and Hong Kong respectively have typically devastated squatter settlements in those communities. In some instances, when technological disasters occur, the impact is much greater than would otherwise be the case. For example, the gasoline leak from a pipeline which exploded in Cubatao, near San Paulo in Brazil in 1984 set off fires in a nearby shantytown that resulted in 508 deaths (Cutter, 1991: 276).

Also, after impact the poor are less able to cope with the losses suffered in disasters. The problem is compounded by the fact that certain populations in urban areas are particularly heterogeneous.

3. Increasingly metropolitan areas will be impacted: along certain social lines they are not well suited for coping with disastrous occasions.

For a variety of reasons, some of which have already been indicated, metropolitan areas will be increasingly subjected to disastrous occasions. In general, the social characteristics of such localities will tend to increase the difficulties in many kinds of crises because of the highly bureaucratic nature of urban organizations, and the heterogeneous sociocultural patterns of urban groupings. Since both make planning for and managing social crises more difficult, the more there are disastrous occasions in urban areas, the more there will be problems.

a. Urban bureaucracies.

Sterotypic negative notions of bureaucracies should be avoided when discussing such types of social organizations. Nevertheless, it is true that bureaucracies are not the most adaptive social organizations for coping with fluid and ambiguous crises, among the very hallmark of the emergency time periods of disastrous occasions. Disasters involve nonroutine occasions. In those kinds of situations, as disaster studies have consistently found, new or emergent rather than traditional or standard behavior patterns are

more adaptive for the demands or problems that surface. For example, hospitals and the hospital system can better provide emergency medical services if the bureaucratic authority structure, the traditional decision making process, and even the traditional division of labor, are not completely followed (Quarantelli, 1983).

However, research indicates that threatened organizations are inclined to be rigid and detached, relying heavily on existing strategies, routines and resources to pull them through such occasions. Put another way, since bureaucracies are not the best social organizations to prepare for and respond to disastrous occasions, their presence in the midst of such crises, can only magnify the problems that will appear.

All cities everywhere have many everyday problems which their bureaucracies do not handle too well with the problem particularly acute in developing societies. It has been written of them that:

> almost any account of Third World urbanization of cities reads like a litany of seemingly intractable problems. What is more, by interchanging a few names and adjusting some figures slightly the litany is depressingly similar throughout much of Asia, Africa, and Latin America (Dogan and Kasarda, 1988: 24 quoting an unreferenced McNulty writing)

Of course, an actual situation may be more complicated than might appear at first glance, but not necessarily in the negative direction. In Mexico City, the formal governmental structure is on paper a highly centralized and rigid bureaucracy. However, after the 1985 earthquake, a detailed study found that in reality the system was somewhat functionally decentralized at the informal level. The result was that at the local level the response by organizations coped relatively well with a series of problems such as the restoration of the public utilities (Dynes, Quarantelli and Wenger, 1990). But in the main, it is to be anticipated that urban bureaucracies will not cope well with disastrous occasions and as such will make populations more vulnerable to disaster impacts.

b. Heterogeneous subcultures.

It is widely believed that many segments of urban populations live in very disorganized and anomic social settings. This is not correct. This perception mostly reflects the view of dominant and majority groups when they look at the non-mainstream social groupings that increasingly live in urban areas. But far from disorganization, what is present are well integrated social worlds and subcultures whose members simply have different values and beliefs than the dominant social pattern and culture, most stemming from different ethnic and/or religious backgrounds. Many of the metropolitan areas in developed countries such as France, have been

the end point of migration from developing countries (and in developing countries the cities too are the magnets for rural migrants, easily seen in Mexico City). A major consequence is that heterogeneity characterizes their urban way of life.

These kinds of population mix can affect response in disastrous occasions in a variety of ways, make planning even more complicated than usual, and generally raise the risks and vulnerabilities for the persons and groups in the mix. For instance, some ethnic and minority groups see hazards differently from other groups, with some assuming natural hazards can be overcome and others assuming human beings have to accept and adjust to threats. Depending on the belief, this can affect efforts at mitigation or prevention of disastrous occasions. People from different cultures can also vary in their support for protective actions, with some taking a somewhat fatalistic and resigned position because of certain kinds of religious values. Adoption of emergency preparedness measures can be affected by this. Also, some groups have very extended kinship systems which can provide considerable support at times of crises; conversely, other disaster victims because they trust no one other than their own, may have few or none to turn to for social support. As another example we may note that studies show minorities in most societies often have the most problems recovering from disastrous occasions because they frequently are not that socially visible to those providing help.

Our point is that any kind of sociocultural mix along any of the lines indicated will complicate and generally make less efficient and effective any aspect of crisis planning or managing. A relatively homogeneous population is much easier to plan for and will have less risks and vulnerabilities in disastrous occasions.

4. Increasingly, localities will have disastrous conditions from sources that may be quite distant.

An interesting pattern for some disastrous occasions of the future is that their source and their point of impact will be quite distant from one another. Sometime impact is within a limited geographic area, although threatening localities away from the original risk source. For example, a chlorine gas cloud in Florida drifted about 28 miles from where a train accident occurred; if the same derailment had occurred in a metropolitan area rail yard in the United States, millions of people would have been put at risk. As another example, a 1980 pollution episode of the Po River in Italy extended over a 60 mile stretch.

But more important are when hazardous effects go over important jurisdictional boundaries, sometime of nation-states. For example, the 540 mile Meuse River arrives in Maastricht, The Netherlands loaded with human sewage and chemical waste picked up earlier upstream in France and Belgium. As is well known, the radiation fallout from Chernobyl fell in various parts of the world, but

especially in certain European countries. The radiation falling on moss in Lapland in northern Scandinavia affected reindeer who used it for food which in turn affected natives who because they used the reindeer for several purposes, suffered economic losses. The toxic contamination of the Rhine River which starting at Schweizerhalle, Switzerland, eventually affected six different nations and polluted upriver for almost 800 miles, or the Ohio River pollution which had severe consequences for several states are again harbingers of what we might expect more in the future.

Consequences at a distance are not confined to technological type disasters. A Japanese bank recently analyzed the effects on the world economy if a major earthquake impacted Tokyo. It projected that because of the central role of Japan in the internationalized financial markets, the economic after shock would be felt around the world. It noted that in 1987, some 18.7% of the about two billion in foreign money which flowed from abroad into US securities came from Japan. The report also estimated that if the earthquake had occurred in 1988, world economic growth would have been curtailed by 0.3 percentage points in 1989; by 0.9 percentage points in 1990; by 1.5 points in 1991; by 2.1 points in 1992; by 2.4 points in 1993 and by 2.6 points in 1994 (Japanese, 1989: 1).

5. Certain future disastrous occasions have catastrophic potential even if they would produce no casualties nor have physical impact.

Some disastrous occasions in terms of their direct effects will be mostly economically costly. It has been noted, for instance, that early discussions of such occasions equated the magnitude of impact to the number of people killed or injured, or to the amount of property damaged. Unfortunately, things are not this simple. The accident at Three Mile Island (TMI) provided a demonstration that factors besides injury, death, and property damage impose serious costs. Although there was not a single death at TMI and few if any latent cancer fatalities are expected, as Slovic has written:

> no other accident..has produced such costly societal impacts. The accident...certainly devastated the utility that owned and operated the plant. It also imposed enormous costs (estimated at 500 billion dollars...) on the nuclear industry and on society (1987: 282).

It did this through stricter regulations and the reduced operation of reactors worldwide, greater public opposition to nuclear power and greater reliance on more expensive energy sources, and increased costs of reactor construction and operation.

As a variant of this, we may note that some future disasters will be very socially disruptive, less because of their direct physical impacts, but as a result from the way that the hazard will be

perceived. A good example of this occurred in Brazil in 1987. A cancer treatment machine abandoned in a junkyard released some dangerous cesium 137 which through radiation contamination killed about four people and seriously affected about 44 others.

But far more consequential was the perceived risk to and from anyone that initially resided in the affected locality, namely Goiania, Brazil. Over 100,000 residents out of a total population of about one million underwent Geiger counter examinations to detect possible contamination; about 8,000 formal certificates were issued to counter the effects of being stigmatized as a hazardous carrier of radiation. This was a reasonable coping effort since anxiety over potential contamination led hotels elsewhere in the country to cancel reservations of persons from Goiania, buses and airplanes to refuse to take Goianians as passengers, and doctors and dentists not taking new patients who did not have the certificates. There was also cancellations of scheduled conventions with regional tourism falling over 40%; property values fell too, with sales for the entire city and state being affected. Possible as much as 50% of the state's export sales were lost during one month with the area's agricultural products being boycotted (or purchased at 50% of value). Even textiles and clothing manufactured in Goiania were affected--some losing nearly 40% of their value (see Petterson, 1988).

Clearly these kinds of future disastrous occasions resulting mostly in non-physical but massive social, economic and/or psychological disruptions will have to be planned for in the future. There will be a need to get away from equating disastrous occasions only with fatalities, a rather narrow and almost completely discarded notion in most of the recent social science research literature.

CONSEQUENCES

The effects of disastrous occasions can be many, multiple and myriad in a great variety of ways. However, in this paper we are only concerned with how these occasions may affect social development or influence social change at the more macro levels of social systems or societies. As such, although they are very important, little attention is paid here to consequences at the individual, household and small group levels of behavior (for such effects, see Drabek, 1986; also Nigg, 1993). Rather our prime concern is if, how, and in what ways disasters and catastrophes have developmental consequences for organizations, communities and societies, the higher macro levels of social activities not reducible only to the acts of the human beings within them.

It is also necessary to stress that much of what goes on in a recovery period after a disastrous occasion is recovery, and not social change. Restoring residences, businesses, public services and irfrastructures, employment, schools, economic activity, tourism and other social activities to preimpact levels does not in

our view constitute social development or change (see Drabek, 1986: 200-249 for summaries of such activities). Although important, such behavior, even when it is differentiated (Nigg, 1993: 261), is basically part of the recovery process bringing the disrupted parts of the system back to its preimpact status (see Rubin, Saperstein and Barbee, 1985). Our interest is in social change or development, that is a move in some significant way away from preimpact levels and directions. There is no implication in saying this that the changes are always necessarily functional or positive in outcome; as discussed later, this is not always the case.

That disasters and catastrophes sometime and under some circumstances bring about change seems indisputable. There is historical evidence in support of such a general contention. Historical studies indicate that the Black Death epidemic in Europe in the 14th Century (Ziegler, 1969; Gottried, 1983; Huppert, 1986) and the massive Lisbon earthquake in Portugal in 1755 which killed 60,000 brought about some major changes not only in the societies, communities and populations affected, but elsewhere also.

However, the social science literature on the topic of the social consequences of disastrous occasions has been rather uneven (see Nigg and Tierney, 1993 for a discussion of why social change is not well documented in the literature). There are occasional exceptions (see, e.g., Geipel, 1991 on the long run effects of the Friuli earthquake). But the research studies as a whole have not been as many or as systematic on this phase of the disaster cycle (mostly recovery) as they have been especially about preparedness and response in the emergency or crisis phases of disastrous occasions (Drabek, 1986: 250). As such, our discussion here will be briefer and more delimited than our extensive comments on the social developmental conditions that lead to disastrous occasions.

Nevertheless, at least four major themes can be discerned in the observations and findings that have been made about major developmental or social change macro level effects or consequences of disasters and catastrophes. The themes are:

(1) Permanent social changes have to be distinguished from temporary modifications;
(2) There are few if any across-the-board effects--rather there are differential consequences in different social spheres and activities;
(3) Changes are more likely from catastrophes than from disasters; and,
(4) There can be positive as well as negative outcomes in social development.

Let us explain these in somewhat more detail.

(1) Permanent changes versus temporary modifications.