The Dynamics of Disaster Recovery: Resilience and Entropy in Hurricane Response Systems, 2005-2008

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The Paradox of Disaster Recovery

The calls for "lessons learned" are widely heard following any disaster. Yet, the challenge of transforming the bitter experience gained from one devastating event into improved performance in response to the next threat is not easy. In the aftermath of disaster, changes are enacted in public policies and procedures to protect the damaged community from future threats. After action reports review operational performance and identify "lessons learned." Investments are made in new equipment and training to increase capacity of response organizations; disaster preparedness programs are initiated to inform the public in a concentrated effort to reduce disaster risk. Yet, over time, interest and action in disaster preparedness wane. Changes in resources, personnel, technologies, and organizational priorities shift the focus of the community away from risk reduction, and the community lapses into patterns of inaction and inattention that leave it vulnerable again to known threats.

This pattern represents a dual dynamic that can be observed in communities that experience disaster. It occurs repeatedly, frustrating those who seek lasting improvement in the capacity of communities to manage known risk. First, there is a strong mobilization of effort – by public, private, and nonprofit organizations – to build resilience to risk in the immediate aftermath of disaster. This effort is soon countered by a second dynamic, entropy, as the urgency and interest in risk reduction fades after the damaging event (Tong 2008), and daily concerns of the community intervene to demand attention and action. The challenge for policy makers and disaster managers is to achieve a balance between these two dynamics – resilience and entropy – in order to achieve sustainable risk reduction.

Achieving an appropriate balance between resilience and entropy in any given community requires a systematic exploration of both dynamics. The recent hurricanes that struck Louisiana, Hurricane Katrina on August 29, 2005 and Hurricane Gustav, on September 1, 2008, offer an unusual opportunity to assess the degree to which both dynamics operated following Hurricane Katrina. Further, these two hurricanes, occurring almost exactly three years apart, document the extent to which changes in policy and practice implemented by public agencies following Katrina altered the operational performance of the response system to Hurricane Gustav. In practical terms, Hurricane Gustav tested the changes in policy and practice enacted after Hurricane Katrina and the degree to which Louisiana and the wider emergency response system had increased its resilience in managing severe storms.

In this analysis, we explore the conditions that foster community resilience to disaster events, and examine specifically the degree to which changes implemented in policy and practice after a damaging event enable a community to reduce risk from subsequent threats. Further, we seek to identify the rate at which entropy inhibits organizational action following disaster, limiting innovations in policy and practice that may have been initiated immediately after the disaster event. We seek to measure the rate of change in each process, and to use this analysis as the basis for identifying the threshold at which communities can maintain sustainable management of risk.

Resilience to Disaster Risk

The call for communities to develop "resilience" in disaster has taken many different forms. In this study, we define resilience as the "capacity for collective action in response to extreme events (Comfort et al. *Forthcoming*)." These events may be sudden and urgent, as in earthquakes or explosions, or they may be slower onset events such as hurricanes or floods. The focus in reference to either type of event is on building awareness of the risk, sharing knowledge of threatening conditions among responsible organizations, increasing flexible options for adaptation to potential danger, and developing capacity for self organization at individual, organizational, and community levels of action. This concept of resilience depends upon ready access to information and the capacity of responsible actors to engage in timely search and exchange of information regarding threatening events. Resilience assumes a process of continual review, reflection, and redesign of actions taken in a changing environment; it means the capacity to update information and correct error as new information emerges from interactions among actors operating in dynamic conditions. Most importantly, resilience relies on the human capacity to learn and to act on valid information.

Social Entropy in Disaster Response

Social entropy derives from the concept, first identified by Enrico Fermi as the Second Law of Thermodynamics(Fermi 1956) that describes the dissipation of energy in an operating system over time. If we consider a set of emergency organizations engaged in coordinated activity to achieve the common goal of restoring a community to functional operations following a disaster as a 'system' of interdependent actors, the same concept of energy infusion and diffusion applies. The operation of an organizational system of actors also depends upon an influx of 'energy,' where energy in social organizations is construed as the flow of information and resources that enables the actors to make decisions, allocate resources, and take actions to address a common problem or to serve a shared goal. The 'state' of the social system undergoing change can be defined by essentially the same classic equation, f(p, V, t) = 0 (Fermi 1956) in which the state of the system is a function of the pressure, Volume, and temperature of heat, or energy that is driving the system. In the social context of a disaster environment, the 'state' of the response system can be defined as a function of p, pressure of time x V, volume of demands made upon the system, x t, defined in physics as temperature, but in response operations as performance of the system in meeting the volume of demands within given constraints of time.

By adapting the concept of entropy developed to measure changes in the state of performance of physical systems to measure similar changes in the state of performance of organizational systems, we are able to assess more accurately the capacity of communities to manage risk. More importantly, we are able to identify the threshold points at which fresh 'energy' in terms of information, resources, and attention may need to be injected into operating emergency response systems to enable them to maintain their performance without slipping into significant dysfunction or 'phase change' in their capacity to manage risk. If we can model these dynamic interactions among component organizations in actual disaster response systems, we may gain insight into the steps needed to maintain response organizations for communities exposed to fluctuating levels of risk. For this purpose, we redefine the terms in the classic equation of the state of a dynamic system from physics to describe the state of a dynamic social system as:

$$f(p_t, V_d, t_p) = 0,$$

where $p_t =$ time pressure, $V_d =$ Volume of demands for action placed on the system, and $t_p =$ performance of the system at a given time interval.

In summary, the concept of social entropy acknowledges the shift in attention and action in a disaster response system as other issues and actors enter the system, scattering the common focus on risk reduction, and triggering other types of interaction among the participating organizations. These entries into the system after a disaster event are part of the ongoing flux of operations in any community. Nonetheless, they increase the degree of heterogeneity and complexity within the system, and disperse the amount of energy that can be focused on disaster risk reduction. Like operating physical systems, however, this pattern of dissipating energy and slackening performance can be altered by 'negative entropy,' that is, a fresh injection of energy into the system. In an organizational system, negative entropy would be measured by the reverse of the components of entropy; that is, by actions that would reduce time pressure upon organizations, additional resources that would ease the demands placed upon the existing system, and increased information that would improve the performance of the system at given intervals or locations.

Measuring Change in Disaster Response Systems

Identifying the key parameters of resilience and entropy in actual disaster response systems requires a careful assessment of the region at risk before a disaster occurs. This task involves building a knowledge base of the existing organizational structure, policy processes, technical infrastructure for communication, coordination, search and exchange of information, as well as exposure to risk. This assessment provides a baseline for measuring resilience, as it outlines the existing capacity of a community to manage the risk to which it is exposed.

The second component of this assessment is to identify the parameters in the system that can or will vary under threat of disaster. These parameters include the: 1) number of potential actors in the response system (public, private, and nonprofit); 2) degree of heterogeneity among those actors in terms of access to resources, training, and prior experience in disaster response; 3) number of demands placed on each actor; 4) time pressure for action; 5) delay in completion of actions requested; 6) policy or procedural constraints on action; and 7) ability to update information and correct error as conditions change.

In order to assess the degree to which the dual dynamics of resilience and entropy characterize the performance of actual response systems, we analyzed data from two hurricanes that struck Louisiana within a period of three years. This analysis reveals first, the response system as it operated in Louisiana following the devastating impact of Hurricane Katrina on August 29, 2005. Second, we performed the same analysis to characterize the performance of the response system that evolved following Hurricane Gustav that struck broadly the same region on September 1, 2008. The difference in performance between the two response systems demonstrates the dynamics of resilience and entropy in practice.

The Response Systems in Context: Hurricanes Katrina and Gustav

Although the two hurricanes struck broadly the same geographic area on the Gulf Coast, there were significant differences in both the physical infrastructure and the populations affected that

influenced the evolution of the respective response systems. Hurricane Katrina formed as a tropical depression in the Bahamas on August 23, 2005, and moved through the Caribbean region and the Gulf of Mexico for days, strengthening into a Category 5 storm until it made landfall as a Category 4 storm with winds surpassing 175 miles per hour just east of New Orleans on August 29, 2005(National Weather Service 2009). New Orleans, the major metropolitan center in the region, was devastated not only by severe winds and rain, but also the collapse of the aging levees and flood walls designed to protect sections of the city that had sunk below sea level over years of environmental change. The damage from flood waters rendered the City of New Orleans uninhabitable for weeks, and all residents had to be evacuated. The death toll was over 1,300, and the losses in property, lost business, schools, and hospitals were estimated at over \$100 billion (Comfort 2006).

Three years later, almost to the day, Hurricane Gustav formed as a tropical depression in the Caribbean on August 25, 2008, strengthened to hurricane status over several days and made landfall on September 1, 2008 near Cocodrie, LA as a Category 2 storm. The storm weakened to a tropical depression, but moved north, inflicting heavy damage on the capital city of Baton Rouge. In this storm, the major damage was to the electrical power system in Baton Rouge, leaving households, businesses, and hospitals without electricity or air conditioning for fourteen days in the heat and humidity of early September in Louisiana. The losses from this storm were significantly less, with an estimated \$4.3 billion in Louisiana. Given the heavy losses in lives, property, and disruption of economic, social, and cultural activities from Hurricane Katrina and the ensuing flood, the question is whether the communities of Louisiana, backed by the state and federal emergency response systems, had learned from the tragedy of Katrina, initiated changes in policy and practice, and improved their performance in response to the threat from Hurricane Gustav, three years later.

Analytical Approach

Our approach to this comparative analysis was to characterize both response systems over a three-week period of operations following each hurricane, as well as the four to five days preceding landfall when the storms were forming and changing in strength and direction. In order to identify the entry of organizations into the response systems on a daily basis, we conducted a content analysis of newspaper reports on response operations in the Times Picayune, the local newspaper published in New Orleans and the major newspaper for the state of Louisiana. Our unit of analysis was the organization, and our unit of observation was the name of an organization identified in news reports as having engaged in disaster operations or disaster response activities following Hurricane Katrina. The period of observation ran from August 27, 2005, three days before the storm until September 19, 2005, three weeks after the storm. We identified the organizations by date of entry into the system, level of jurisdictional authority: municipal, parish, state or federal; and source of funding: public, private, or nonprofit. We also identified the number of interactions reported by organization and the types of transactions that the organizations performed, although this information is not presented in this report. These data were then used to identify the networks of organization and action that form and reform in carrying out the varied activities of disaster response.

Using the same approach and the same source, newspaper reports from the *Times Picayune*, we conducted a comparable content analysis to identify the response system following Hurricane Gustav. The dates included in this analysis were virtually the same period, three years later,

August 26 – September 21, 2008. The descriptive statistics for the two response systems are presented in Tables 1 and 2 below.

in the Fun Hurricane Katrina Kesponse System										
		Source of Funding								
	Pu	blic	Pri	vate	Non-	Profit	Spe Int	ecial- erest	То	tals
Level of Jurisdiction	N	%	N	%	Ν	%	N	%	Ν	%
International	11	2.1	3	0.6	5	0.9	0	0	19	3.6
National	0	0	24	4.5	75	14.1	1	0.2	100	18.8
Federal	67	12.6	0	0	0	0	0	0	67	12.6
Regional	1	0.2	7	1.3	26	4.9	0	0	34	6.4
State	79	14.8	7	1.3	4	0.8	2	0.4	92	17.3
Sub-Regional	11	2.1	12	2.3	9	1.7	0	0	32	6.0
Parish/County	55	10.3	3	0.6	1	0.2	0	0	59	11.1
District	27	5.1	2	0.4	0	0	0	0	29	5.4
City	53	9.9	27	5.1	21	3.9	0	0	101	18.9
Totals	304	57	85	15.9	141	26.5	3	0.6	533	100.0

Table 1Frequency Distribution of Organizations Identifiedin the Full Hurricane Katrina Response System*

Source: Times Picayune, New Orleans, LA. August 27 – September 19, 2005.

Table 2Frequency Distribution of Organizations Identifiedin the Full Hurricane Gustav Response System

	Source of Funding									
	Public Pri		Private Nonprofit		onprofit	Special Interest		Totals		
Level of Jurisdiction	Ν	%	N	%	N	%	Ν	%	Ν	%
International	1	0.3	1	0.3	1	0.3	0	0	3	0.9
National	0	0.0	39	11.8	13	3.9	0	0	52	15.7
Federal	25	7.5	0	0	0	0	0	0	25	7.5
Regional	3	0.9	8	2.4	4	1.2	0	0	15	4.5
State	39	11.8	5	1.5	17	5.1	0	0	61	18.4
Subregional	3	0.9	1	0.3	4	1.2	0	0	8	2.4
Parish/County	77	23.2	2	0.6	7	2.1	0	0	86	25.9
District	13	3.9	0	0	0	0	0	0	13	3.9
City	30	9.0	17	5.1	22	6.6	0	0	69	20.8
Totals	191	57.5	73	22.0	68	20.5	0	0	332	100.00

Source: Times Picayune, New Orleans, LA. August 26 – September 21, 2008.

Hurricane Katrina, a more severe storm that triggered secondary devastation from flooding caused by the collapsed levees, generated a larger response system, with 533 organizational

actors than Hurricane Gustav, with 332 organizational actors identified from news reports.. Yet, there were other significant differences between the two response systems. Recognizing that the first response to any disaster event is necessarily local, it is telling to see that the proportion of organizational actors from the local jurisdictions – city, district, parish – was 35.4% in the Katrina response system, in contrast to over half, 50.6%, of the actors in the Gustav response system. Similarly, the proportion of national and federal organizations participating in the Katrina response system was markedly higher at 31.4% in contrast to 23.2% for the Gustav response system.

In our analysis, we identified the interactions among the participating organizations for each response system, and calculated the measures of centrality for each response system, using the UCINet software program (Borgatti et al. 2002). The network maps that reveal the patterns of interaction among organizations for the two response systems also showed markedly different patterns in coherence, density, and centrality. The maps for each system are shown in Figures 1 and 2 below. The list of organizations represented by the acronyms included in the maps is included in the Appendix. The network map for Hurricane Katrina shows a large system that is characterized by five clusters of interacting organizations, but sweeping wings of loosely connected organizations. The diagram is cluttered, but it is difficult to identify dominant patterns of interaction: Federal Emergency Management Agency, Office of the Governor of Louisiana, and Department of Social Services, Louisiana, and three smaller hubs of interaction: Louisiana National Guard, with units from neighboring states, and the US Army Corps of Engineers.



Figure 1. Full Network Map for Hurricane Katrina Response System Source: *Times Picayune*, New Orleans, LA. August 25 – September 19, 2005.

Figure 2. Full Network Map for Hurricane Gustav Response System Source: *Times Picayune*, New Orleans, LA. August 26 – September 21, 2008.



Notably, the dominant nodes in the network map for Hurricane Gustav are the expected hubs for information search, exchange, and resource allocation. These agencies have legal responsibility for managing risk and responding to extreme events when they do occur. The network map for Gustav reveals a greater degree of coherence among the participating organizations than the comparable map for Hurricane Katrina. This coherence is demonstrated by the higher degree of centralization reported for the response network, 20.7%, for Hurricane Gustav in comparison to the degree of centralization, 12.8%, reported for Hurricane Katrina.

The tables of descriptive statistics and the network maps present profiles of the two disaster response systems as they evolved over three week periods following Hurricanes Katrina and Gustav. Yet, the two systems exhibited quite different patterns of system level and internal performance as they evolved over time.

Evolution of Networks Over Time: Hurricanes Katrina & Gustav

In order to provide a comparative analysis of change in the Katrina and Gustav disaster response networks over time, we first generated a unique one mode network (organization X organization) for each day of the disaster response period. Then, for each hurricane, we performed a quadratic assignment procedure (QAP) using UCINET 6 (Borgatti et al. 2002) to calculate the correlation of network ties for each consecutive day. The correlations of network ties for each day are plotted over the three-week time period of the analysis in order to display the rate of change and

stability of the response systems over time.¹ Values of 0 indicate no significant correlation. All other correlations are significant at p < .01.

The graphs for Katrina and Gustav reveal the striking changes in the response system for both hurricanes. The evolution of the response system for Gustav, as displayed in Figure 4, demonstrates a relatively stable system in the first period in comparison to that for Katrina, presented in Figure 3. Yet, following September 6, 2008, we observe a sudden and continuing change in the response system for Hurricane Gustav for all correlations between the consecutive days until September 11th. After September 11th, again we observe a relatively stable system compared to Katrina. These observations suggest that unlike the response system for Gustav, the response system for Katrina was far from stable at any stage of the response period. Almost all of the correlations are non-significant, except for the correlation between September 2nd and 3rd and September 10 and 11th. Moreover, even these significant correlations are fairly low (.03 and .06 respectively).

The relatively high correlation between the network structures in the first few days of response to Hurricane Gustav suggest that the organizations involved in the system were much more prepared and acted according to a plan. Therefore, the network structures in the first few days following landfall resemble each other relatively closely. However, when we look at the Katrina network overtime, we clearly see a much more chaotic pattern. In the Katrina system, the networks do not "evolve", but change dramatically every day. While a degree of change is necessary for better performance, a degree of stability is also required to ensure an effective response system. Therefore, the relatively higher correlations for Gustav may be used as a proxy measure for better performance of the Gustav response network.



Figure 3. Change Over Time for Hurricane Katrina Source of Data: *Times Picayune*, New Orleans, LA. August 27 – September 19, 2005.



Figure 4. Change Over Time for Hurricane Gustav Source of Data: *Times Picayune*, New Orleans, LA. August 26 – September 21, 2008.

Seeking to identify dynamic changes in the response systems, either through strengthening collaboration, interpreted as resilience, or declining interactions, interpreted as entropy, we analyzed the data by the organizations' date of entry into the response systems, that is, the date at which the organizations were reported to take action in response operations, as well as by source of funding: public, private, or nonprofit.

Analyzing the date of entry into the response systems by source of funding, we noticed that the relationship between the entry date (X) and number of organizations (Y) follows a curved line (curvilinear), not a straight line. In that case, the standard regression method of calculating the line of least squares will not describe or predict the relationship accurately. To capture the fluctuating entry pattern, we used a polynomial regression line instead of linear regression because a curved line provides the best fit to the data points (McDonald 2008). The following equation was used in this analysis:

$$P(x) = a0 + a1^*x + a2^*x^2 + \ldots + an^*x^n,$$

where a0, a1, ..., are regression parameters to a set of N tabulated values of x (date) versus y (number of organization entered at that date). This model is a general regression model with k predictors raised to the power of i where i=1 to k. When we set power as k=2, we calculated the equation of the parabolic curve pattern of the organizations' entry to the system, and used a statistics package, STATA, to calculate the coefficients a0, a1, ..., by minimizing the sum of squares of the deviations between the calculated P(x) and the data for y (this equation is located in the right upper corner of each graph) (Kleinbaum 1998). The following graphs provide plots of the fitted curves by date and source of funding:



Figure 5. Number of Entries by Date for Hurricane Katrina (Public only)







Figure 7. Number of Entries by Date for Hurricane Katrina (private only)

Figure 8. Number of Entries by Date for Hurricane Gustav (public only)





Figure 9. Number of Entries by Date for Hurricane Gustav (Non-profit only)

Figure 10. Number of Entries by Date for Hurricane Gustav (private only)



Comparing the findings from the analysis, the data show very different patterns of performance by date of entry and by sector between the response systems for Hurricanes Katrina and Gustav. Examining the polynomial regression lines for all three sectors – public, nonprofit, and private – we see public organizations entering the response system for Hurricane Katrina only a day before landfall on August 29, and then a steady decline over the three-week period. For nonprofit organizations, the regression line is virtually flat, indicating a rather erratic pattern of entry into the system. Private organizations show a pattern of decline similar to public organizations, although not quite as steep. The response system that evolved following Hurricane Gustav reveals a markedly different pattern. First, the public organizations entered the response system a full four days before the storm made landfall, indicating a greater degree of awareness and preparedness for action. Second, the polynominal regression line shows a smooth upward curve of resilience that tapers down as the number of organizations entering the system declines, indicating entropy in the system. The regression lines for the nonprofit and private sectors show similar curves of upward resilience in response to perceived need and downward entropy as demand for services drop and the system wanes. While this analysis is based on content analysis of news reports and is subject to the limitations of journalistic reporting, the data do provide a daily count of organizations entering into the response systems, as well as their level of jurisdictional authority and source of funding. The polynomial regression findings document not only different rates of change and timing in the mobilization of the response systems.

Conclusions

These findings provide an early glimpse of the dynamics operating within the two response systems that evolved following Hurricanes Katrina and Gustav. The data document the widespread observation that the response system following Hurricane Katrina exhibited little resilience over the three-week period of the study. The downward trend of organizational interactions documented in all three sectors – public, nonprofit, and private -- suggests the emergence of entropy as the entry of new actors into the system declined. Although Katrina was a more severe storm than Gustav and threatened the City of New Orleans, the period of mobilization in response to hurricane warnings was a brief two days.

In contrast, the response system to Hurricane Gustav mobilized in response to hurricane warnings a full five days prior to landfall and strengthened steadily as the storm approached. The response system did show evidence of entropy in the gradual decline in entry of new organizations as the system made the transition from response to recovery on Day 10 after landfall.

More important, the findings suggest that even though Hurricane Gustav was a weaker storm and largely bypassed the metropolitan region of New Orleans, changes in response policy and practice initiated following Hurricane Katrina did increase the resilience of the affected public, private, and nonprofit organizations in Louisiana in their response to Hurricane Gustav. At least within a period of three years, the insights gained and actions taken following the severe losses from Hurricane Katrina informed and strengthened public, nonprofit, and private organizations in their capacity for disaster mitigation. The critical question is whether this improved performance is sustainable over a longer interval between hurricanes, ten, twenty or thirty years. Or, as the distance in time and memory from the devastation of Hurricane Katrina fades, will entropy erode the performance demonstrated in response to Hurricane Gustav?

The unusual situation of assessing the changes introduced in organizations responsible for mobilizing operations in response to a hurricane threat in essentially the same geographic region after the brief interval of three years increases understanding of the dynamics of disaster response. The challenge will be whether this degree of resilience can be sustained over time. Past experience from other major disasters indicates that entropy increases as time from the event lengthens, and personnel, resources, and memories change. The critical question is whether improved information technology for storing, searching, retrieving, and exchanging information regarding risk among multiple organizations and jurisdictions can be used to maintain the level of community knowledge and capacity to reduce risk essential for resilience. This requires periodic injections of fresh information, resources, and attention to offset the natural shift in attention and energy over time away from disaster risk, or the recurring emergence of social entropy. Such an injection represents 'negative entropy,' that is, a deliberate effort to to maintain an active balance between the capacity to act to reduce disaster risk, or resilience, and the shift in attention away from disaster risk over time, or entropy.

Understanding the dynamic between resilience and entropy in managing disaster risk requires a reconsideration of the design and implementation of policies and procedures for disaster risk reduction. Determining what and where the thresholds are for shifts in the capacity of a community to take mitigating action to reduce disaster risk will depend upon maintaining a culture of interorganizational learning. The findings from this analysis of response operations between Hurricanes Katrina and Gustav demonstrate that organizations can and do learn, and that resilience does evolve on a regional scale. The more difficult task is continuing to seek and test the balance between resilience and entropy as conditions, personnel, resources, demands, and attention change over time.

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End Notes

¹ Our data may reveal a weakness in validity, since once an organization is in the system and interacting with other organizations, additional interactions may not be reported everyday by the newspaper. Consequently, the correlations observed overtime are likely to be much higher in reality. Yet, assuming that the newspaper accounts are reliable, (e.g. if there is a bias in terms of reporting the continued interactions among organizations over time, it is similar for both response systems, since the data for the content analysis of the Katrina and Gustav systems are taken from *Times Picayune*), then comparison of the response systems for Gustav and Katrina are valid since the data for both analyses are collected from the same source.

Appendix. Organization list with Acronyms

236th Louisiana Air National Guard Combat Communications Squadron	236th ccs	Baton Rouge Visitors and Convention Bureau	brvcb
911 Emergency Call Centers	911	Bechtel National, Inc.	becht
Air Force Academy	afa	BellSouth	bell
Air National Guard: 159th Fighter Wing	159th FW	Best Western Hotels	bwest
Air National Guard: 1st Air Force	1AF	Boasso America Corp.	boas
Alaron Trading Corp.	atc	Boh Bros. Construction Co.	bhobro
Algiers Economic Development Foundation	aedf	Bonnabel High School	bhs
Allstate Insurance	ai	Boomtown Casino	boom
Alvarez & Marsal	a&m	BP, PLC	bp
American Airlines	aa	Broadmoor Construction Inc.	bci
American Broadcasting Corporation	abc	Brookings Institution	brook
American Red Cross	arc	Bureau of Alcohol, Tobacco, Firearms and Explosives	atf
American Red Cross Southwest Service Area Office	arcssao	Carnival Corporation	carn
America's New Orleans Fund, Inc.	anofi	Catch 22 Foundation	cat22
Anadarko Petroleum Corp.	apc	Catholic Charities of the Archdiocese of New Orleans	ccano
Apache Corp.	ac	Catholic Charities USA	ccusa
Aramark	amk	Catholic Life Center	clc
Archdiocese of New Orleans	ano	Centers of Disease Control and Prevention	cdc
Arden Cahill Academy	aca	Ceres Gulf, Inc.	ceres
Area's Levee Board Officials	albo	CH2M Hill	ch2m
Arkansas National Guard	ang	Chalmette Refinery Field Hospital	crfh
Army Corps of Engineers	ace	Chalmette Refining LLC	crllc
Arthur Monday Senior Citizens Center	amscc	Charity Hospital	chahosp
Ascension Baptist Church	abapc	Charter Communications, Inc.	cci
Associated Branch Pilots	abp	Chase Bank	chase
Astor Crowne Plaza	acp	Chateau Sonesta Hotel	csh
AT&T	at&t	ChevronTexaco Corp.	chev
Atonement Lutheran School	als	Children's Hospital	chhosp
Baptist Mercy Hospital	bmh	Cingular Wireless	cing
Barriere Construction Co.	bcc	City of Algiers	calg
Bass Enterprises	bass	City of Baton Rouge, Department of Public Works	cbrdpw

Baton Rouge Metropolitan Airport	brma	City of Baton Rouge, Police Department	cbrpd
Baton Rouge Technology Center	brtc	City of Gretna	cgret
City of Gretna, Police Department	ctretpd	Conference USA	conusa
City of Harahan	chara	Continental Airlines	ca
City of Harahan, Police Department	charapd	County of Harris, Texas	cntyhar
City of Kenner	cken	County of St. Louis, Missouri	cntystlou
City of Kenner, Police Department	ckenpd	Covington Field Hospital	cfh
City of Los Angles Fire Department	clafd	Cox Communications	cox
City of Mandeville	cmand	Delta Airlines	da
City of New Orleans	cno	Democratic Party	demo
City of New Orleans Sewerage & Water Board	cnoswb	Department of Administration, Louisiana	dadminla
City of New Orleans, City Attorney Office	cnwcao	Department of Agriculture and Forestry, Louisiana	dagla
City of New Orleans, City Council	cnocc	Department of Commerce, United States	dcus
City of New Orleans, Department of Health	cnodh	Department of Culture, Recreation and Tourism, Louisiana	dcrtla
City of New Orleans, Finance Department	cnofin	Department of Defense, United States	dod
City of New Orleans, Fire Department	cnofd	Department of Economic Development, Louisiana	dedla
City of New Orleans, Housing Authority	cnoha	Department of Education, Harris County Texas	dedhct
City of New Orleans, Police Department	cnopd	Department of Education, Louisiana	dedla
City of Slidell	cslid	Department of Education, United States	dedus
City of Slidell, Fire Department	cslidfd	Department of Emergency Preparedness, Louisiana	depla
City of Slidell, Office of the Mayor	cslidom	Department of Environmental Quality, Louisiana	deqla
City of Slidell, Police Department	cslidpd	Department of Health and Hospitals, Louisiana	dhhla
City of Slidell, Public Affairs Office	cslidpao	Department of Health and Human Services, United States	dhhsus
City of St. Gabriel	cstgab	Department of Homeland Security, United States	dhsus
City of Vancouver	cvan	Department of Housing and Urban Development, United States	dhudus
City of Westwego	cwest	Department of Insurance, Louisiana	dila
City of Westwego, Police Department	cwestpd	Department of Justice, Louisiana	dila
Civil Air Patrol - Louisiana Wing	cap	Department of Justice, United States	djus
CJ Brown	cibro	Department of Labor, Louisiana	dlla
Clarence M. Kelly & Associates	cmk&a	Department of Natural Resources, Louisiana	dnrla
Cleco Corp.	cleco	Department of Public Safety and Corrections, Louisiana	dpscla
Coalition to Restore Coastal Louisiana	crcla	Department of Social Services, Louisiana	dssla
Coast Waterworks, Inc.	cwi	Department of State. Louisiana	dosla
Coldwell Banker Phelps & McKey Realtors Inc.	coldwel	Department of State. United States	dosus
Columbia Broadcasting Service	cbs	Department of the Treasury, Louisiana	dotrsla
Columbia Sussex Corp.	csc	Department of Transportation and Development, Louisiana	dtdla
Department of Transportation. United States	dotus	Federal Emergency Management Agency, United States	fema
Department of Wildlife and Fisheries, Louisiana	dwfla	Federal Housing Administration	fha
Devon Energy Corp.	devon	Fertility Institute of New Orleans	fino
Dewberry Technologies	dewbry	Florida National Guard	fna
Dillard University	dilu	Fluor Corp.	fluor
Diocese of Baton Rouge	dbr	Foley & Indell	f&i
Disaster Mortuary Operational Response Team	dmort	Freddie Mac	fremac
Division of Administration Louisiana	dala	French Quarter Hotel	fah
Dixie Electric Membership Corporation	demco	Geico	geico
Dixon Correctional Center	dec	General Accountability Office. United States	gaous
DMJM Harris-AECOM	dmim	General Electric	ge
Drug Enforcement Agency, United States	deaus	General Motors	gm
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DRW Investments LLC	drw	George Washington University	fwu
E.J. Morris Senior Center	ejmsc	German Air Force	gar
East Jefferson General Hospital	ejghosp	Gootee Construction Inc.	gote
Ecole Classique School	ecs	Government of Afghanistan	gvafg
Eighth Coast Guard Auxiliary District	ecgad	Government of Bangladesh	gvban
Elayn Hunt Correctional Center	elayn	Government of Canada	gvcan
Eleanor McMain Magnet Secondary School	emmss	Government of Cuba	gvcub
Emergency Management Assistance Compact	emac	Government of Qatar	gvqat
Entergy Corp.	entergy	Government of Saudi Arabia	gvsa
Environmental Protection Agency, United States	epaus	Government of Sri Lanka	gvsl
Episcopal High School	ehs	Government of Thailand	gvthai
Equifax	equi	Government of The Netherlands	gvneth
Ernest N. Morial Convention Center	enmcc	Governor of Louisiana	govla
Experian	esperi	Governor of Mississippi	govmiss
Exxon Mobil Corp.	exxon	Greater New Orleans Expressway Commission	gnoec
Fannie Mae	famae	Gulf Royal Dutch Shell, PLC	shell
Federal Aviation Administration	faa	Harrah's New Orleans Casino	harah
Federal Bureau of Investigations	fbi	Harvy Lincoln Elementary	hle
Federal Communications Commission, United States	fccuss	Henry's Kitchen	hkit
Federal Deposit Insurance Corp.	fdic	Herb Wallace Fire Station	hwfs
Federal Disaster Mortuary Operational Response Team	fdmort	Heritage Foundation	herfnd
Federal Drug Administration, United States	fdaus	Hibernia National Bank	hnb
Hibernia National Bank Operation Center Houston	hnboch	Lamar Dixon Center	lamar
Hibernia National Bank Operation Center Shreveport	hnbocs	Latter & Blum Inc.	1&b
Hilton Hotels	hilton	Legal Council for the Mayor of New Orleans	lcmno
Historic New Orleans Collection	hnoc	Liberty Bank and Trust	lbt
Home Depot	hmdepo	Lift	lift
Homeland Security Division of LOHSEP	hls	Little Sisters of the Poor's Mary Joseph Residence	lspmjr
Houma Courier	hc	LM Ericsson	lme
Houma Terrebonne Civic Center	htcc	Louis Armstrong International Airport	laia
House Tax Writing Committee	htwc	Louis Armstrong International Airport Field Hospital	laiafhosp
Houston Astrodome	astro	Louisiana Air National Guard	laang
Houston Independent School District	hisd	Louisiana Arts and Science Center	lasc
Houston's Toyota Center	htc	Louisiana Associated General Contractors	lagc
Hyatt Hotels	hyatt	Louisiana Banking Association	lba
Illinois Conservation Police	icp	Louisiana Bond Commission	lbc
Independent Schools Associations of the Southwest	isas	Louisiana Democratic Party	ldp
Institute for Regional Forecasting	irf	Louisiana Emergency Operations Center	leoc
International Aid	intaid	Louisiana Gaming Control Board	lgcb
International Business Machines	ibm	Louisiana Governor's Office of Film and TV	lboftv
International Council of Shopping Centers	icsc	Louisiana Heart Hospital	lhh
International Longshoreman's Association	ila	Louisiana High School Athletic Association	lhsaa
Israel Augustine Middle School	iams	Louisiana Hospital Assocation	lha
J&J Maintenance, Inc.	j&j	Louisiana Legislative Black Caucus	llbc
JetBlue Airways	jetblu	Louisiana Legislature	laleg
John Curtis Christian School	jccs	Louisiana National Guard	lang
Joint Legislative Committee on Insurance	ilci	Louisiana Notary Association	lna
Kellogg Brown & Root Services	, kb&r	Louisiana Nursing Home Association	lnha
Kentucky Fried Chicken	kfc	Louisiana Occupational Therapy Association	lota
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Kentucky Utility Crew	kuc	Louisiana Office of Financial Institutions	laofi
Kenyon International Emergency Services	kies	Louisiana Office of Homeland Security and Emergency Prenaredness	lohsep
L.E. Rabouin Career Magnet School	lercms	Louisiana Offshore Oil Port, Inc.	loop
Lafourche Telephone Company	latelco	Louisiana Oil Spill Coordinator's Office	losco
Lake Pontchartrain Hurricane Levee System	lphls	Louisiana River Pilots Association	lrpa
Lakeland Hospital	lakhosp	Louisiana Shrimp Association	lsa
Lakeview Regional Medical Center	lakrmc	Louisiana State Fire Marshal	sfm
Louisiana State Police	lsp	National Association of the Advancement of Colored People	naacp
Louisiana State University	lsu	National Basketball Association	nba
Louisiana State University Board of Supervisors	lsubos	National Bond Lawyers Association	nbla
Louisiana State University Department of Psychiatry	lsudop	National Broadcasting Corporation	nbc
Louisiana State University Health Care Services Division	lsuhcsd	National Center for Missing and Exploited Children	ncmec
Louisiana State University Hurricane Center	lsuhc	National Disaster Medical System	ndms
Louisiana State University Medical Center	lsumc	National Football League	nfl
Louisiana State University Police Department	lsupd	National Guard	natgd
Louisiana State University School of Journalism	lsusj	National Hurricane Center	nhc
Louisiana State University, Manship School for Mass Communications	lsumsmc	National Marine Fisheries Service	nmfs
Louisiana Supreme Court	lsc	National Mortgage Bankers Association	nmba
Louisiana Supreme Court Committee on Bar Admissions	lsccba	National Trust for Historic Preservation	nthp
Lowe's	lowes	National Weather Service	nws
Lt. Governor of Louisiana	ltgovla	Natural Hazards Research and Applications Center at the University of Colorado	nhrac
Lutheran High School	lhs	New Jersey Air National Guard	naangd
LVI Services, Inc	lvi	New Mexico National Guard	nmngd
MaCann Protective Services	macan	New Orleans Chamber of Commerce	nocc
Major League Baseball	mlb	New Orleans Emergency Management System	noems
Mandeville Police Department	mpd	New Orleans Hornets	noh
Marrero Marrero-Estelle Fire Station	marrer	New Orleans Metropolitan Convention and Visitors Bureau	nomcvb
Marriott Hotels	mariot	New Orleans Mission	nom
Mayor of New Orleans	mayno	New Orleans Museum of Art	noma
Memorial Medical Center	mmc	New Orleans Saints	nos
Metairie Park Country Day	mpcd	North Shore Regional Medical Center	nsrmc
Metairie Transit Facility	mtf	North Shore Square Mall	nssm
Michoud Assembly Facility	maf	Northrop Grumman Corp.	ngc
Minerals Management Service, United States	mmsus	Northwest Airlines	na
Moody's	moody	O. Perry Walker High School	opwhs
Motorola, Inc.	motola	Ochsner Foundation Clinic	ofc
Ms. Mae's Bar	mmb	Ochsner Foundation Hospital	ofh
Munters	munt	Office of Community Services, Louisiana	ocsla
Murphy Oil Corp.	murph	Office of Councilwoman Jackie Clarkson	ocjc
National Aeronautical and Space Administration	nasa	Office of Financial Institutions, Louisiana	ofila
National Association of Home Builders Research Council	nahbrc	Office of Former President Bush	ofpb
Office of Former President Clinton	ofpc	Office of US Senator Charles Grassley	
Office of Homeland Security, New Orleans	ohsno	Office of US Senator Hillary Clinton	ouscg
Office of Management and Budget, United States	ombus	Office of US Senator Joseph Lieberman	oushc
Office of Senator David Vitter	osdv	Office of US Senator Max Baucus	ousjl
Office of Senator Harry Reid	oshr	Ohio National Guard	ousmb
Office of Senator Mary Landrieu	osml	Operation Life-Line Depot	ongd
Office of State Representative Arthur Morrel	osram	Oppenheimer & Company	olld

Office of State Representative Cedric Richmond	osrcr	Our Lady of Holy Cross College	0&c
Office of State Representative Joe Salter	osrjs	Our Lady Wisdom Health Care Center	olhcc
Office of State Representative John Alario	osrja	Owner-Operator Independent Driver's Association	olwhcc
Office of State Representative Nita Hutter	osrnh	P&O Ports	ooida
Office of State Representative Peppi Bruneau	osrpb	Papa John's franchise near Rouse's Supermarket	p&o
Office of State Senator Cleo Fields	osscf	Parish of Ascension, School District	papa
Office of State Senator Craig Romero	osscr	Parish of Assumption, Police Department	parascsd
Office of State Senator Don Hines	ossdh	Parish of East Baton Rouge	parasupd
Office of State Senator Edwin Murray	ossem	Parish of East Baton Rouge, Fire Department	parebr
Office of State Senator Mike Michot	ossmm	Parish of East Baton Rouge, School Board	parebrfd
Office of State Senator Robert Barhnam	ossrb	Parish of East Baton Rouge, School District	parebrsb
Office of State Senator Walter Boasso	osswb	Parish of East Feliciana	parebrsd
Office of the Chief of Staff to the Governor of Louisiana	cosla	Parish of Jefferson	paref
Office of the Mayor of Atlanta	omatl	Parish of Jefferson Emergency Management Agency	parjef
Office of the Mayor of Las Vegas	omlv	Parish of Jefferson, Clerk of Courts	parjefema
Office of the Mayor of San Francisco	omsf	Parish of Jefferson, Correctional Center	parjefcoc
Office of the President of the United States	potus	Parish of Jefferson, District Court	parjefcc
Office of the Vice President of the United States	ovpus	Parish of Jefferson, Emergency Medical Services	parjefdc
Office of US Representative Bobby Jindal	ousrbj	Parish of Jefferson, Morgue	jefems
Office of US Representative Charles Rangel	ousrcr	Parish of Jefferson, Office of the Coroner	parjefm
Office of US Representative Charlie Melancon	ousrcm	Parish of Jefferson, Office of the Sheriff	parjefooc
Office of US Representative Dennis Hastert	ousrdh	Parish of Jefferson, School District	parjefos
Office of US Representative Mark Foley	ousrmf	Parish of Lafayette	parjefsd
Office of US Representative Nancy Pelosi	ousrnp	Parish of Lafayette, School District	parlaf
Office of US Representative Peter King	ousrpk	Parish of Lafourche	parlafsd
Office of US Representative Thomas Tancredo	ousrtt	Parish of Orleans	parlafo
Office of US Representative William Jefferson	ousrwj	Parish of Orleans Prison	paror
Parish of Orleans, Civil District Court	parorcdd	Parish of St. Tammany, Public Works Department	parstpwd
Parish of Orleans, Communications District	parorcd	Parish of St. Tammany, School District	parstsd
Parish of Orleans, Levee District	parorld	Parish of Tangipahoa	partan
Parish of Orleans, Office of the Coroner	paroroc	Parish of Terrebonne	parter
Parish of Orleans, Recorder of Mortgages	parorrm	Parish of Washington	parwas
Parish of Orleans, Register of Conveyances	parorrc	Parish of West Baton Rouge	wbr
Parish of Orleans, School District	parorsd	Pete Maravich Center Field Hospital	pmcfh
Parish of Plaquemines	parpla	Pinnacle Entertainment	pinnacl
Parish of Plaquemines Emergency Management Agency	parplaema	Port of Galveston	portg
Parish of Plaquemines, Office of the Sheriff	parplaos	Port of New Orleans	portno
Parish of Plaquemines, School District	parplasd	Professional Golf Association	pga
Parish of St. Bernard	parsb	Public Service Commission, Louisiana	pscla
Parish of St. Bernard Emergency Management Agency	parsbema	Radio Amateur Civil Emergency Service	races
Parish of St. Bernard, Fire Department	parsbfd	Rainbow/PUSH	push
Parish of St. Bernard, Office of the Coroner	parsboc	Reality Executives Integrity First Real Estate	reifre
Parish of St. Bernard, Office of the Sheriff	parsbos	Regional Assistance Center for the County of St. Louis, Missiouri	raccstlm
Parish of St. Bernard, Police Department	parsbpd	Regional Transit Authority	rta
Parish of St. Bernard, Port, Harbor and Terminal District	parsbphtd	Regions Bank	regbnk
Parish of St. Bernard, School District	parsbsd	Ridgewood Preparatory School	rps
Parish of St. Charles	parsc	Risk Management Solutions, Inc.	rms
Parish of St. Charles, School District	parsesd	Royal Sonesta Hotel	rsh

Parish of St. Gabriel, Morgue	parsgm	Salem Lutheran School	sls
Parish of St. James, School District	parsjsd	Salvation Army	salvarm
Parish of St. John the Baptist	parstjo	Sarah T. Reed High School	strhs
Parish of St. John the Baptist, School District	parbsd	Second Harvest Food Bank	shfb
Parish of St. John, School District	parsjosd	Senate Committee on Homeland Security and Government Affairs	schsga
Parish of St. Tammany	parst	Senate Finance Committee	sfc
Parish of St. Tammany Council	parstc	ServiceMaster	sm
Parish of St. Tammany, Assessment Office	parstao	Shelter in Corpus Christi Texas	scct
Parish of St. Tammany, Clerk of Courts	parstee	Sheraton Hotels	sheraton
Parish of St. Tammany, Emergency Operations Center	parsteoc	Slidell Memorial Hospital	smhosp
Parish of St. Tammany, Office of Emergency Preparedness	parstoep	SMG	smg
Parish of St. Tammany, Office of the Sheriff	parstos	Social Security Administration, United States	ssa
Parish of St. Tammany, Police Department	parstpd	South Carolina National Guard	scngd
South Louisiana Electric Cooperative Assocation	sleca	The Spirit of America	soa
Southeastern Motor Freight	smf	The WorkSource	work
Southern Baptist Volunteers	sbv	Tiger Athletic Foundation	tiger
Southern Methodist University	smu	Times-Picayune	tp
Southgate Towers	st	TJC Engineering, Inc.	tjc
Southwest Airlines	swa	Touro Infirmary	touro
Southwinds Motel	swm	Town of Grand Isle	twngi
Sports Authority	sa	Town of Grand Isle Police Department	twngipd
Sprint Wireless	sprint	Town of Jean Lafitte	twjela
St. Charles Parish Hospital	scphosp	TransUnion	transunion
St. Martin's Episcopal School	stmes	Treasure Chest Casino	tcc
St. Rita's Nursing Home	strita	Truman Middle School	tms
St. Tammany Parish Home Builders Association	stphba	Tulane National Primate Research Center	tnprc
St. Tammany Parish Hospital	stparhosp	Tulane University	tu
St. Ville Elementary Library	svel	U.S. Joint Forces Command: Standing Joint Forces Headquarters	sjfhq
St. Vincent de Paul Society	svps	United Airlines	ua
Standard & Poor	s&p	United States Army	usarmy
State Farm Insurance	sfi	United States Army: Logistics Readiness Center	lrc
State of Arkansas	arkansas	United States Coast Guard	uscg
State of Louisiana	LA	United States Congress	uscon
State of Mississippi Emergency Operations Center	misseoc	United States Customs Agency	usca
State of Texas	texas	United States Defense Mapping Agency	usdma
Stella Worley Middle School	swmc	United States Fish & Wildlife Service	usfws
Stennis Space Center	ssc	United States Geological Survey, St. Petersburg Laboratory	usgsspl
Sunshine Garden Health Food Store in Covington	sghfs	United States Marine Corps	usmc
SuperDome	sd	United States Navy	usnav
Superdome Commission	sdcom	United States Post Office	uspost
Sylvanie F. Williams School	sfws	United States Public Health Service	usphs
Tenet Healthcare Corp.	tenet	United States Secret Service	ussec
Terrytown 5th District Volunteer Fire Department	tdvfd	United States Senate	ussen
Texas National Guard	tngd	University of Memphis	um
Texas Workforce Commission	twc	University of Southern Mississippi	usm
The Humane Society	human	Urban League	urban
The Shaw Group, Inc	shaw	Verizon Wireless	verizon

Voluntary Organizations Active in Disaster: Louisina Chapter	voad
W.G. Yates & Sons Construction Co.	wgy&s
Waffle House near Covington	waffle
Wal-Mart	walmrt
Wal-Mart (Tchoupitoulas Street)	walmrtts
Walter P. Moore & Assoc.	wpm&a
WAPT – TV	wapttv
Warren Easton Fundamental High School	wefhs
Washington - St. Tammany Electric Cooperative	wstec
WBRZ – TV	wbrztv
WDSU – TV	wdsutv
West Jefferson General Hospital	wjfhosp
West Jefferson Medical Center	wjmc
Western Union	west
Westwego Alario Center	westweg
WGNO – TV	wgnotv
Whole Foods	whole
William Franz School	wfs
Winn-Dixie's Riverside Market Place	windix
WVUE – TV	wvuetv
WWL – TV	wwltv
Zephyr Field Field Hospital	zephyr