International Charter
Space and Major Disasters

Charter Activation	477
Charter Call ID	549
Disaster Event	Dam collapse and Flooding in Brazil
Disaster Location	Minas Gerais and Espirito Santo States / Brazil
Date of Final Reporting	02/02/2016

PM Report

*Reporting forms completed by: Rafael Pereira Machado, Lucas Mikosz and Marcos Vinicius Borges – CENAD/Brazil

*Reporting forms reviewed by: Ivan Márcio Barbosa

Project Managers for Charter activations are expected to provide the PM report to the Charter Executive Secretariat within 45 days after the start of the activation.

A. Disaster Event Summary	
*A1. Emergency type:	Dam Collapse and Flooding

*A2. Date disaster initiated: 05 November 2015

*A3. Disaster location and extent: Minas Gerais and Espírito Santo (States) – 650 Km.

A4. Estimated number of deaths: 17 deaths, 02 missing bodies and 03 bodies unidentified to date.

A5. Estimated number of people affected: about 1.265 people were left homeless.

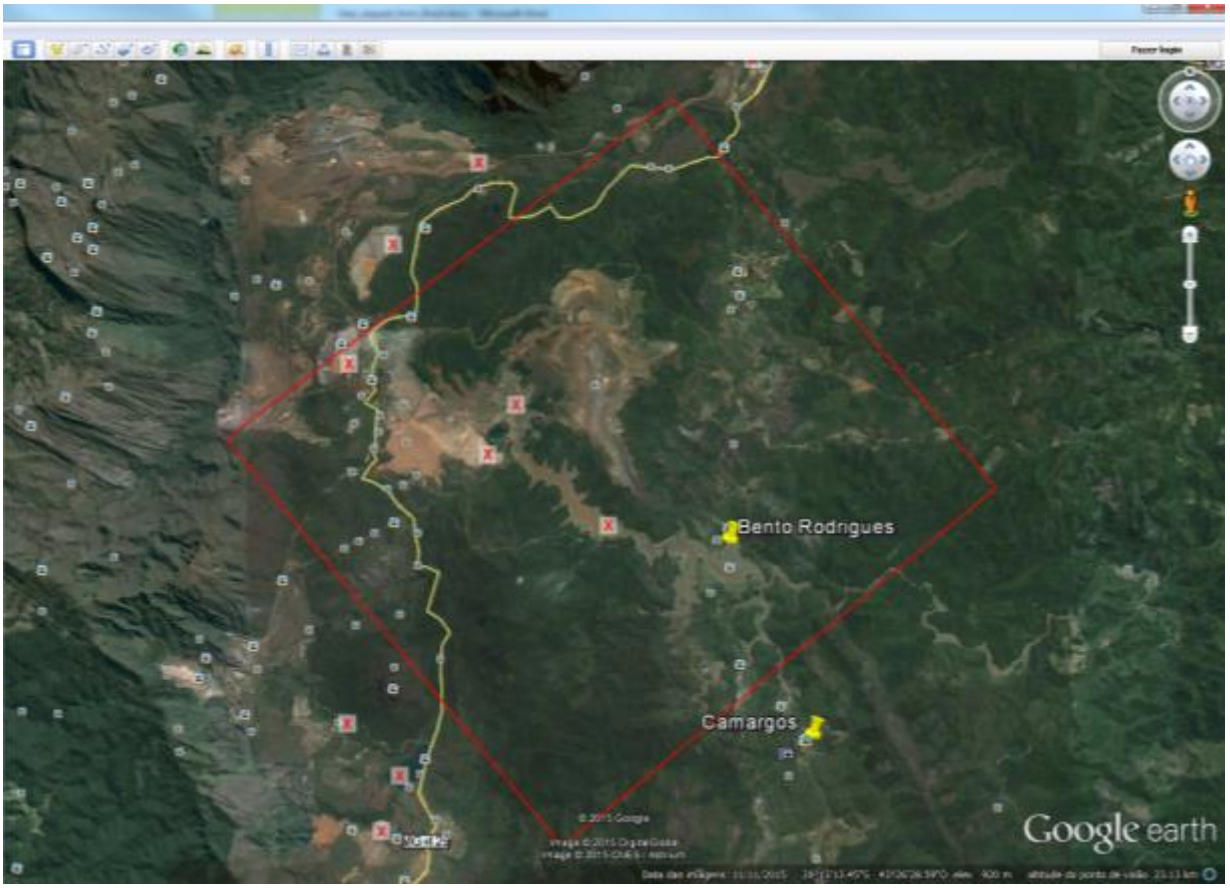
A6. Estimated economic losses:
It is considered the worst environmental disaster in the country (in terms of land mass). The full scale of the damages still unknown and there are studies in progress to measure the impact of this disaster. The economic loses include the inoperability of mining companies but also include thousands of fishermen and farmers living on the banks of the Rio Doce and cities that rely on water supply from Doce River.

A7. Additional disaster impacts (environmental, infrastructure, etc):
1 – Fundão dam, Mining Samarco, whose owners are Vale and BHP Billiton, collapsed at 16h20 from November 5th, 2015;
3 – About 35 million cubic meters of tailings extravasated of Fundão Dam;
4 – Environmental impacts are incalculable and possibly some irreversible;
5 – 1500 hectares of vegetation were destroyed by the mud between Mariana and Linhares.
6 – 1249 fishermen were hampered due to the high turbidity of the water;
7 – Places directly affected by tailings mud: Bento Rodrigues, Camargos, Paracatu de Cima, Paracatu de Baixo, Pedras, Bicas, Campinas, Borba, Gesteira and Barra Longa;
8 – In addition to numerous municipalities affected by water rationing (high turbidity) over Gualaxo do Norte, Do Carmo and Doce rivers:
8.1 – MINAS GERAIS STATE: Mariana; Barra Longa; Rio Doce; Santa Cruz do Escalvado; São José do Goiabal; Pingo D'Água; Ipatinga; Ipaba; Naque; Periquito; Alpercata; Governador Valadares; Tumiritinga; Galileia; Conselheiro Pena; Resplendor; Itueta and Aimorés;
8.2 – ESPIRITO SANTO STATE: Baixo Guandu; Colatina and Linhares;
9 – Tailings mud took 40 minutes to travel 10 km to Bento Rodrigues District (Mariana City);
10 – Bento Rodrigues and Paracatu de Baixo Districts (Mariana City) were practically decimated and covered by tailings mud of Fundão Dam;
11– In Bento Rodrigues District - Only 17,8% of the buildings were not affected by mud and 650 people were affected (Of the 252 buildings, 207 are in the affected area);
12 – Water rationing in some municipalities of Minas Gerais and Espírito Santo over Gualaxo do Norte, Do Carmo and Doce rivers;
13 – The dried tailing mud prevent the development of plant species;
14 – The mud traveled 650 km over the Gualaxo do Norte, Do Carmo and Doce rivers;
15 – Massive death of fishes and aquatic species: 11 tons of dead fish (08 in the Minas Gerais and 03 in the Espírito Santo);
16 – The mud reached the Atlantic Ocean on November 22Th, 2015;
17 – The mud spread over 9 km in the coast of Espírito Santo State;
18 – The affected area is part of the Comboios Biological Reserve in the Atlantic Ocean, a coastal protected area used for nesting sea turtles, including the critically endangered leatherback sea turtle;
19 – Researchers warned that mud, whether toxic, will profoundly affect river ecosystems, terrestrial and oceanic of Doce River Basin.

A8. Additional disaster event details:
The Dam Fundão operated by the Mining Company Samarco collapsed up on November 5Th, 2015 at about 16:20, pouring 35 cubic meters millions of iron ore tailings. The tailing mud traveled 650 km passing through 03 rivers (Gualaxo do Norte, Do Carmo and Doce). About 10 villages were directly affected by the tailing mud and indirectly affected 22 municipalities in the Minas Gerais and Espirito Santo states. The disaster caused significant numbers to date: 17 dead; 02 missing; 03 unidentified bodies; 80% of Bento Rodrigues was destroyed completely; 1,265 people affected; 1500 hectares of destroyed vegetation; 1249 adversely affected fishermen; 11 tons of dead fish; 80 km^2 affected area of the Atlantic Ocean; among others. Anyway, it is a technological disaster with incalculable social and environmental consequences, and many irreparable. Perhaps the biggest disaster already occurred in the country.

* mandatory

B. Activation Information Charter Call ID549			
*B1. Date of Charter activation 06 November 2015			
*B2. Geographical Coordinates (Lat - Long)			
Bounding Box:	Upper left corner: S 20° 12' , W 43° 31'	Centre Point(s):	(1): S 20° 13' , W 43° 27' , radius: 8
	Upper right corner: S 20° 12' , W 43° 21'		(2):
	Lower left corner: S 20° 13' , W 43° 31'		(3):
	Lower right corner: S 20° 13' , W 43° 21'		



*B3. Authorized User/Requestor: Rafael Machado	*Organization: BRAZILIAN DISASTER AND RISK MANAGEMENT - CENAD	*Date AU contacted ODO: 6 November 2015
*B4. ECO: ECO_CNSA ECO_CNSA	*Organization: CNSA	*Date ECO contacted PM: 06 Nov 2015
*B5. Project Manager: Rafael Machado	*Organization: BRAZILIAN DISASTER AND RISK MANAGEMENT NATIONAL CENTRE - CENAD	*Date PM nominated: 06 Nov 2015
B6. Value-adding Reseller or organization(s): CENAD		Date VAR received first images (dd/mm/yyyy): 09/11/2015
*B7. End User(s): Brazil	*Organization: CENAD	Date first product delivered to End User (dd/mm/yyyy): 13/11/2015

* mandatory

C. Intervention Summary

*C1. Describe the activation in detail and describe the interaction between the PM and the AU:

CENAD was the PM and AU for the present Call.

*C2. Provide a chronology of events associated with the disaster and the Charter activation:

Call 549:

AU call submission on 06 Nov 2015 00:06:23

ECO URF validation on 06 Nov 2015 00:47:03

ERF v.1.0 sent to MPP of CNES on 06 Nov 2015 02:26:50

ERF v.1.0 sent to MPP of ISRO on 06 Nov 2015 02:27:23

ERF v.1.0 sent to MPP of KARI on 06 Nov 2015 02:27:50

ERF v.1.0 sent to MPP of ROSCOSMOS on 06 Nov 2015 02:28:15

ERF v.1.0 sent to MPP of USGS on 06 Nov 2015 02:30:52

ERF v.1.0 sent to MPP of CNSA on 06 Nov 2015 02:32:00

AAP received from MPP of KARI on 06 Nov 2015 03:26:08

AAP received from MPP of ROSCOSMOS on 06 Nov 2015 06:02:36

PM nominated on 06 Nov 2015 12:17:04

Data Product received from MPP of ROSCOSMOS on 08 Nov 2015 16:48:24

Data Product received from MPP of KARI on 13 Nov 2015 06:06:51

*C3. Fill in the table below identifying the available satellite data with an [X]. List the date (mm/dd/yyyy) that each image was collected).

Agency	Satellite Instrument Mode	Sensing dates of requested products	Date of:	Sensing / Reception dates of metadata / products			
				Attempt 1	Attempt 2	Attempt 3	Archive
CNES	Pleiades	10/11/2015	Reception	11/11/2015			
			Sensing	10/11/2015			
CNES	Pleiades	11/11/2015	Reception	12/11/2015			
			Sensing	11/11/2015			
CNES	Pleiades	12/11/2015	Reception	12/11/2015			
			Sensing	12/11/2015			
USGS	WordView 2	21/07/2015	Reception	09/11/2015			
			Sensing	21/07/2015			
USGS	WordView 2	07/11/2015	Reception	09/11/2015			
			Sensing	07/11/2015			
USGS	Aster	11/11/2015	Reception	12/11/2015			
			Sensing	11/11/2015			
USGS	WordView	12/11/2015	Reception	12/11/2015			

	2		Sensing	12/11/2015			
USGS	WordView 3	12/11/2015	Reception	18/11/2015			
			Sensing	12/11/2015			
USGS	Landsat-8	12/11/2015	Reception	24/11/2015			
			Sensing	12/11/2015			
USGS	Landsat-8	19/11/2015	Reception	24/11/2015			
			Sensing	19/11/2015			
NRSC ISRO	RISAT-1 MRS	08/11/2015	Reception	09/11/2015			
			Sensing	08/11/2015			
NRSC ISRO	Resourcesat-2 Fmx	10/11/2015	Reception	12/11/2015			
			Sensing	10/11/2015			
ROSCOS MOS	Resurs-P	10/11/2015	Reception	11/11/2015			
			Sensing	10/11/2015			
ROSCOS MOS	Resurs-P Geoton	11/11/2015	Reception	11/11/2015			
			Sensing	11/11/2015			
ROSCOS MOS	Resurs-P	13/11/2015	Reception	14/11/2015			
			Sensing	13/11/2015			
KARI	KOMPSAT-2 MSC	11/11/2015	Reception	23/12/2015			
			Sensing	11/11/2015			
KARI	KOMPSAT-2 MSC PMS	08/11/2015	Reception				
			Sensing	08/11/2015			
KARI	KOMPSAT-3 AEISS PMS	08/11/2015	Reception				
			Sensing	08/11/2015			
ROSCOS MOS	Kanopus-V MSS/PSS	08/11/2015	Reception				
			Sensing	08/11/2015	09/11/2015	13/11/2015	14/11/2015
ROSCOS MOS	Resurs-P Geoton-L1	06/11/2015	Reception			23/12/2015	
			Sensing	06/11/2015	07/11/2015	08/11/2015	
ROSCOS MOS	Resurs-P Geoton-L1	12/11/2015	Reception		23/12/2015		
			Sensing	12/11/2015	13/11/2015		
ROSCOS MOS	Resurs-P Geoton-L1	14/11/2015	Reception				
			Sensing	14/11/2015	16/11/2015	17/11/2015	
ROSCOS MOS	Resurs-P Geoton-L1	14/11/2015	Reception	14/11/2015			
			Sensing	14/11/2015			

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D. Intervention Assessment
D1. Explain how the value-adding service provider was chosen: On the present Call, CENAD used its own Monitoring Division to generate value added products. No external service provider was required.
*D2. List the value-added products obtained from the Charter data:

1. AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BENTO RODRIGUES DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 11/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
2. AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - PARACATU DE BAIXO DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 12/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
3. AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BARRA LONGA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 10/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
4. COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BARRA LONGA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 10/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
5. COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - PARACATU DE BAIXO DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 12/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
6. COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BENTO RODRIGUES DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: Pleiades – Acquired: 11/11/2015 – Copyright: CNES 2015 - Distribution: Airbus Defence and Space, all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center);
7. AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY – MARIANA CITY (DISTRICTS: BENTO RODRIGUES, CAMARGOS AND PARACATU DE BAIXO) AND BARRA LONGA CITY (DISTRICT: GESTEIRA), MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015 – Source: USGS – LANDSAT 8 – Acquired: 11/12/2015 – Copyright: USGS 2015 - Distribution: USGS 2015 (USA), all rights reserved Map produced by CENAD (Brazilian National Risk and Disaster Management Center).

*D3. Comment on the quality of the value-added products:

The value added products were generated based on the requests areas informed by own CENAD. The overall quality of the products was good and CENAD is constantly improving its techniques for a better utilization of the data provided by Charter.

D4. Identify the end users of the value-added products and how they used the products during the various phases of the disaster cycle. If the value-added products were used to illustrate the impact or extent of the disaster during briefing meetings, include this information:

The users of the products generated by CENAD were: Mining Company Samarco, Civil Defense of Mariana City (Minas Gerais State), Civil Defense of Barra Longa City (Minas Gerais State), Civil Defense of Minas Gerais State, Defense Ministry, CPRM (Research of Resources Minerals Company), IBAMA (Brazilian Environment and Renewable Natural Resources Institute) and the own CENAD. The data were used to understand the causes of the dam collapsing, the size of the area affected by the tailings mud, the affected communities and the environmental impact.

*D5. Comment on how useful the value-added products were in practice for the end user. Include any other relevant information about how the Charter assisted the end user in mitigating the effects of the disaster:

End users of value-added products were: Mining Company Samarco, Municipal Civil Defense of Mariana and Barra Longa, Civil Defense of Minas Gerais State, Defence Ministry, CPRM, IBAMA and CENAD.
After the disaster and delivery of final products, the Cenad did not receive any feedback from these end users so far: Mining Company Samarco, Civil Defense of Minas Gerais State, Defense Ministry, CPRM and IBAMA.
The CENAD along with Municipal Civil Defense of Mariana and Barra Longa, the end products used for the preparation of ***MUNICIPAL CONTINGENCIES PLANS*** based on PAE (Emergency Action Plan of Samarco).

*D6. Identify data provided by the Charter that was not used. If possible, explain why it was not used:

Most of the images that were not used was because of low resolution, low contrast and / or cloud cover. Much of the disaster occurs on a narrow valley, so it was only possible to identify the affected areas using images with pixels smaller than 10 meters.

D7. Based on use of the data provided by the Charter, provide recommendations to improve the scenarios for Charter activations of this type in the future:

Centering the activities on the COS-2 ambient would be positive, as the hardest part on the PM task is to deal with different servers, FTPs and download methods, with high volume and sensitive information.

D8. Summarize the conclusions of the project. Discuss any relevant issues associated with the use of the value-added products in the emergency response; the functional units of the Charter; the ability of the PM, value-added service provider and end users to work within the Charter structure; and/or, any other issues encountered during the activation:

The use of images provided by space agencies with the activation of the International Charter Disaster is of fundamental importance to the PM, development of products and end user.
Products generated by the PM allow specialists to better understand the disaster occurred: the affected area, the affected population, isolated areas, escape routes, the rescue points, the causes and consequences of the disaster, among others.
The images provided by the Charter are the initial basis of all the work for emergency operations.

D9. Additional comments, questions, observations, and lessons learned:

It was the first time the CENAD acted in an environmental disaster of this magnitude. Perhaps the greatest environmental disaster in Brazil and perhaps the world.
650 km of rivers were affected by tailings mud, thousands of dead fish and uprooted trees, countless people affected and decimated entire towns.
Some new procedures were developed and implemented in this call.
Certainly, it was a great learning experience for all of us. So much for the PM and for end users of the products.

D10. Provide a copy of user feedback forms submitted by the end users or email correspondence regarding the end use(s).

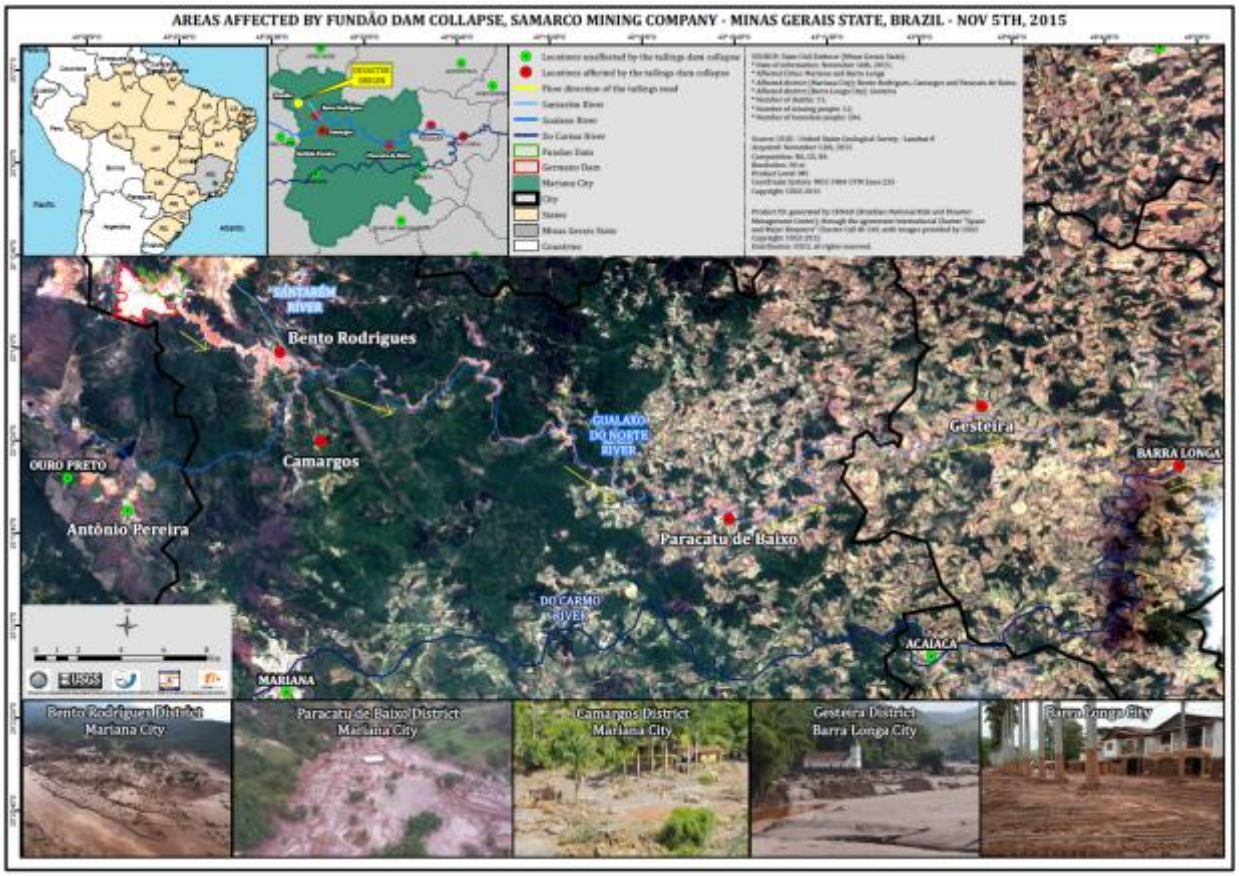
The CENAD's own PM and also the end user of the products.

Through the products we identified the affected areas and its extension, better understanding of dam break causes, the locations hit by tailings mud, among others. These maps also provide products to other end users who extracted important information for the development of the work of each body responsible about the dam break.

Certainly, it was a great learning experience for all of us. So much for the PM and for end users of the products.

E. Supporting Documentation

*E1. Insert a map of the affected area and extent of the disaster impact:



*E2. Provide samples of media coverage of the disaster event from TV, radio, news papers, websites, etc. Where possible, copy the content of the article into the PM report rather than only the web addresses:

1ª SOURCE

O que se sabe sobre o rompimento das barragens em Mariana (MG)

Bento Rodrigues foi tomado pela lama que saiu das barragens e ficou devastado

Algumas perguntas sobre o **acidente com duas barragens em Mariana**, no interior de **Minas Gerais**, permanecem **sem resposta**. Mas outras questões já estão claras. Veja o que se sabe até o mo-

mento sobre a tragédia:

1 - Onde ficam e quais são as barragens que se romperam?

A barragem que rompeu foi a do Fundão, que acabou danificando a barragem de Santarém, ambas ficam no subdistrito de Bento Rodrigues, a 35 km do centro do município de Mariana, cidade histórica mineira a 124 km de distância de Belo Horizonte**.**

Arte/UOL

2 - A quem pertencem as barragens?

À mineradora Samarco, empresa fundada em 1977 que produz pequenas bolas de minério de ferro usadas na produção de aço. A Samarco é controlada pela Vale e pela anglo-australiana BHP Billiton. Ela opera em Minas Gerais e no Espírito Santo e é a 10ª maior exportadora do país. Após a tragédia, a empresa suspendeu as atividades de mineração na região. O governo de Minas embargou o licenciamento de funcionamento da empresa, que não pode extrair minério até o cumprimento de exigências de segurança**.**

3 - O que as barragens continham?

Lama resultante do rejeito da produção de minério de ferro. De acordo com a Samarco, o rejeito é composto, em sua maior parte, por areia e não apresenta nenhum elemento químico danoso à saúde. Segundo o Ibama (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis), a lama é composta principalmente por óxido de ferro e areia. A Vale também despejou rejeitos de outra mina, a Alegria, na região**.**

A equipe técnica do Ministério Público **coletou amostras da lama** da barragem para verificar se ela é tóxica ou não. O parecer sobre a tragédia deve ficar pronto no começo de dezembro.

4 - Quando as barragens se romperam?

Na tarde do dia 5, uma quinta-feira, por volta de 15h30. A barragem do Fundão, que é maior, se rompeu e transbordou para a de Santarém, na mesma região**.**

5 - Qual o volume de lama que vazou?

De acordo com o Ibama, o volume extravasado foi estimado em 50 milhões de metros cúbicos, quantidade que encheria 20 mil piscinas olímpicas**.**

6 - O que aconteceu com o subdistrito de Bento Rodrigues, em Mariana?

Foi tomado pela lama que saiu das barragens e ficou devastado. A avalanche destruiu a maioria dos imóveis. Mais de 600 pessoas ficaram desabrigadas e foram resgatadas pelo Corpo de Bombeiros. Eles abandonaram as casas e fugiram para partes altas do distrito, mas afirmaram que nenhum sinal de alerta foi emitido**.** A Samarco admitiu que avisou moradores somente por telefone. Ainda assim na lista havia apenas telefones públicos, nenhum de morador, e muitos desatualizados. O governo federal liberou o saque do FGTS aos atingidos pelo desastre.

7 - Outras localidades foram afetadas?

Sim. Seis localidades de Mariana, além de Bento Rodrigues, foram atingidas. O detrito das barragens tomou conta, por exemplo, do rio Gualaxo e chegou ao município de Barra Longa, a 60 km de Mariana e a 215 km de Belo Horizonte.
Como a lama também chegou ao rio Doce, o abastecimento de água foi interrompido em municípios mineiros como Governador Valadares e em municípios do Espírito Santo.

8 - Quantas pessoas morreram e quantas estão desaparecidas?

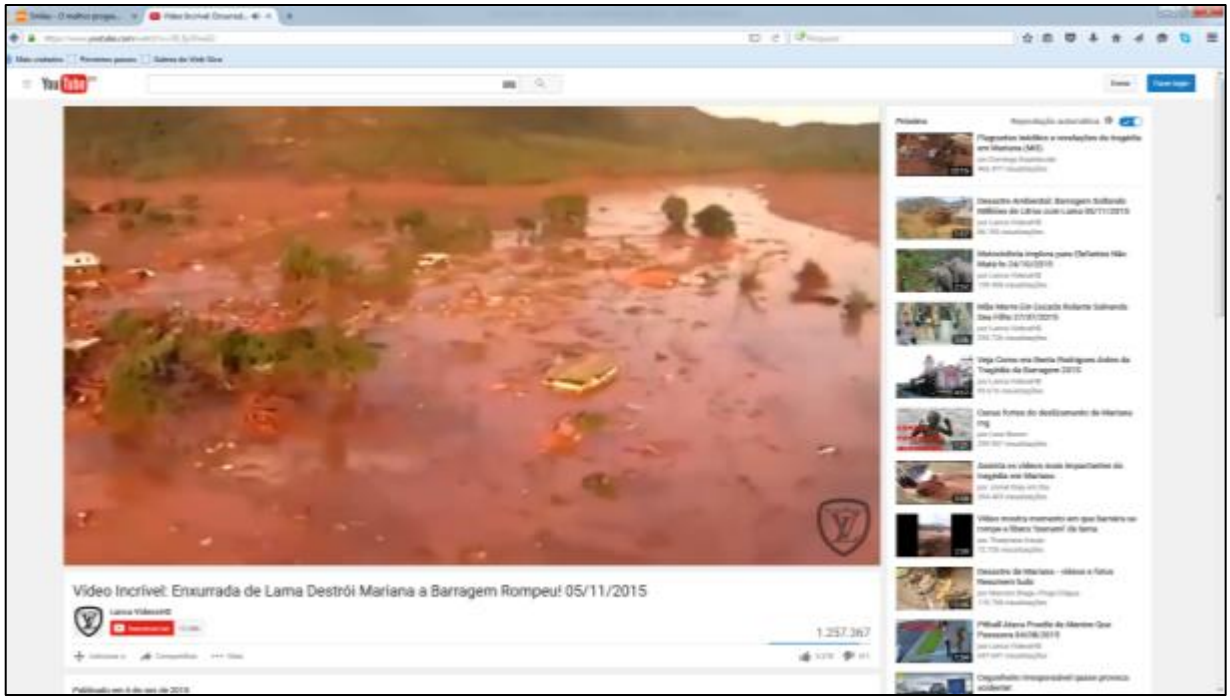
Até o momento, 16 corpos foram identificados. As vítimas confirmadas são Emanuele Vitória Fernandes e Tiago Damasceno Santos, crianças moradoras do subdistrito de Bento Rodrigues, e os trabalhadores Cláudio Fiúza, Sileno Narkevicius de Lima, Mateus Márcio Fernandes, Waldemir Aparecido Leandro, Marcos Roberto Xavier, Marcos Aurélio Moura, Samuel Vieira Albino, Ednaldo Oliveira de Assis, Daniel Altamiro de Carvalho, Claudemir Elias dos Santos, Pedro Paulino Lopes, Maria Elisa Lucas, Maria das Graças Celestino Silva e Antônio Prisco de Souza.

Há três corpos ainda não identificados, e são três os desaparecidos. Bombeiros estão fazendo varreduras nas áreas atingidas, com o apoio de cães farejadores.

http://noticias.uol.com.br/cotidiano/ultimas-noticias/2015/11/06/o-que-se-sabe-sobre-o-rompimento-das-barragens-em-mariana-mg.htm
11/12/2015

2ª SOURCE

Video on YouTube shows various disaster movies.



https://www.youtube.com/watch?v=XD_8y3VweZc
06/11/2015

3ª SOURCE

BHP-owned mine dam bursts in Brazil, killing 17 people and devastating nearby town

Video: Brazilian mining dam floods neighbouring towns in mud (ABC News)

A dam holding back waste water from an iron ore mine in Brazil that is co-owned by BHP Billiton has burst, unleashing a deluge of thick, red toxic mud that has smothered a village and killed at least

17 people, an official says.

More than 50 more were injured in the disaster in Brazil's south-eastern Minas Gerais state, said Adao Severino Jr, fire chief in the city of Mariana.

The number of missing is set to surpass 40, Mr Severino said, but the toll was not yet official.

The G1 news service of the Globo Media group reported that between 15 and 16 people died and 45 others were missing, citing the local union.

Civil defence authorities could not confirm casualties and said numbers reported in Brazilian media were speculative.

At a media conference in Melbourne, BHP Billiton's CEO Andrew Mackenzie said it had yet to fully assess the extent of damage and casualties from the massive mudslide.

"Most of what happened there has been under the cloak of darkness," Mr Mackenzie said.

"At daybreak, clearly we will do an awful lot more and give you further updates.

"We have of course offered our full and complete assistance to the Samarco team and to the local authorities, in the first instance to manage the immediate rescue efforts, and then of course to help with the very important cleanup and afterwards the investigation."

The head of emergency planning at Samarco, a 50-50 joint venture between top iron ore miners Brazil's Vale and Australia's BHP, told GloboNews of reports of seismic activity in the area in the hour leading up to the incident.

The company's press representatives could not confirm the reports.

Civil defence authorities in Mariana said it was evacuating about 600 people to higher ground from the village of Bento Rodrigues, where television footage showed dozens of homes destroyed by the mudslide.

The footage showed a car rested on top of a wall where the roof of a building had been ripped off.

Bento Rodrigues has a population of about 600, most of whom work for the mining company.

"The situation is grim. It is dark. There is a lot of mud," Mr Severino said. "There is no way to survive under that material."

Some homes seemed to have been swept hundreds of metres by the rushing wall of mud.

Rescue crews continued to search the muddy waters after nightfall.

Mariana mayor Duarte Junior said teams are having trouble reaching the site.

"The closest we could get was more or less 500 meters. We cannot get closer because of the mud," he said. "We do not really know what happened."

Brazilian army units nearby stood ready to help the search and rescue effort and the minister of national integration, Gilberto Occhi, planned to visit the state on Friday to provide assistance, accord-

ing to a note from the presidency.

They said the flood had also reached another village further down the hill, called Paracatu de Baixo, and that inhabitants there were being evacuated.

The dam was holding tailings, a mining waste product of metal filings, water and occasionally chemicals. It was located near the Gualaxo do Norte river, adding to fears of potential water contamination.

Samarco produces about 30 million tonnes per year of iron ore, just under 10 per cent of Brazil's output. Iron ore is transported down a slurry pipe from Germano to Espirito Santo, where it is turned into pellets.

http://www.abc.net.au/news/2015-11-06/bhp-owned-mine-dam-bursts-in-brazil-devastating-nearby-town/6919074

Updated 6 Nov 2015, 12:41pm

*E3. Insert a copy of the URF here:

User Request Form
(Affected area information)

To be filled by ODO
Call ID 549

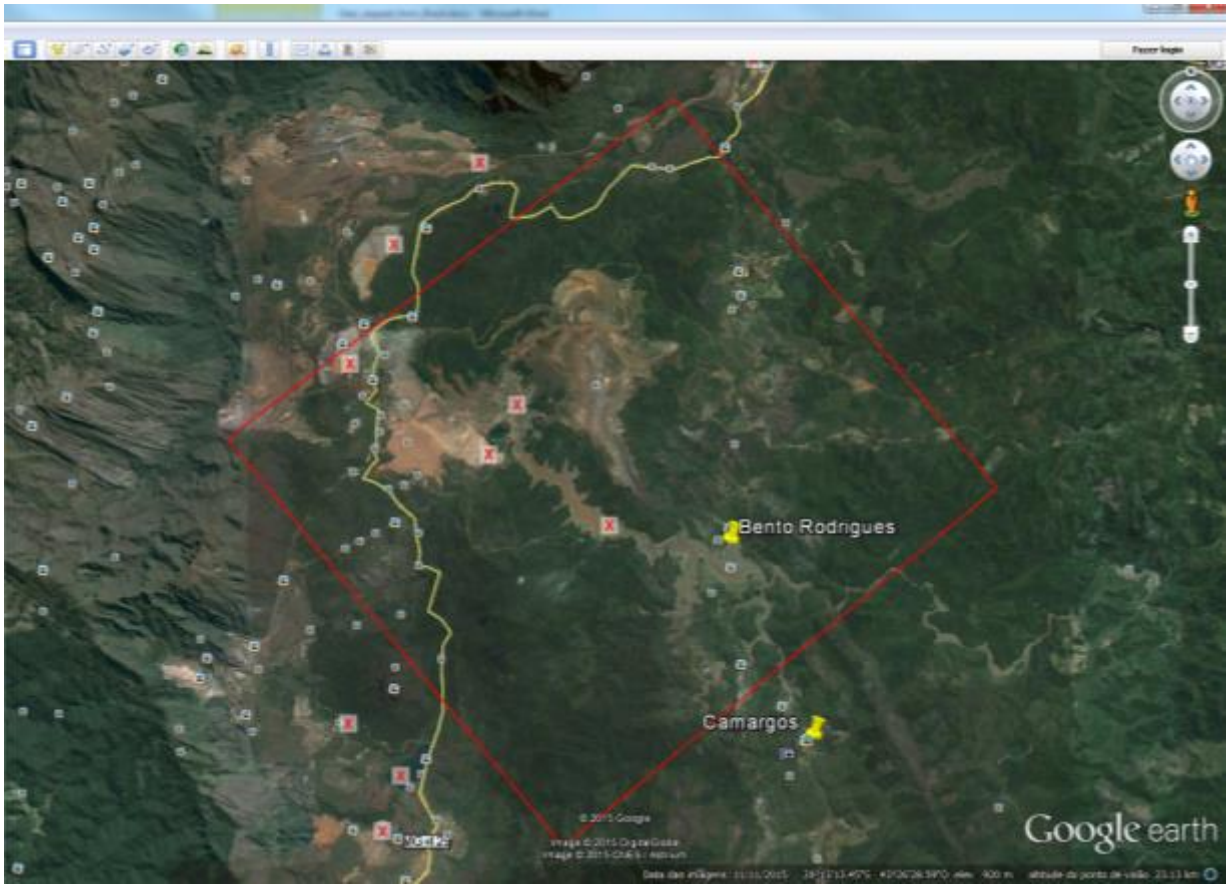
1. Date and time of the call	**DAY 5 MONTH (Spell) November YEAR 2015** **TIME 19:00h LOCAL TIME ZONE BRT UTC TIME-3h**
2. Name of the organization and caller (to be used for call back) Phone Fax Cellular phone E-mail	BRAZILIAN DISASTER AND RISK MANAGEMENT NATIONAL CENTRE - CENAD +55 61 2034-4620 +55 61 2034-4600 Ext. +55 61 9232-0363 Ext. rafael.machado@integracao.gov.br rafaelmachado.mi@gmail.com;marcos.borges@integracao.g

3. Type of disaster

☐ earthquake	☐ ice	☐ ocean wave (tsunami)
☐ fire	☐ landslide	☐ oil spill
☐ flood	☐ ocean storm (hurricane, cyclone, typhoon)	☐ volcano

☒ other (e.g. wind storm, tornado, industrial accident...) specify: Tailing Dam Failure

4. Geographical location	**5. Geographical Coordinates in Degrees, minutes, seconds**	
Region/Country name, approximate geographical location and surface extent. Region/country name: Southwest BRAZIL/ State of Minas Gerais-MG Location From Mariana/MG To Mariana/MG Extent (km2) 144	a) Center Point(s) in priority order 1. Lat 20° 13' 17" S Long 43° 27' 1" W 2. Lat ° ' " S Long ° ' " W 3. Lat ° ' " S Long ° ' " W Please include any additional information on a separate page.	b) Upper left Lat 20° 12' 51" S Long 43° 31' 3" W  Lower right Lat 20° 13' 24" S Long 43° 21' 50" W



6. Approximate date/time of occurrence or predicted occurrence	november 05th, 2015', 6:00 pm.
7. Additional information on the disaster	Tailing dam failure, occurred at Bento Rodrigues District, close to Mariana city at Minas Gerais state - Southwest region of Brazil. The dam failure caused a major displacement of mining waste over workers and also over parts of Bento Rodrigues district. Brazilian press informs that up to now there are at least 15 deaths and 45 missing people.
8. Additional instructions (shipping instructions)	Due to the extention and the type of the disaster, high resolution optical image from the area is needed.
To be filled by ODO	**Authorized User** ☒ **Other** ☐

Authorized User/Cooperating Body: Fill the form as indicated above and fax it to +39-06-94-180 202. A completed form may additionally be sent as a backup via email to: charterops@disasterscharter.org.

*E4. Provide a copy of the Emergency Data Request Submission forms for the various satellites:

DOSSIER

Date 5 November 2015	Call ID: 549

ECO on-duty

Name	ECO_CNSA ECO_CNSA
Agency	
Phone	+86 10 58937092
Fax	
Mail	chartereco@163.com

AU

Organization	BRAZILIAN DISASTER AND RISK MANAGEMENT NATIONAL CENTRE - CENAD
Name	Rafael Machado
Phone	+55 61 2034-4620
Fax	+55 61 2034-4600
Mail	rafael.machado@integracao.gov.br

EU

Organization	BRAZILIAN DISASTER AND RISK MANAGEMENT NATIONAL CENTRE - CENAD
Name	Rafael Machado
Phone	+55 61 2034-4620
Fax	+55 61 2034-4600
Mail	rafael.machado@integracao.gov.br

Emergency type

☐ earthquake	☐ ice	☐ ocean wave (tsunami)
☐ fire	☐ landslide	☐ oil spill
☐ flood	☐ ocean storm (hurricane, cyclone, typhoon	☐ volcano

Other: Tailing Dam Failure

Area Details

Geographical location	Geographical Coordinates in Degrees, minutes, seconds	
Region / Country name, approximate geographical location and surface extent Region/Country name: State of Minas Gerais-MG / BRAZIL Location From To Extent (km2)	a) Center Point(s) in priority order Lat: 20° 13' 17" S Long: 43° 27' 1" W Radius 8	b) Upper left Lat: 20° 12' 51" S Long: 43° 31' 3" W  Lower right Lat: 20° 13' 24" S Long: 43° 21' 50" W

Information and preferences provided by Requester:

Due to the extention and the type of the disaster, high resolution optical image from the area is needed.

General Information on the event

Emergency Request Forms		
Agency	ERF File Name	Date of Sending
CNES	CNES-549-ERF.doc	06 November 2015 02:26:50
ISRO	ISRO-549-ERF.doc	06 November 2015 02:27:23
KARI	KARI-549-ERF.doc	06 November 2015 02:27:50
ROSCOSMOS	ROSCOSMOS-549-ERF.doc	06 November 2015 02:28:15
USGS	USGS-549-ERF.doc	06 November 2015 02:30:52
CNSA	CNSA-549-ERF.doc	06 November 2015 02:32:00

Acquisition & Archive Plan			
Agency	Satellite / Instrument / Mode	Date	Program / Archive
KARI	KOMPSAT2 / MSC / PMS	08 November 2015	Program
KARI	KOMPSAT3 / AEISS / PMS	08 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	06 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	12 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	13 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	07 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	08 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	14 November 2015	Program
ROSCOSMOS	KANOPUS_V / MSS_PSS /	08 November 2015	Program

Acquisition & Archive Plan			
Agency	Satellite / Instrument / Mode	Date	Program / Archive
ROSCOSMOS	KANOPUS_V / MSS_PSS /	09 November 2015	Program
ROSCOSMOS	KANOPUS_V / MSS_PSS /	13 November 2015	Program
ROSCOSMOS	KANOPUS_V / MSS_PSS /	14 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	16 November 2015	Program
ROSCOSMOS	RESURS_P / GEOTON_L1 /	17 November 2015	Program

E5. Provide a copy of any user feedback forms submitted by the end users or email correspondence regarding the end use(s).

The CENAD's own end user. The same received images; products developed through images; understood the disaster regarding the causes and consequences; supported in the preparation of contingency plans in the municipalities of Mariana and Barra Longa in the Minas Gerais State. The products also subsidized environmental agencies involved in disaster.

User Feedback Form

Indicate your choice with an "_X_". (VG: Very Good, G: Good, R: Regular, B: Bad)

1. Did you encounter difficulties in triggering the Charter?	Yes __	No X
Comments:		

2. How was the communication with the Charter officers?	VG X	G __	R __	B __
Comments:				

3. Did the delivered data fulfill your request?	Yes X	Partly __	No __
Comments:			

4. Were the data delivered in due time?	Yes X	No __
If not, what was your expectation? Comments:		

5. Were data delivered in an appropriate way?	Yes X	No __
Comments:		

6. Were data presented in an appropriate format?	Yes X	No __
Comments:		

7. Was the information content relevant and accurate?	Yes X	No __
Comments:		

8. How was the overall quality of the products delivered?	VG X	G __	R __	B __
Comments:				

9. Did you use the data for:			
Operations _X_	Communication _X_	Planning _X_	Documentation _X_
Lessons Learned _X_	Other __	Nothing __	

Comments:

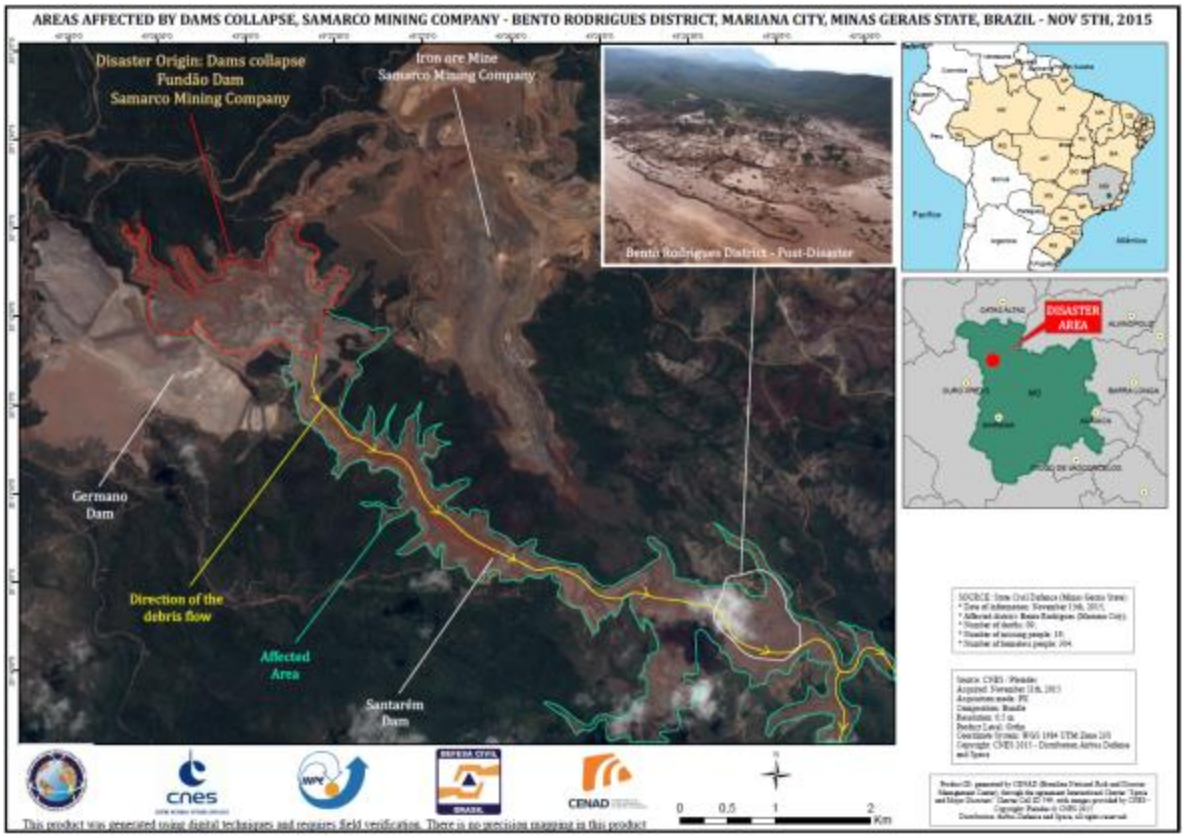
1. The data were used to understand the causes of the dam collapsing, the size of the area affected by the tailings mud, the affected communities and the environmental impact;
2. The CENAD along with Municipal Civil Defense of Mariana and Barra Longa, the end products used for the preparation of ***MUNICIPAL CONTINGENCIES PLANS*** based on PAE (Emergency Action Plan of Samarco).

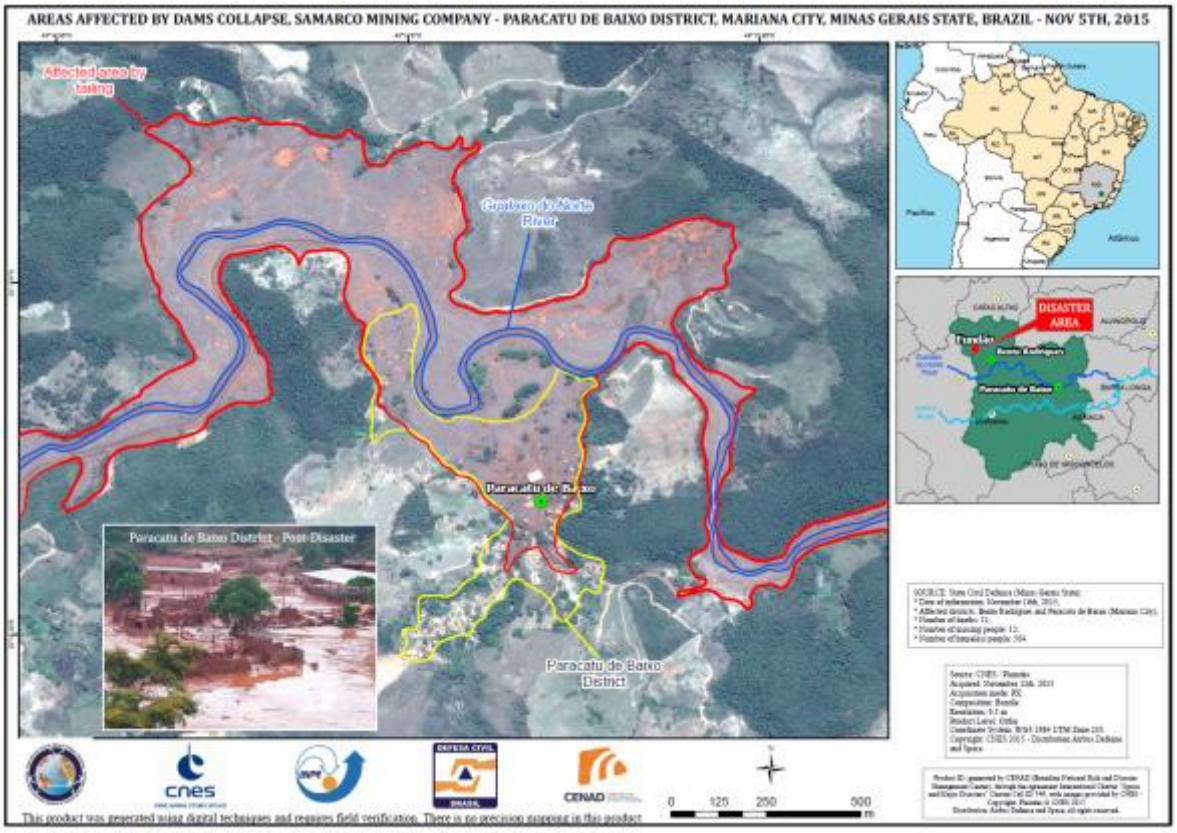
10. Overall, the Charter contribution to this emergency was:	VG X	G __	R __	B __

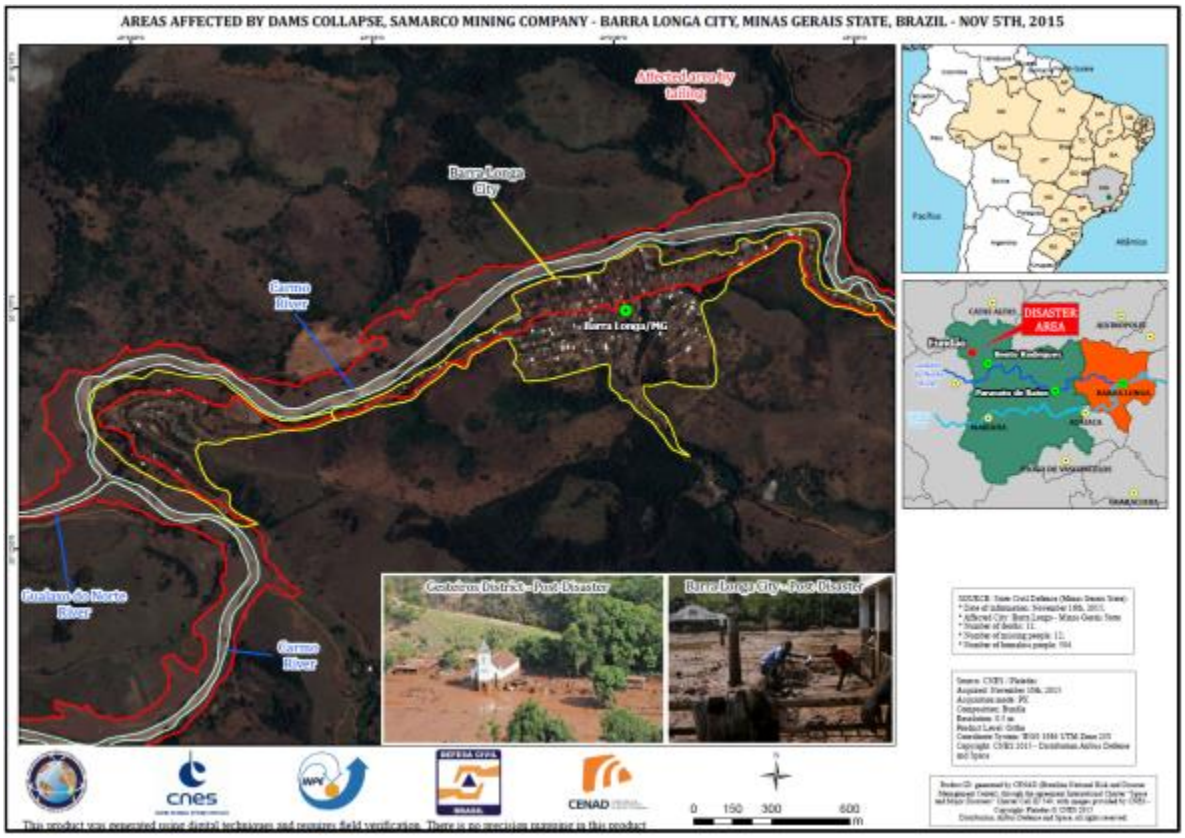
Comments:

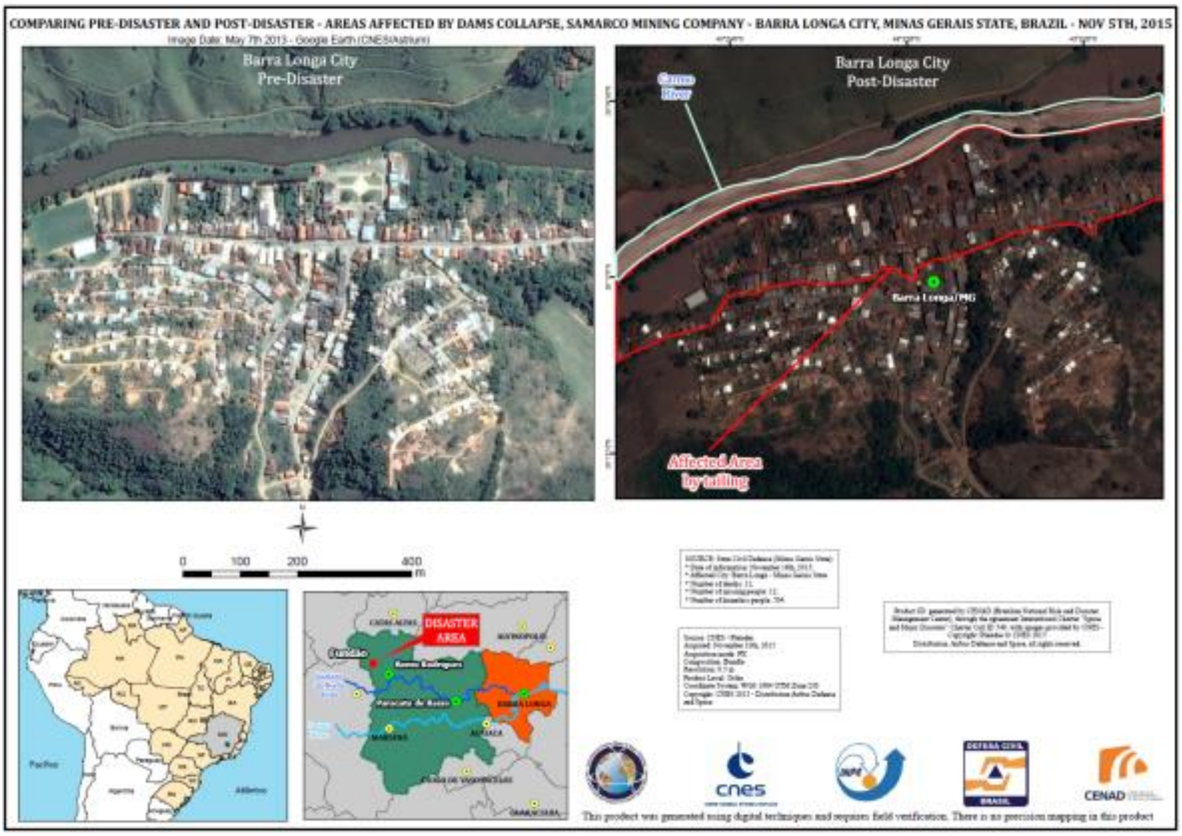
Additional Comments:

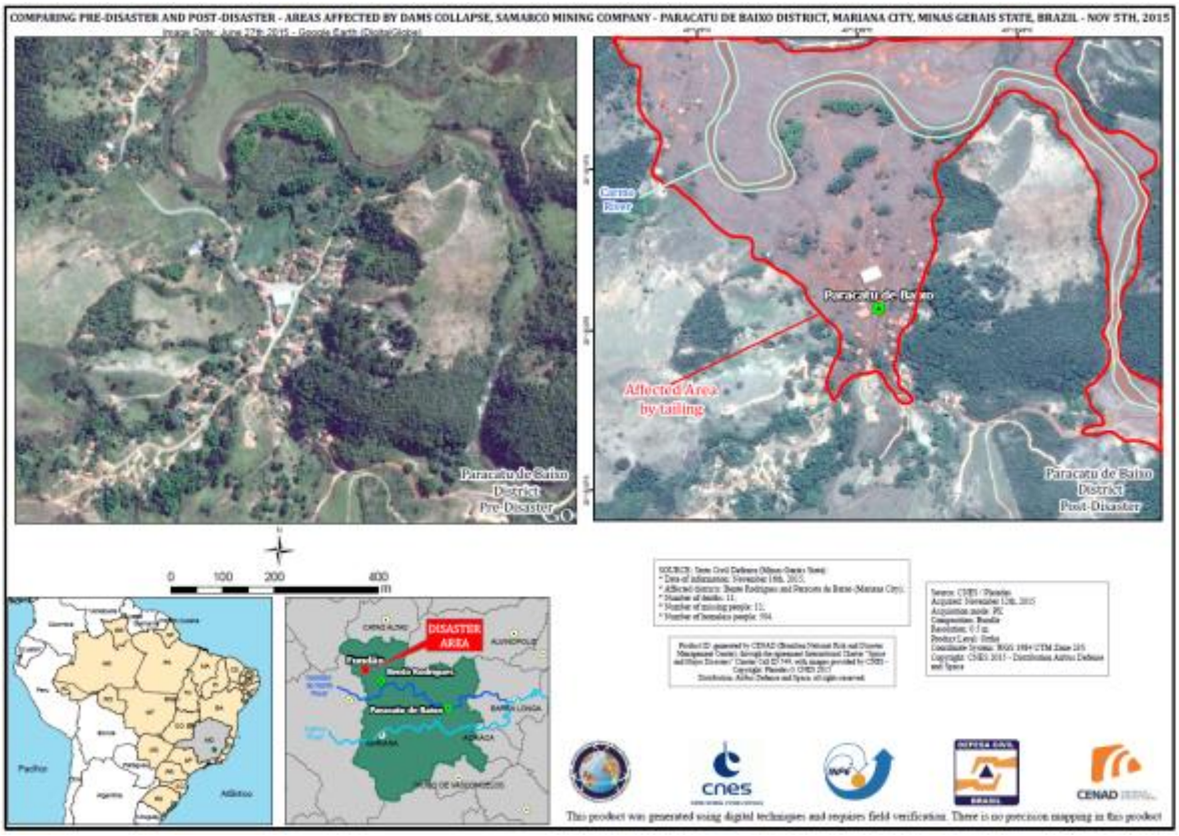
*E6. Provide a copy of the value-added products here. Please insert copies into this document as .jpeg or other small file formats:

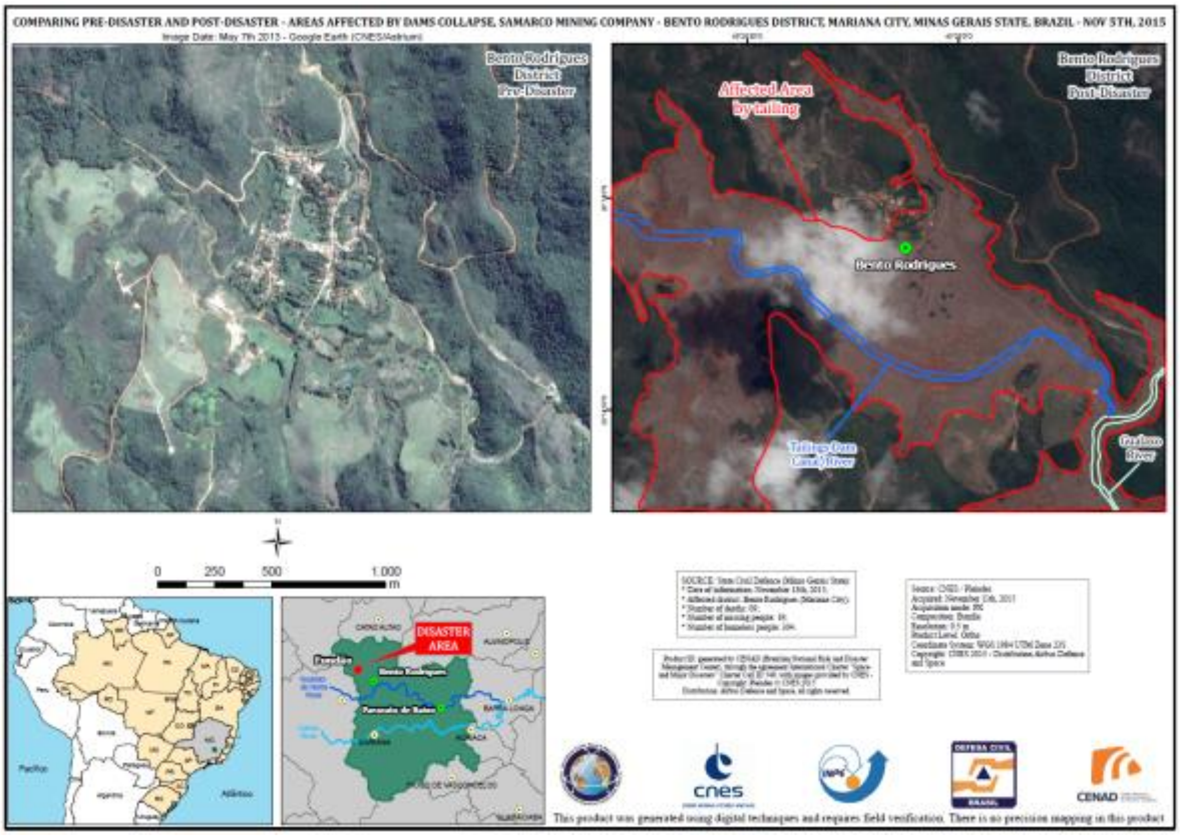


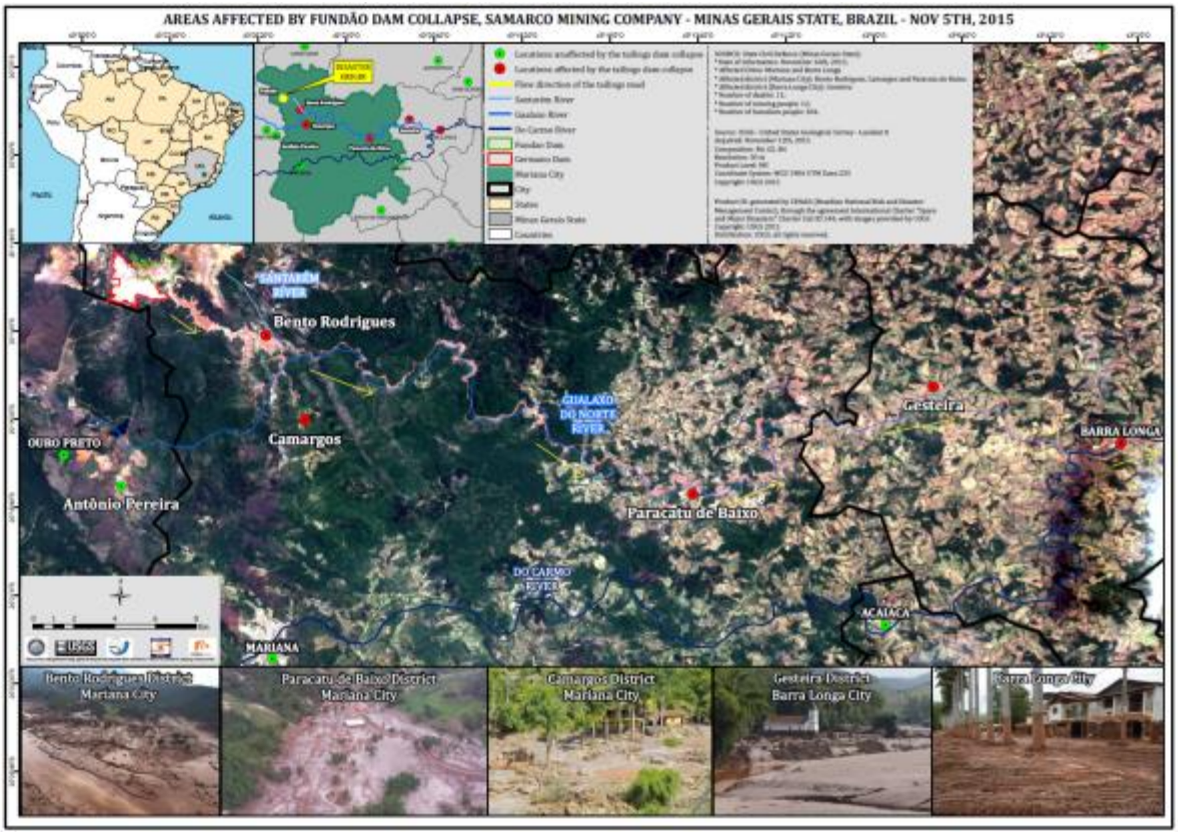

AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - PARACATU DE BAIXO DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
Affected area by tailing
Gualaxo do Norte River
Paracatu de Baixo
Paracatu de Baixo District - Post-Disaster
Paracatu de Baixo District
DISASTER AREA
Mariana
Ponte Nova
Pacific
Atlantic
This product was generated using digital techniques and requires field verification. There is no precision mapping in this product.
0 125 250 500 m


AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BARRA LONGA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
Affected area by tailing
Barra Longa City
Carmo River
Barra Longa/MG
Gualaxo do Norte River
Carmo River
Gesteiras District - Post-Disaster
Barra Longa City - Post-Disaster
DISASTER AREA
Mariana
Ponte Nova
Pacific
Atlantic
This product was generated using digital techniques and requires field verification. There is no precision mapping in this product.
0 150 300 600 m


COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BARRA LONGA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
Image Date: May 7th 2013 - Google Earth (CNES/Astrium)
Barra Longa City
Pre-Disaster
Barra Longa City
Post-Disaster
Carmo River
Barra Longa/MG
Affected Area by tailing
DISASTER AREA
Fundão
Bento Rodrigues
Paracatu de Baixo
BARRA LONGA
MARIANA
Pacific
Atlântico
This product was generated using digital techniques and requires field verification. There is no precision mapping in this product


COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - PARACATU DE BAIXO DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
Image Date: June 27th 2015 - Google Earth (DigitalGlobe)
Paracatu de Baixo District Pre-Disaster
Carmo River
Paracatu de Baixo
Affected Area by tailing
Paracatu de Baixo District Post-Disaster
DISASTER AREA
Fundão
Bento Rodrigues
Paracatu de Baixo
BARRA LONGA
Pacific
Atlântico
This product was generated using digital techniques and requires field verification. There is no precision mapping in this product


COMPARING PRE-DISASTER AND POST-DISASTER - AREAS AFFECTED BY DAMS COLLAPSE, SAMARCO MINING COMPANY - BENTO RODRIGUES DISTRICT, MARIANA CITY, MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
Image Date: May 7th 2013 - Google Earth (CNES/Astrium)
Bento Rodrigues District Pre-Disaster
Affected Area by tailing
Bento Rodrigues District Post-Disaster
Bento Rodrigues
Tailings Dam Canal River
Gualaxo River
0 250 500 1.000 m
DISASTER AREA
Fundão
Bento Rodrigues
Paracatu de Baixo
BARRA LONGA
cnes
CENAD
This product was generated using digital techniques and requires field verification. There is no precision mapping in this product


AREAS AFFECTED BY FUNDÃO DAM COLLAPSE, SAMARCO MINING COMPANY - MINAS GERAIS STATE, BRAZIL - NOV 5TH, 2015
SANTARÉM RIVER
Bento Rodrigues
GUALAXO DO NORTE RIVER
Gesteira
BARRA LONGA
OURO PRETO
Camargos
Antônio Pereira
Paracatu de Baixo
DO CARMO RIVER
ACAIACA
MARIANA
Bento Rodrigues District Mariana City
Paracatu de Baixo District Mariana City
Camargos District Mariana City
Gesteira District Barra Longa City
Barra Longa City

* mandatory