



## TIMELINE OF A DISASTER: FROM THE CONSTRUCTION OF THE VAJONT PLANT TO THE TRIAL

by Francesco Niccolini

(Translation by Alessandra Del Vesco)

**1928**

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**August 4th.** First report for the planning of an artificial reservoir by Professor Giorgio Dal Piaz: *The structural conditions of the whole Vajont basin, despite all appearances, are in fact no worse than those of most mountainous basins in the Venetian area.* Mm (Ministerial memorandum), n. 42.

**1929**

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**January 30th.** SADE (Società Adriatica per l'Elettricità - Adriatic Energy Corporation) requests concession for derivation of the Vajont stream (a tributary of the River Piave) for hydro-electric power generation enclosing a project by engineer Carlo Semenza.

**1937**

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**August 9th.** Geological report by Professor Dal Piaz.

**1940**

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**June 5th.** New geological report by Professor Dal Piaz.

**June 22nd.** SADE requires authorization to exploit the outflows of the river Piave and its tributaries Boite, Vajont and some other minor streams and build a 200m-high dam near the Colomber bridge to obtain a reservoir with a capacity of 50 million cubic meters.

**1943**

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**October 15th.** Favorable vote by the Superior Council of Public Works. The meeting is attended by 13 members out of 34, therefore without the legal quorum. (Parliamentary Committee of Inquiry, n. A1 7).

**1948**

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**March 24th.** Authorization granted by Presidential Decree.

**March 25th.** Report by Professor Dal Piaz: *"The numerous on-the-spot inspections, together with further surveys and digs performed had confirmed that the rock – generally solid - on which the dam at the newly- designed height (202 m) would be erected was even more compact"*. (Mm n. 48)

**May 15th.** SADE submits the request for a variance for the exploitation of the outflows of the Piave, Boite and Vajont rivers and the creation of a 58 million-cubic-meter reservoir.

**October 11th.** Engineer Carlo Semenza's letter to Professor Dal Piaz: *"We should now consider the possibility of raising the level of the reservoir above the present limit (677 m), up to about 730 m [...]. Your opinion about this would be highly appreciated"*.

**October 15th.** Dal Piaz's reply to Semenza: *"I must confess that I tremble at the very thought of the new perspectives"* (Quotation from Dante, literally: the new perspectives do make my veins and pulses tremble, TN)

**December 21st.** Geological report by G. Dal Piaz with the title: *"The geological structure of the Vajont Valley regarding the slope slides that can be activated by the designed reservoir and its level fluctuations"*. Special attention is given to the areas of Erto and Pineda, which present debris of uncertain stability: Dal Piaz claims that, though not denying the possibility of slope failures, the slides are smaller than may appear at first glance.

## 1949

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**January 23rd.** The Erto-Casso city council ratifies the selling to SADE of the lands located in the Vajont Valley that belonged to the state at the price of 3,500,000 lire (3.94 lire per square meter) to be bound in state treasuries for the Ministry of Agriculture and Forestry as they are intended for civic use. Owing to a mistake in the land registry, the city council sells some private plots as well. When the money due to the Ministry of Agriculture and Department of Finance has to be paid, the Council has already spent that money, together with the sum that has to be returned after the illegitimate, though unintentional, selling of private property. SADE anticipates the sum due on behalf of the Council, to be deducted from the fees for riparian rights as a consequence of the use of the stream water. In the following months SADE and the owners of private land in the area start negotiating the purchase.

## 1952

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**March 18th.** SADE claims they will build a suspension walkway over the lake to make communication between the two banks possible again, after being interrupted by the reservoir.

**December 18th.** Presidential Decree that grants authorization concerning the 1948 request for variance (May 15th, 1948).

## 1953

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**November 18th.** Extra notes to the geological report by Dal Piaz (dating Dec. 12th, 1948).

## 1957

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**January.** SADE starts excavation works with no authorization.

**January 31st.** SADE sends a request to vary the dam design and raise its height up to 266 meters, enclosing the 1948 geological report by Dal Piaz and his extra addition, dated January 31st 1957.

**February 6th.** Dal Piaz's letter to Semenza: *"I tried to write down the report for High Vajont, but I must admit it didn't work out well and I'm not at all satisfied. Kindly send me the text you told me about, which I found impeccable. Please, tell me as well if the heading must be that of the office it is addressed to and if the report must be either backdated or showing the present date. As soon as I receive your text I'll have it typed and sent it back to you. I apologize for the inconvenience."*

**February 7th.** Semenza's reply to Dal Piaz: *"Please find enclosed the text that I believe you might stick to. Dotted space was left for you to add notes regarding the conditions of the known inter-layer seams. The extra notes should be dated following my indications in the paper. Anyway, you are free to decide [...] To save time, you are kindly requested to complete and sign the report before you send it to us."* The date Semenza indicates in his note is January 31st, 1957.

**April 1st.** Engineer Bertolissi is appointed state official for the Vajont dam by the Civil Engineering Department: in this position he has to permanently survey the construction site and regularly report to the Engineering and Dams Departments.

**April 2nd.** SADE submits the execution plan, signed by engineer Carlo Semenza with the dam at 266 meters (from 200m of the previous design) and the increase of the reservoir capacity to 150 million cubic meters. The estimated cost amounts to 15 billion lire, with a state contribution of 4 billion 805 million.

**April 17th.** The Fourth Section of the Superior Council of Public Works authorizes the start of works, which SADE already began in January.

**May 31st.** The Dam Department requires a geological report that pertains to the new project.

**June 11th.** Dal Piaz sends Semenza a hand-written geological report with a note: *"I hope my writing satisfies your desires so that no fundamental changes are necessary. When most convenient for you, please let me have the text with your comments, which I will take into high consideration as is my custom."*

**June 14th.** Semenza's reply to Dal Piaz: *"I'm giving you back the draft of the report which, after two or three slight corrections of little moment, I had typed again, so that it may be of use to you for its final version."*

**June 15th.** The general assembly of the Superior Council of Public Works issues its favorable vote, with a request: *"It is however necessary to complete them (i.e. the geological studies) for the safety of the local inhabitants and the state facilities that will stand near the reservoir at maximum level."* In other words the project that has been approved highlights at the same time the necessity of further surveys. Carlo Semenza attends the meeting, bringing with him a copy of Dal Piaz's geological report.

**August 6th.** Geotechnical report by Austrian Leopold Müller (the second SADE has commissioned him to carry out): [...] *The area along the left bank, characterized by piles of debris under green pastures and numerous farmhouses is at high risk of landslides, though being a rock formation. The rock there is pervasively fractured and deteriorated, therefore it can be easily removed or placed in movement.*”

**September 25th.** SADE sends the Ministry the official version of the geological report that was submitted in draft form on June 6th 1957.

## 1958

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**February 12th.** SADE communicates to the Dams Department that the favorable vote and the request for further studies have both been taken into account and adds observations about the notes, suggestions and recommendations.

**April 1st.** The Fourth Section of the Superior Council of Public Works appoints the Testing Commission, whose function is to make sure the dam will be erected following the prescriptions, the filling and drawdowns will provide satisfactory results and the plant will prove fully efficient. The Commission includes geologist Francesco Penta; chief engineer of the Dams Department Francesco Sensidoni; the President of the Fourth Section of the Superior Council of Public Works, engineer Pietro Frosini, who had urged the authorization for the project with the Superior Council; the President of the Superior Council of Works Luigi Greco, who had authorized the project. Regulations of this Department of Public Works openly forbids that anyone who has contributed to drawing up a project is a member of the testing Commission for that very project. Literally, neither Frosini nor Greco actually drew it up, they only approved it. Yet, their involvement in its approbation is incompatible with the impartiality required. Besides, Francesco Penta is a private consultant for SADE for one of SADE's plants, that of Pontesei in Forno di Zoldo.

**April 22nd.** Belluno Civil Engineering Department authorizes SADE to start concrete castings.

**April 24th.** SADE signs the conditions sanctioned by the 1957 vote (June 6th), therefore committing to carry out the required extra geological surveys.

**August 25th.** The Ministry of Public Works grants the first sum of money as a State contribution to SADE.

**October 3rd.** SADE is authorized to replace the walkway on the reservoir that was promised in 1952 with a perimeter road all along the entire left bank. The inhabitants of Casso express their opposition as they would prefer a bridge. SADE replies that a suspension bridge is not viable as *“the nature of the soil [would] not allow the building of such a structure.”*

**October 29th.** Dal Piaz's new report, concerning the perimetral road on the left bank of Vajont. The document also reveals the presence in the area of Pozza of fissured rock and deep cracks running parallel to the valley. Yet Dal Piaz states that there are *“no visible surface signs revealing previous movements.”*

## 1959

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**March 7th.** The Ministry of Public Works grants the second sum of money as a State contribution to SADE.

**March 22nd.** Pontesei landslide: 3 million cubic meters of rocks plunge into this other SADE reservoir. The generated wave kills worker Arcangelo Tiziani, aged 55. The geological consultant of the plant is engineer Francesco Penta, a member of the Testing Commission for the Vajont dam.

**March 23rd.** Geologist Pietro Caloi – who has been studying the area of the dam since 1953 – writes a letter to engineer Tonini concerning the Pontesei landslide: “...*please read again the report on it I sent you in July 1958: what has happened is foreseen in disconcerting detail.*”

**March 27th.** Caloi, again referring to Pontesei landslide and its predictability, writes to engineer Rossi-Leidi: “*Please reassure engineer Biadene: discretion is customary to me. Yet, if I may say, I would suggest that the natural conclusions should be drawn and taken into account.*”

**May 3rd.** A civic Committee for the rebirth of the Erto Valley is established by 126 citizens from Erto and Casso.

**May 5th.** In the daily L'Unità an article is published under the title “*SADE bosses around but mountain dwellers defend themselves*”, where Tina Merlin exposes SADE's responsibilities for the situation and warns about the dangers that the future reservoir will put the Erto population in. Merlin and the editor of the paper are sued for “*spreading false, exaggerated, tendentious news, bound to cause civil disturbance.*”

**May 30th.** Final authorization for the 1957 project is granted.

**July 19th-21st.** First survey of the Testing Commission, whose members are taken to Cortina d'Ampezzo and Venice on the terrace of Hotel Europa for dinner. Engineer Francesco Sensidoni, who has to submit a detailed report to the Superior Council of Public Works, “*remembers very little of Vajont after all the sightseeing, lunches and dinners.*” To be sure of what he writes, he asks SADE to provide a report, which SADE promptly does. It is the Director of SADE, Research Department Dino Tonini that sends it to him.

**July 23rd.** The Belluno Chief of the Civil Engineering Department, engineer Desidera, who has just ordered SADE to stop working on the ring road on the left bank of the Vajont river as no draft project has been submitted to the office, is removed from his position and transferred somewhere else by means of an urgent letter by the Minister of Public Works himself.

**September.** The construction of the dam is completed with the following characteristics:

Height: 261.60 meters

Length at crest: 190.15 meters

Height on sea level: 725.50 meters

Width at base: 22.11 meters

Width at crest: 3.40 meters

Chord at crest: 168 meters

Concrete employed: 360,000 cubic meters

Rock removed: 400,000 cubic meters

**October.** SADE asks Professor Caloi to carry out a geophysical study on the left bank upstream from the dam.

**October 10th.** Sixth geological report by Leopold Müller: his doubts about the stability of the left bank are such as to advise SADE to test the solidity of the left bank by means of ten different methods of investigation.

**October 22nd.** Second survey by the Testing Commission.

**October 28th.** SADE asks for experimental filling of the reservoir up to 600 meters above sea level.

**December.** A seismic station – which Caloi describes as “*unique in the world*” - is installed near the centralized controls of the dam.

**December 2nd.** Frejus dam in France collapses. Semenza writes to Dal Piaz: “*I hope I’ll see you soon, so that we can also talk again about the Vajont dam, which the Frejus disaster, urges us to do.*”

## 1960

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**February 4th.** Caloi hands in his study, which records the “*presence of a strong autochthonous rock support*”, that is solid, compact rock, highly elastic and with a 10-12 meter thick debris surface. The study is delivered to the control authorities.

**February 9th.** On behalf of the Dams Department, Engineer Frosini grants SADE permission for an experimental filling of the reservoir up to 595 meters above sea level (the communication is issued by the Belluno Civil Engineering Department on Feb 2nd, 1960). SADE had started filling water on 2nd Feb.

**March.** During the first filling a landslide detaches from the slope of Mount Toc, just above the valley floor and right behind the mouth of the Massalezza stream.

**May.** The first control points are installed: they are meant to record possible sliding motions of Mount Toc.

**May 10th.** On the basis of the encouraging results of the first filling, SADE asks for permission to raise the water level to 660 meters above sea level, without a drawdown.

**June.** Geological study by Franco Giudici and Edoardo Semenza (son to engineer Carlo, designer of the dam) required by SADE on Professor Müller’s suggestion. After listing a series of minor risks, the study reads: “*In case the slide plane of the entire mass – or at least the part of it that was*

*closer to the reservoir – was even slightly inclined towards the reservoir itself - the phenomenon would be even more serious. Under these circumstances the movement could be re-activated by the presence of water, with consequences that are currently highly unpredictable and depending on the general conditions of the slide plane.”* This study by Giudizi and Semenza will never be submitted to the control authorities. On the other hand, before being officially delivered to SADE, the report is examined by engineer Semenza who writes the following words to his son: *“Dearest Edo, we hold it necessary for you to preliminarily show Professor Dal Piaz the study, of which I will promptly send him notice by means of a letter you can see attached. If ever you had to soften any of your assertions, it won’t certainly be the end of the world.”* (Letter by Carlo Semenza to his son Edoardo, dated 24th May 1960). Engineer Semenza addresses the following words to Dal Piaz: *“Dear Professor, I would be really pleased if you could read it (i.e. the study). Should any minor disagreements occur, it wouldn’t be a problem: they would be my son’s responsibility anyway and he will sign the report if you find it proper.”*

**June 11th.** The Dams Department grants permission to carry out the filling up to 660 meters above sea level (document dated 22nd June, 1960).

**July 9th.** Dal Piaz’s report on the landslides: *“It cannot be excluded that these decollements of the outer edge of the plane may contribute to giving the underlying basin surface an increasingly minor inclination, gradually reaching (...) balance”.* Nevertheless, Dal Piaz himself encourages *“regular monitoring”*.

**November 4th.** A landslide of 700,000 cubic meters breaks away from the slope of Mt. Toc and crumbles into the reservoir, some time after an M-shaped crack about 2 km long has opened on the left bank of the valley: this will be the margin of the 1963 rockslide. After this event, Edoardo Semenza continues his investigations. He will later tell Examining Judge Mario Fabbri: *“In the end I assumed the unstable mass to be about 2 kilometers long, with a volume of 250 million cubic meters and thickness varying from 100 to 250 meters on average. I expressed my conclusions orally to Professor Müller on the site (at the Vajont dam), who at that moment accepted them and set forth further diagnoses on the details of the fissures and the movements that had occurred. This happened during one or two meetings in November 1960.”*

**November 15th-16th.** A meeting is called on the site of the dam with all SADE technicians: Müller, Semenza, Pancini (construction manager), Linari, Ruol, Biadene. They decide to lower the level of the reservoir and build a by-pass tunnel meant to keep the two parts of the lake that would result from a possible landslide dividing it connected. Estimated cost: a billion lire.

**November 17th.** The drawdown starts, the level getting to 600 meters on December 31st.

**November 28th.** Third survey by the Testing Commission.

**November 30th.** In Milan the trial against Tina Merlin of L’Unità starts: three witnesses from Erto and the photographs of November 4th’s landslide put the suing part off testifying. The trial ends with Tina Merlin and the paper found not guilty, because, as the verdict reads: *“There is nothing false, exaggerated or biased”* in the offending article.

**December.** Beginning of Professor Caloi's second geoseismic campaign. He and Professor Müller are never given the chance to meet, neither do they know each other's studies.

**December 1st.** Professor Penta's memorandum: *"One of the numerous fissures, about 2,500 meters long, has raised most fears as it can be interpreted as the intersection with a deep-set failure surface probably getting as far down as the valley basis, separating a huge debris mass from the mountain. [...] Before accepting such a catastrophic interpretation"* – Professor Penta adds that the available data: *"Refer to superficial motions, but there are no elements to state that the phenomenon extends that deep or that there is actually a mass moving [...] the movement might regard a blanket 10 to 12 meters thick at the most, displacing at low speed and, anyway, not involving such massive material as to decide against the existence of the reservoir or predict the risk of anomalous strain on the dam. [...] Alternatively, the possibility of a sudden displacement of a huge mass of material (soil and subsoil) should be acknowledged."*

## 1961

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**January 1st.** The by-pass tunnel starts being dug between 624 and 614 meters above sea level.

**January 7th.** On behalf of the Dams Department, the Belluno Civil Engineering Department officially orders SADE to study the fissure so as to determine whether it is deep or superficial.

**January 10th.** The Belluno Engineering Department appoints the state officer to report weekly about the sliding phenomenon and behavior of the dam.

**January 31st.** SADE commissions CIM - Hydraulic Models Centre in Nove near Vittorio Veneto - a physical-hydraulic model, scale 1:200 of the Vajont reservoir and dam in order to establish the effects of waves caused by landslides falling into the reservoir. CIM is a research center entrusted to the Hydraulic Institute of Padua University. The legal aim of CIM is building and experimenting *"big hydraulic model plants both operating or under construction by SADE"*. The CIM steering committee includes, besides Professors Augusto Ghetti and Francesco Marzolo from the Hydraulic Institute, four SADE representatives: the chairman of the Research center, Engineer Tonini, as well as Engineers Indri and Sestini and Professor Ghetti's own brother.

**February 2nd.** During the Provincial Council Meeting in Belluno, the Communist and Socialist groups submit an appeal on the measures to be taken *"to avert the risks endangering the communities of Erto, Longarone and surrounding villages"*. The proposal to appoint a geologist trusted by the Council to carry out new surveys is accepted. The Provincial President Alessandro Dal Borso asks a colleague from Udine to offer his cooperation as Erto belongs to the province of that town. The reply, which Dal Borso reports during the Provincial Council assembly on February 13th reads: *"The province of Udine is not in the least interested in the matter, which is no concern of theirs."*

**February 3rd.** Professor Müller's fifteenth report on the Toc landslide. Müller refers to two different landslides, one to the east and one to the west of the Massalezza stream. This double landslide is interpreted in different ways: Edoardo Semenza thinks it is a unique mass, which Müller divides into *"typographic junks out of clarity purposes"*; SADE engineers talk about two



distinct landslides. Müller's conclusions about the whole plant sound hopeless: *"I think there can be no doubts about the depth of the sliding surface or the rim area. The volume of the slide should then be estimated at 200 million cubic meters."* Müller thinks that at this point the countermeasures are not viable from the practical, human and economical points of view. *"The question: can the slide be halted by using artificial methods? must, in general be answered negatively, because, even if, in theory, one should decide to completely give up the idea of creating a reservoir, one would have to suppose that such a large landslide, after moving once, would not soon return to a complete stop."* Müller's report will never be sent to the control authorities.

**February 13th.** During the assembly, the Provincial Council in Belluno adopts unanimously the proposed agenda giving the Provincial Government mandate to contact the competent ministries so that all the safety measures granting the protection of the communities of the area of the Vajont basin are promptly taken. Professor Müller will never read the report, whereas he was informed of the previous, reassuring study by Professor Caloi. The two experts have never met and never will.

**February 21st.** The title of a new article by Tina Merlin on L'Unità reads: *"While SADE is allowed to escape the law, a huge mass of 50 million cubic meters is threatening the life and properties of Erto's inhabitants."*

**April 10th.** Professor Caloi's report: unlike the previous study carried out between 1959 and 1960, Caloi now thinks that the rock is shattered, with enormous degradation in its elastic properties, especially on the lefthand slope, which only a year before appeared solid and compact, and is now highly fractured: an unprecedented phenomenon in technical literature, in Caloi's view.

**April 10th.** Fourth survey by the Testing Commission, after which Penta and Sensidoni state that the movements on the left bank have almost slowed to nil and a serious worsening of the situation due to the raise of the reservoir level is unlikely.

**April 15th.** Penta visits the reservoir, water being under 600 meters above sea level and the bypass tunnel under construction. The situation is under control. *"It can be said that in the present circumstances and provided the reservoir is kept at around the current level, there are no direct threats."*

**April 20th.** Carlo Semenza writes a letter to Engineer Vincenzo Ferniani: *"You can imagine the way I feel in the present situation. [...] After lowering the reservoir level, also due to cold weather, the movements on the left bank have halted and I believe that so long as the level is kept this low, there is no need to be concerned. Yet, what will happen with the new filling? [...] I must admit that these slides have been worrying me for months now: things have turned out to be overwhelming and there are no viable valid countermeasures. [...] Professors Dal Piazz and Penta are quite optimistic: they don't seem to think that a big mass will slide down, and hope (and so do I) that the mass in motion will rest on itself. They both agree on all possible safety countermeasures. [...] After many successful achievements and remarkable constructions, I find myself before something that, due to its dimensions, seems to be getting out of hand."*

**May 5th.** After the queries of the President of the Belluno Provincial Council, Solicitor Da Borso, the Minister of Public Works Benigno Zaccagnini, referring to the slide that occurred on November 4th 1960 describes the area as being characterized by “*continuous, homogeneous, solid rock that is certainly steady.*” The Minister reassures Dal Borso by writing the following words: “*On the whole I think the soil there is steady and capable of merely producing superficial slides of filling material.*” Not in the least reassured, Da Borso decides to go to Rome to obtain further information. When back in Belluno he admits that “*in Rome it’s like beating your head against the wall because SADE is a state within the state.*”

**May 10th.** The by-pass tunnel is completed. SADE asks for the authorization to resume the experimental filling up to 660 meters above sea level.

**July 19th.** Professor Indri from SADE sends a letter to Professor Ghetti of the Hydraulic Institute of Padua University and research manager of the experiment at CIM commissioned by SADE. The letter illustrates the criteria according to which the tests on the model are supposed to be carried out. SADE is interested in learning the size of the wave produced by the collapse of a landslide of 20 to 40 million cubic meters, with the reservoir at 680 to 720 meters above sea level. The tests assume that, following the ideas of SADE’s engineers and Müller’s studies, the mass is divided into two parts detaching separately from Mt. Toc and sliding one after the other. The material chosen for the experiment is primarily sand, then, once it becomes clear that wet sand is no good for sliding, gravel is used, made of rounded pebbles. At first, in order to keep the gravel on the wooden plank simulating Mt. Toc’s inclined plane steady, it is kept in position by more wooden planks: at the moment of the test, the wooden planks cause higher waves than the gravel itself. Therefore, the planks are replaced by canvas nets in which the gravel is contained, first descending by gravity, later being accelerated by a tractor. The landslide at Pontesei is taken as a model: “*The Committee has proposed that other falls should be simulated prolonging fall times to five minutes, as two or three minutes are considered too short, given the average speed of phenomena of this kind. An example is the Pontesei landslide, which took approximately 10 minutes to fall.*” Engineer Linari, who actually was at Pontesei at the moment of the slide, had a different view. When questioned by the examining magistrate and asked if he had reported the fall modes to Biadene and Semenza, he will testify as follows: “*That happened in about thirty seconds and at that point, fortunately, I tried to run away.*” The tests will go on for over a year.

**July 25th.** Three Christian Democrats from Belluno apply to the Minister of Public Works about the risks of the reservoir, which have been demonstrated by the construction of the by-pass tunnel. The minister passes the question on the President of the Fourth Section of Public Works, who in his turn asks engineer Pancini of SADE for a report. Interestingly, the company replies: “*The by-pass tunnel is necessary as the November 4th’s slide has filled part of the gorge, thus splitting the reservoir into two.*”

**August-September.** Four piezometers are installed on the left slope of Mt. Toc: these are steel tubes inserted into the ground by means of boreholes, getting to depths ranging from 167 and 221 meters. Piezometers have two functions: checking the level of water inside the rock and verifying whether the slide is superficial or deep. In the first case, the motion of a superficial ground stratum

would break the tubes, fit in deeply; in the second case the tubes would keep on working, confirming the slide involves a very deep level of ground and rock, deeper than the position of the piezometers themselves. One of the four pipes goes out of order at once, while the other three will remain intact until the day of the disaster without breaking or deforming.

**August 1st.** Frosini, President of the Fourth Section of Superior Council of Public Works retires and is replaced by engineer Curzio Batini, Chief of the Dams Department, who is in charge of the final decisions regarding the authorizations for the fillings.

**September 19th.** A group of people visit CIM in Nove: Professor Giovanni Padoan, who has succeeded Greco as President of The Superior Council of Public Works, engineer Curzio Batini, deputy Director of SADE engineer Marin and the dam staff – Semenza, Biadene, Tonini, Pancini, Dal Piaz. They are shown a simplified experiment, a test with less gravel, “so that waves are less conspicuous.”

**October 5th.** SADE asks for permission to raise the water level to 680 meters above sea level.

**October 16th.** An order of the Prefect of Udine allows SADE to permanently take over all the buildings that are in the way of the construction of the ring road on the left bank of the reservoir, in fact expropriating the land owners.

**October 17th.** Fifth and last survey of the Testing Commission allowing the continuation of the filling, although the report reads: “*The possibility the slide is re-activated by the elevation of the water level in the basin cannot be excluded.*”

**October 19th.** Before authorization is granted, SADE has resumed the filling.

**October 30th.** Carlo Semenza dies. His place is taken by Alberico Biadene.

**October 31st.** Penta’s survey regarding the surveys of April 10th and October 17th, 1961: he claims it is impossible to determine whether the motion of the slide is superficial or deep. He thinks that there are not enough elements to confirm Müller’s catastrophic interpretation, which, however, cannot be totally excluded. He’s inclined to believe that the movement is taking place along a superficial, failure surface.

**November 16th.** Authorization for resuming the filling is granted, but only up to 640 meters above sea level, with daily increases of no more than one meter and bi-weekly reports on the condition of the dam and banks. SADE has been filling the reservoir since October 19th.

**December 5th.** SADE asks again for the authorization to reach 680 meters above sea level

**December 13rd.** The Dams Department grants authorization for 655 meters above sea level.

**1962**

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**January 31st.** SADE asks again for the authorization to reach 680 meters above sea level.

**February 6th.** The Dams Department grants authorization for 675 meters above sea level.

**March.** Biadene erases from the bi-weekly reports the reference to the tremors recorded by the sophisticated instruments installed in the area of the dam.

**March 30th.** The Board of Directors of CIM in Nove maintains that: *“At present, research about the effects of a flooding wave downstream from the dam affecting the Piave River valley is not necessary.”* On the other hand, in the same meeting engineer Indri points out that the division of the wave from Vajont towards the inhabited area of Longarone should be investigated.

**April 20th.** Professor Dal Piaz dies as a consequence of the injuries he suffered in the car crash occurring on October 17th, 1961 when he was with the members of the Testing commission on the way back from the survey at the dam.

**April 27th.** Tremor.

**May 3rd.** SADE asks for the authorization to reach 700 meters above sea level.

**May 13th.** Tremor.

**June 8th.** Authorization to reach 700 meters above sea level is granted.

**June 22nd.** The Municipal Council of Erto-Casso issues an order prohibiting access to the outer land below 730 meters above sea level and sailing in the reservoir.

**July 3rd.** Professor Ghetti’s report on the tests carried out in Nove read: *“700 meters above sea level can be considered totally safe even in the circumstance of the most catastrophic landslide. In any case it will be appropriate, during the expected continuation of the research, to examine the effects in the Vajont gorge and at its confluence with the Piave River, of flood waves as big as that indicated above, for possible spilling over the dam.”* Ghetti’s report is not delivered to the control authorities.

**July 8th.** Government official Bertolissi’s report reads: *“Besides the fissures that appeared after the 1960 landslide, further failures have opened, some of which being superficial, others deeper [...] A geologist’s survey of the nature of the fissures and the motions under way would provide a more precise view of the situation.”* After October 16th, no geological studies are reported to have been carried out or commissioned by SADE or ENEL.

**August 3rd.** The chief engineer of the Belluno Civil Engineering Department in the cover letter of the Government official’s report dated July 8th, 1962 writes: *“The undersigned office agrees [...] that a prompt survey by a geologist is highly recommendable.”* The Dam Department will never answer back.

**November 17th.** Water level reaches 700 meters above sea level and is kept there until December 2nd; then a new drawdown starts and goes on until April 4th, when the level has got to 647.50.

**December 1st.** Engineer Almo Violin is appointed Chief of the Belluno Civil Engineering Department, taking over from engineer Desidera. In his turn, Violin replaces engineer Beghelli, in charge with the Dams Department, with a surveyor who admits his ignorance on the subject and

says he has never seen the Vajont dam. Violin will himself admit: *“knowing dams only from university memories; that he hadn't met the Government official; having seen the Vajont dam only once out of personal curiosity.”*

**December 10th.** Government Official Bertolissi's report reads: *“The diagrams regarding the motions of the areas of Mt Toc's slopes under surveillance show that the lowering speed has increased remarkably.”*

**December 12th.** Birth of ENEL (National Electricity Company): following Law number 1643 dated December 6th 1962, SADE's activities concerning the production, import, export, transportation, transformation, distribution and sale of electric power are transferred to the new institution.

## 1963

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**January 10th.** Government Official Bertolissi's new report reads: *“The diagrams regarding the motions of the areas of Mt Toc's slopes under surveillance show that the lowering speed has increased remarkably if compared to last October and previous months: in my opinion the motions are close to a critical point.”*

**March 14.** Presidential Decree that sanctions the transfer of SADE to ENEL

**March 16th.** The Municipal Council of Erto-Casso decides on the acquisition of the primary school building erected by SADE at Pineda and donated to the community.

**March 20th.** ENEL-SADE asks for a new authorization to elevate the water level to 715.15 meters above sea level, exceeding the safety level identified by Ghetti by 15 meters. The Ministerial Commission comments as follows: *“These days a decision has been taken not to prolong the commendable activity of experimentation carried out on hydraulic models at Nove Centre, although Professor Ghetti at the end of his report encouraged an extension of the tests downstream from the dam so as to obtain information about the possibility of further increases of the water level in the reservoir [...] without risks of damage. The remarkable amount of data collected with great care and precision by SADE staff in the area of the basin, have not been reportedly examined or analyzed any further.”*

**March 30th.** The Dams Department of the Ministry grants authorization to elevate the water level to 715 meters above sea level, without a written go-ahead by the Testing Commission, who has no longer met.

**April 11th.** The third and last filling starts.

**July 1st.** The Mayor of Erto-Casso, reassured by the donation of the school, revokes the ordinance of June 22nd 1962, allowing free access to the reservoir. SADE and ENEL warn Udine Prefecture of the *“situation of danger in the Vajont area”* and recall *“the Mayor of Erto-Casso's responsibilities”*. In fact the ring road lying on the same side as the school is already off-axis by half a meter, after two years since the construction began. The Mayor therefore reinstates the old ordinance and the no-access order.

**July 22nd.** The Mayor of Erto-Casso cables the Udine Prefecture and ENEL in Venice requiring urgent measures and pointing out the dangers “*due to inexplicable muddy waters in the lake and constant rumbling and tremors in the municipal territory.*” No reply will follow.

**July 27th.** Report of the official transfer of SADE into ENEL. As regards the Vajont basin, in Annex A, sheet 9 the basin is described as in operation, just as the Colomber power station linked to it.

**September 1st.** The water level reaches 709.40 meters. This level will be maintained, with slight variations up to 710 meters, until September 26th, when the last drawdown will start.

**September 2nd.** Tremor. From now on, non-stop until October 9th, all the control points on the left slope will record a permanent increase in speed: 6.5 mm on Sep. 2nd, 12 mm on Sep.15th, 22 mm on Sep. 26th, 40mm on Oct. 2nd and 3rd, up to 200mm on Oct. 9th.

**September 2nd.** The Mayor of Erto-Casso writes a letter to ENEL-SADE: “*With reference to my previous telegram of last July – which stood unanswered; given the communities in Erto-Casso are living in a constant state of anxiety and alarm; considering others underestimate these problems, which to the people here regard their safety, life and properties, this administration highlights again their worries for the safety of the population and the villages and their doubts about the stability of the reservoir banks. Therefore solid reassurances are required on the esteemed society’s part to act so that the inhabitants of the villages stop living in a nightmare*”. The administration also warns ENEL-SADE “*to remove the source of the present situation of danger for the people, who need to be put in a condition of safety and serenity and only then to bring the reservoir into operation again.*” The letter is also sent for information to the Ministry of Public Works, The Civil Engineers Department and Udine Prefecture. In the Ministry’s archives no trace of this letter remains.

**September 4th.** Water level reaches 710 meters and will go no further up.

**September 12th.** Biadene replies to the Mayor of Erto’s letter, talking about “*rather bold statements*”, recalling “*the geological studies carried out by late Professor Dal Piaz*” to reassure Erto’s inhabitants.

**September 15th.** On Mt. Toc one more crack opens; trees dipping downhill are seen, new holes on the ring road appear, the M-shaped fissure running across the mountain widens.

**September 18th.** Biadene, Pancini and other ENEL-SADE staff as well as experts Caloi and Oberti meet at the dam: Biaden gives up the idea to get to 715 meters and plans to possibly decide for a drawdown should the situation turn bad.

**September 26th.** Biadene decides to start the drawdown.

**September 27th.** The drawdown begins.

**September 30th.** Mario Pancini, Director of the dam site, on leaving for his holidays, personally informs the ENEL-SADE branch in Rome about the situation and the start of the drawdown. He also

asks Engineer Paroncini – chief Director of ENEL’s hydraulic constructions – to convince Professor Penta to carry out a new urgent survey.

**October 1st.** Pancini leaves for the USA. Engineer Beniamino Caruso, Works Director of Middle Piave takes his place at the dam, without receiving any instructions by him. At the same time, Surveyor Rittmeyer, a SADE employee at the dam who has already obtained permission to be transferred to Venice, is informed his transfer has been revoked and he is asked to remain on site.

**October 2nd.** Biadene himself goes to Rome to the ENEL-SADE headquarters and talks with Engineer Paroncini about the landslide: Biadene asks him to persuade Penta to go to the dam site. Caruso goes to the dam and, after learning about the new movements of the control points and other recent fissures, applies to the Civil engineering department. He does that two days later and without talking to Chief Engineer Violin or anybody else on an official basis.

**October 5th.** Caloi’s report, where he mentions a slide that occurred at 04:45 on August 10, 1963. Neither the entity nor the place are known.

**October 6th.** The road running parallel to the reservoir is almost impassable due to the cracks that keeps on opening on the road surface.

**October 7th.** Caruso goes back to the dam and warns Biadene the situation is worsening; the Civil Engineering Department organizes a survey by the Government official. Some workers find two fissures that are one-meter wide, ten-meter long in a woodland area on the left slope of Mt. Toc; through the day others open; moreover, stones roll down, while cracking sounds come from the depths of the mountain.

**October 7th, evening.** An order is issued for evacuation of Mt. Toc, with the exception of the hamlets Pineda, Liron, Prada.

**October 8th, 10:30.** Biadene and Caruso go to the dam site and realize how serious the situation is. Caruso goes to see Violin at the Civil Engineering Department in Belluno, who in turn invites Government official Bertolissi to go to the dam site. Caruso asks him not to “*spread alarmist rumors*”. Violin requires a written report.

**October 8th, 12:00.** Biadene calls the ENEL-SADE office in Venice, requiring a cable to be sent to the Mayor of Erto-Casso so that an evacuation order for the whole area of Toc is issued and access to the banks of the reservoir as well as the roads on the left bank of the basin prohibited. The ordinance is released.

**October 8th, 15:30.** Bertolissi goes to the dam site and writes a report highlighting “*the seriousness of the situation, for which prompt instructions are expected by the Dams Service.*” The report is delivered to Engineer Violin, Chief of the Civil Engineering Department in Belluno on October 9th, and sent to Rome by regular mail in the afternoon. Biadene also calls the ENEL-SADE office in Rome, begging Paroncini to convince Penta and the Testint Commission to carry out a new survey. Penta accepts to send Professor Esu on Friday 11th. Carabinieri have some settlements at 730 meters below sea level evacuated.

**October 9th, morning.** The motions of the slide are such as to clog the exit drain of the reservoir. Biadene writes to Pancini, asking him to come back from his holidays. *“These days the speed of the slide displacement has increased considerably [...] the cracks on the soil, the holes on the road, the visible incline of the trees on the outcrop over La Pozza, the opening of the big fissure that borders the upper edge of the slide, the movements of the control points even towards Pineda, which has never happened before, all of this makes us think the worst. Yesterday we cabled the Mayor of Erto and the Udine Prefecture asking for the ordinance of no-access on the road to be reinstated. In the meantime the reservoir level is diminishing by one meter a day and this morning it should be at 700 meters. I intend to reach 695 with the purpose of granting a safety belt against waves. [...] I apologize for giving you such a quantity of bad news and asking you to interrupt your holidays and come back. [...] May God bless us all.”*

**October 9th, 12:00.** During lunch break some workers on the crest of the dam notice that the movement of the mountain is visible to the naked eye.

**October 9th, 13:00.** Behind the workers' temporary lodgings on the left bank, a crack 50 cm wide, 5 m long opens. Three hours later the crack has increased by 40-50 cm.

**October 9th, 15:00-16:00.** A worker that is walking in the Massalezza area above the level of the road sees trees fall and raise great clods of earth with their roots.

**October 9th, 17:00.** Caruso receives from Venice instructions to ask the Headquarters of Carabinieri to set up a roadblock in the dangerous area.

**October 9th, 17:50.** Biadene phones Penta, who reassures him: *“I highly recommend to stay calm and not think too far ahead.”* It is during this call that Biadene informs Penta for the first time about the experiments on model at Nove and the indication of 700 meters above sea level as safety limit. Straight afterwards Batini calls Biadene, who confirms the continuation of the drawdown, *“in accordance with the activity in the Soverzene plant”*, illegitimately brought into operation with the aim to produce electric power thanks to the water from the reservoir.

**October 9th, 20:00.** Trucks can no longer pass on the road on the left bank. The road to Mt. Toc is blocked by ENEL-SADE.

**October 9th, evening.** At Cafè Deon in Belluno Caruso meets the chief officer of Carabinieri and explains that it is necessary to close off state road Alemagna northwards and southwards of Longarone. The officer calls from a bar to the Headquarters of Carabinieri in Cortina d'Ampezzo and issues the order, which is transmitted to the officer in Longarone.

**October 9th, 22:00.** Rittmeyer calls Biadene in Venice to tell him how worried he is, as the mountain has visibly started yielding. He is particularly concerned for the hamlet of Le Spesse, at 729 above sea level. A telephone operator overhears the conversation and breaks in to ask whether Longarone is in danger. Biadene reassures her but encourages Rittmeyer *“to sleep with an eye open.”* Other versions maintain that the phone call in which the operator intrudes is not the one mentioned, but one in which an operator from SADE in Longarone asks to be put through to



factory Mec Marmi to inform them that during the night water might flow out of the dam as a consequence of some sliding and worry the workers there.

#### **October 9th, 22:39. The slide collapses.**

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Not in two parts, but as a whole compact mass of 260 million cubic meters of rock. At that moment the water level is at 700.42 The 50m-million cubic meters wave raised by the landslide takes two different directions: upstream towards the hamlets of Frasein, San Martino, Le Spesse, Pineda, Liron and Prada; downstream, after climbing over the crest of the dam, towards Longarone and the hamlets nearby: Pirago, Villanova, Faè, Rivalta as well the hamlets in the municipality of Castellavazzo: Vajont and Codissago. Finally the water flows into the River Piave.

**The wave causes the death of 1919 people, very few are injured. In the whole area the only human artefact to resist the wave and remains undamaged is Carlo Semenza's dam on the Vajont stream.**

**October 11th.** A Commission of inquiry on the Vajont disaster is set up at the precise request of the Minister of Public Works in agreement with the Prime Minister. In office on October 14th, the Commission is given two months to submit a report. Its function is "*to determine the causes, recent and remote, that [had] caused the catastrophe.*" The Commission will submit the report after 90 days.

**November 7th.** Final report of the Testing Commission which considers its mandate fulfilled and "*the prosecution of proof tests on the dam*" impossible.

#### **1968**

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**February 20th.** Investigating Judge Mario Fabbri hands down a sentence of prosecution against Alberico Biadene, Mario Pancini, Pietro Frosini, Francesco Sensidoni, Curzio Batini, Francesco Penta, Luigi Greco, Almo Violin, Dino Tonini, Roberto Marin, Augusto Ghetti. Penta and Greco cannot be sued as they have died.

**November 28th.** Mario Pancini takes his own life.

**November 29th.** The first instance trial starts in L'Aquila.

#### **1969**

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**December 17th.** The first instance trial ends. The prosecution asks for a 21-year sentence for all the defendants except Violin for whom a 9-year sentence is asked. The charges are: culpable landslide disaster and flood disaster aggravated by the predictability of the event and aggravated culpable manslaughter. Biadene and Violin are sentenced to six years imprisonment (including three condoned) for culpable manslaughter not having warned the people and ordered evacuation; all the other defendants are acquitted. The predictability of the landslide is not acknowledged.

#### **1970**

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**July 26th.** The appeal trial starts in L'Aquila, with the discharge of Batini's position suffering from a serious form of nervous disorder (he will die in 1975).

**October 3rd.** Biadene and Sensidoni are found guilty of culpable landslide, flood and manslaughter and condemned to respectively 6 years (including three condoned) and 4 and a half years (including three condoned); Frosin and Violin are acquitted for lack of evidence; Marini and Tonini are acquitted because the act does not constitute a crime; Ghetti is acquitted for not committing the crime.

## 1971

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**March 15th-25th.** During Cassation (Supreme Court) trial in Rome Biadene and Sensidoni are found guilty of one disaster: aggravated flood, aggravated by the predictability of the event including the landslide and manslaughter. Biadene is sentenced to 5 years (including 3 condoned), Sensidoni is sentenced to 3 years and 8 months (including 3 condoned). Tonini is acquitted for not committing the crime. All the other sentences are confirmed. A for night later, the 7-year period from the alleged crime, all the charges would have been past the limitation period.

## 1975

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**December 16th.** L'Aquila Court of Appeal rejects the claim of Longarone Municipality for compensation on Montedison, which the company SADE has been absorbed into, ordering instead ENEL to pay fair compensation for the damages suffered by the municipalities involved, which are themselves asked to pay the legal expenses for Montedison. Accordingly, the costs between Longarone Municipality and Montedison are agreed to be compensated.

## 1982

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Florence Court of Appeal, reversing prior sentence by L'Aquila Court of Appeal, orders ENEL and Montedison to pay for the damages suffered by the State and Montedison for the damages suffered by Longarone Municipality, reserving the right to determine the extent and costs of the damages and their distribution between the civil parties held responsible for them.

## 1986

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**December 17th.** The Supreme Court of Cassation rejects the appeal initiated by Montedison with regard to the 1982 sentence.

## 1997

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**February 15th.** Belluno Civil and Penal Courts order Montedison to compensate for the damages suffered by Longarone Municipality estimated at 55,645,758,500 Lire including material, non-material and moral damages, besides 526,546,800 Lire for litigation and legal costs and 160,325,530 Lire for extra expenses.

The judgement is immediately enforceable. The same year the Supreme Court of Cassation rejects ENEL's appeal against the Erto-Casso Municipality and the newly-born Municipality of Vajont,

ordering ENEL to compensate for the damages, which will be estimated by Belluno Civil and Penal Courts at 480,990,550 Lire for financial and property losses; 500,000,000 Lire for the damages suffered on the loss of part of the population and their activities; 500,000,000 Lire for environmental damages.

## **1999**

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**June 23rd.** The final transaction between Montedison and Longarone Municipality is signed in Longarone Town Hall.