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Liquid Waste in the Danube Basin: Transboundary Pollution Across the Czechoslovak–Austrian Frontier in the 1970s

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ABSTRACT

This article examines industrial wastewater as liquid waste in motion across the Czechoslovak–Austrian frontier in the 1970s. Using bilateral commission protocols, related correspondence, official treaty material and contemporary Austrian fisheries reporting, it reconstructs how recurring sugar-beet pollution, bacteriological uncertainty and oil spills transformed the Danube, Morava and Dyje into monitored environments. It argues that, because pollutants moved faster and less predictably than national administrations could respond, the two states developed seasonal schedules, coordinated and split sampling, laboratory standardisation and accelerated warnings. These practices sustained technical cooperation between socialist Czechoslovakia and neutral capitalist Austria without eliminating border controls, asymmetric evidence or disagreement over methods and responsibility. The case shows that cross-border monitoring was itself a waste infrastructure, translating mobile pollution into comparable observations, negotiated causes and administrative obligations.

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1. INTRODUCTION

During the Cold War, industrial wastewater did not remain confined within national territories. Rivers carried industrial residues across political frontiers, linking upstream production zones with downstream ecosystems, fisheries, groundwater reserves and urban water supplies. In densely industrialised East-Central Europe, where rivers crossed or constituted borders over relatively short distances, this circulation created environmental problems that nationally organised systems of monitoring and pollution control could not adequately assess on their own. Border rivers were therefore not simply political boundaries or managed hydraulic systems. They were also corridors through which liquid waste moved across political space, making pollution a problem of transboundary measurement, attribution and coordination (Winiwarter, Schmid and Dressel 2013, Pritchard 2011, Hünemörder 2010, Kirchhof and McNeill 2019).

Industrial wastewater is often approached through the point of discharge: waste leaves a factory, treatment plant, refinery, sewer or industrial yard and enters a river. This article follows what happened afterwards. In the Danube–Morava–Dyje system, pollutants repeatedly resurfaced downstream as fish kills, oil films, deteriorating water quality and demands for explanation. Their movement created a particular administrative problem. While pollution travelled with the river, responsibility, measurement and environmental authority remained divided by national borders. Austrian and Czechoslovak officials therefore had to develop ways of detecting, comparing, and tracing pollution across a shared river system.[1]

The article treats industrial wastewater as liquid waste in motion. Its fluidity created distinctive problems of observation and control: pollutants dispersed, diluted and mixed with other substances, travelled through river channels and groundwater, and often became perceptible only intermittently – as smell, foam, discoloration or oily surfaces. A history of wastewater must therefore examine not only sites of discharge and treatment, but also the monitoring practices and technical infrastructures through which pollution could be detected, measured, compared and made administratively actionable across borders (Tarr 1996, Gille 2007, Hamlin 1990).

River histories have shown how modern states transformed flowing waters through engineering, regulation, and environmental observation, while rivers themselves connected jurisdictions even as they marked political boundaries. Waste histories, meanwhile, have shifted attention beyond sites of disposal toward circulation and the practices through which residues became visible, measurable, and governable. Bringing these perspectives together suggests that a frontier river was not simply a passive sink or conduit. It was a socio-technical system that both transported pollution and shaped the production of evidence, responsibility and dispute around its movement (White 1995, Pritchard 2011, Blackbourn 2006, Brain and Pál 2018, Gille 2007, Tarr 1996, Hamlin 1990, Melosi 2011, Pál 2023b, Pál 2024a).

These problems of mobile pollution took shape within a particular postwar institutional landscape. In socialist East-Central Europe, water management increasingly integrated river engineering with industrial development, public water supply, flood control, irrigation and expert planning. Transboundary cooperation was generally organised through bilateral intergovernmental arrangements, as in the 1958 Czechoslovak–Polish boundary-water agreement. Other European waters produced different institutional forms: the Baltic became a site of multilateral scientific exchange across the Cold War divide, while the Rhine developed an increasingly elaborate Western European regime of pollution control. The Czechoslovak–Austrian boundary-water commission occupied a distinctive position within this landscape. It linked a Warsaw Pact state directly to a neutral capitalist neighbour through a durable legal framework, annual negotiations and recurring technical cooperation.[2]

Existing scholarship has substantially revised older narratives of socialist environmental failure by examining hydraulic modernisation, environmental expertise, transnational river governance, authoritarian environmentalism, high-modernist landscape transformation and systems of waste recovery and material circulation. Yet it tells us much less about the routine work through which officials turned mobile pollution into mutually discussable evidence: selecting sampling profiles and seasons, crossing a guarded border, collecting samples, comparing laboratory results, investigating discrepancies and deciding when downstream authorities had to be warned. Boundary-water protocols make these practical and epistemic operations unusually visible (Janáč 2020; Pál 2023a; Pál 2024b; Gille 2007).

The article uses close qualitative analysis and event reconstruction to trace pollution incidents and monitoring practices across successive meetings of the Czechoslovak–Austrian boundary-water commission. We follow recurring references to pollutants, dates, river reaches, indicators, sampling arrangements, attribution and administrative responses in order to reconstruct how particular problems developed over time. The principal archival source base is held in the Slovak National Archives, whose partly

1 Slovak National Archives, Bratislava (hereafter SNA), Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 41, Treaties and Protocols on Boundary Waters, boxes 5–7 (1963–1970), 29 (1971) and 51 (1972).

2 For contrasting institutional forms, see Janáč and van der Vleuten 2016, Laakkonen 2001, Bernauer and Moser 1996. The 1958 Czechoslovak–Polish agreement is listed in Ministry of the Environment of the Czech Republic 2009: 36.

processed collections preserve Czechoslovak copies of jointly negotiated annual protocols alongside preparatory files and correspondence. Although preserved on the Czechoslovak side and often written in Czech or Slovak, the protocols were approved by both delegations and correspond in substance to their German-language counterparts; they therefore constitute a shared bilateral record rather than a unilateral Czechoslovak account. Preparatory materials and internal correspondence primarily illuminate Czechoslovak institutional perspectives, while Austrian fisheries publications and treaty documents provide additional Austrian context. Taken together, these sources allow us to reconstruct not simply episodes of pollution, but the repeated practices through which moving waste was detected, compared, attributed and transformed into an object of bilateral governance.[3]

2. ENVIRONMENTAL AND INSTITUTIONAL PREHISTORY, 1950S–1969

The Danube, Morava (March) and Dyje (Thaya) formed a connected but hydrologically unequal system. The Morava, a 353-kilometre tributary of the Danube, drained a catchment of about 26,658 square kilometres across Czechoslovak and Austrian territory. From its confluence with the Dyje, it formed part of the Austrian–Czechoslovak border before entering the Danube at Devín, immediately upstream of Bratislava. The Dyje catchment covered about 13,426 square kilometres – larger than the Morava catchment above their confluence – yet carried a lower mean discharge at the confluence, 43.7 compared with 65.1 cubic metres per second. Its Austrian tributaries included the Pulkau, while the lower Morava and Dyje flowed through an agricultural lowland characterised by extensive floodplains. These differences in discharge, tributary inputs and seasonal dilution shaped both the movement of pollutants and the difficulty of determining their origin and effects.[4]

The same waters served several, sometimes conflicting, purposes. The Danube flowed from the industrial and urban corridor of Linz and Vienna toward Bratislava, where Austrian discharges could affect downstream reaches and water supplies dependent on riverbank-filtered groundwater. The Morava and Dyje connected sugar factories, farms, municipalities, floodplain fisheries and hydraulic works on both sides of the frontier. Municipal and industrial residues therefore moved through a shared river system in more than one direction: Austrian pollution could reach Czechoslovak users along the Danube, while organic loads from Moravian industry and agriculture could affect Austrian stretches of the Morava and Dyje (Boško 1968: 250–53; Boško 1961: 1; Mucha et al. 1966: 5–8; Winiwarter, Schmid and Dressel 2013).

Long before the permanent commission began work, fishermen, hydrologists and journalists described several Czechoslovak rivers as biologically degraded or as industrial sewers. Pollution was visible episodically through foul-smelling reaches, bacterial irregularities or sudden oxygen loss. Yet the same effect could have several interacting causes. Organic wastewater was most damaging during low flow, when warmer water carried less oxygen and dilution and self-purification weakened; drought or ice could turn a recurring discharge into a catastrophe. This dependence on timing and river conditions meant that routine samples taken on fixed dates could easily miss the periods when recurring discharges became most destructive (Suchovský 1958: 5; Mucha 1958: 379–80).

A contemporary Austrian fisheries report illustrates the scale of such episodes. Curt A. Moser, an Austrian fisheries writer, described a dramatic deterioration in water conditions between 20 and 25 October 1969, when fish of several species were observed gasping at the surface and carcasses appeared along the Morava. Moser also cited an expert estimate that eighty to ninety per cent of the fish stock in the Morava and Dyje had been lost during that year's sugar-beet processing campaign. The figure was a contemporary estimate rather than the result of a systematic fish census, but it shows the scale at which Austrian fisheries observers perceived the episode and how such events could be mobilised in arguments for stronger international water protection.[5]

A second Austrian report documented the hydrological vulnerability that could make such losses especially severe. During the winter of 1969–70, Lower Austrian floodplain waters were only twenty to thirty centimetres deep, and hundreds of fish crowded into small openings, gasping for air. Roland Bucksch, an Austrian jurist and water-management specialist who served as managing director of the Austrian Water Management Association (ÖWWV), linked the emergency to the previous autumn's fish

3 The principal archival series are Slovak National Archives, Bratislava (SNA), Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses and series 41, Treaties and Protocols on Boundary Waters, especially boxes 7, 29, 50, 51, 75, 76, 101, 132, 190, 306 and 373. The working method was qualitative content analysis and longitudinal event reconstruction, not a statistical estimate of total pollutant loads.

4 International Commission for the Protection of the Danube River 2009: 4–7. The plan gives a total Morava length of 353 km, a catchment area of 26,658 km², mean discharge at the Morava–Dyje confluence of 65.1 m³/s, a Dyje catchment of 13,426 km² and Dyje mean discharge of 43.7 m³/s.

5 Moser 1970: 8–10. The figure of 80–90 per cent was presented as an estimate by experts consulted in a contemporary fisheries report; it should not be read as a systematic fish census.

kill and to the annual sugar-beet processing campaign, arguing that prolonged low-water conditions intensified the effects of recurring organic pollution. Taken together, the two reports point to the same seasonal mechanism later discussed by the commission: fisheries damage depended not simply on the volume of wastewater discharged, but on the interaction between pollution, flow, temperature and oxygen conditions (Bucksch 1970: 58–59).

Emerging demands for international water protection increasingly depended on scientific institutions capable of tracing pollution, assessing water quality, and understanding rivers as interconnected systems. The Bratislava branch of the Czechoslovak Water Management Research Institute was established in 1951 and became the independent Water Management Research Institute (Výskumný ústav vodného hospodárstva, VÚVH) in 1968; its research programme encompassed hydrology, hydraulics, water quality and the growing problem of oil contamination.[6] The International Association for Danube Research, founded in 1956, provided a broader forum for limnological coordination across the basin. Researchers at VÚVH, the Slovak Academy of Sciences, and other Danube institutions investigated hydrochemistry, groundwater circulation, municipal wastewater, and the suitability of river water for drinking, industrial, and agricultural use. Such work increasingly approached the Danube basin as an interconnected hydrological environment and demonstrated that pollution measurements could not be interpreted independently of flow, dilution and local river conditions.[7]

Yet scientific knowledge alone did not create cooperation; it had to be incorporated into an existing bilateral framework for managing shared waters. Czechoslovak–Austrian water administration itself had roots well before the Cold War. A 1928 treaty established a Joint Technical Commission to coordinate regulation works, dikes, maintenance, and related projects on the Morava and Dyje. Its activity ceased in 1938, but bilateral administration resumed after the war, with the first postwar session in 1951 again concentrating primarily on hydraulic works, particularly on smaller Dyje tributaries. A new agreement, signed in Vienna on 7 December 1967 and entering into force on 18 March 1970, substantially broadened this framework. Alongside river regulation, flood and ice protection, drainage, and water supply, it explicitly encompassed water purity, hydrometric observation and warning procedures. The commission that emerged in 1970 therefore combined considerable institutional continuity with a significantly expanded environmental mandate, creating the framework within which pollution measurement and cross-border warning could become regular objects of bilateral cooperation.[8]

The broadened bilateral framework acquired particular urgency because it coincided with a succession of serious pollution incidents. Looking back in April 1970, commission members discussed a 1968 bacteriological anomaly on the Danube as well as fish deaths on the Morava and Dyje. In 1969, Austrian observers recorded four fish kills on the Morava – on 19 and 26 October and 4 and 10 November – upstream of Hohenau; measurements on 5 November detected no dissolved oxygen. The Dyje experienced further fish kills on 28 October and 24 November, the first reported there for several years. Austrian representatives emphasised pollution associated with the sugar-beet processing campaign, whereas Czechoslovak experts stressed the interaction between organic loads from sugar factories and exceptional drought, heat and very low water levels. Importantly, the disagreement concerned the relative weight of these factors and the attribution of responsibility, not whether serious ecological deterioration had occurred.[9]

Joint monitoring therefore emerged from several pressures at once: untreated or insufficiently treated industrial and municipal effluent, recurring sugar-beet processing campaign discharges, visible fish mortality, concern for bank-filtered drinking water near Vienna and Bratislava, accidental oil releases, and an inherited legal obligation not to damage the neighbour's waters. The hydrology of shared rivers made unilateral observations increasingly insufficient. A fish kill recorded on one bank could be missed on the other; bacterial counts varied with sampling location and flow; an oil slick could pass a monitoring point between scheduled visits. By the end of the 1960s, the practical question was no longer simply whether information should be exchanged, but how observations made on opposite sides of the border could be rendered comparable quickly enough to identify sources, attribute responsibility, and limit downstream harm.

6 SNA, Water Management Research Institute (VÚVH), 'Zoznam vyriešených úloh a štúdií za roky 1951–1969' [List of Completed Tasks and Studies, 1951–1969]; Z. Nanáčková-Zekeová, 'Prieskum mestských odpadových vôd z Bratislavy' [Survey of Municipal Wastewater from Bratislava], 1960, in the same list.

7 Daubner 1964: 3; Water Management Research Institute n.d.; International Association for Danube Research n.d. The Bratislava institute dates its establishment to 1951 and independence to 1968; the International Association for Danube Research was founded in 1956.

8 Povodí Moravy 2022: 32–33; Ministry of the Environment of the Czech Republic 1967: arts. 1–3, 11 and 13–16 (hereafter Treaty on Boundary Waters); Ministry of the Environment of the Czech Republic 2009: 36. The latter confirms entry into force on 18 March 1970.

9 SNA, series 41, 1970, box 7, 'Protokol o I. zasadaní československo-rakúskej komisie pre hraničné vody' [Protocol of the First Session of the Czechoslovak–Austrian Commission for Boundary Waters], Bratislava, 14–24 April 1970, section 'Udržiavanie čistoty hraničných vôd' [Maintaining the Purity of Boundary Waters], 32–35.

3. BUILDING A SHARED MEASUREMENT SPACE AFTER 1970

The first Czechoslovak–Austrian Commission for Boundary Waters met in Bratislava from 14 to 24 April 1970, less than a month after the treaty entered into force. It replaced the Joint Technical Commission while preserving its practice of alternating meetings and recurring expert work. Its mandate extended well beyond pollution, encompassing projects and maintenance affecting boundary waters, river regulation, flood protection, hydrometric observation, water supply, navigation-related works and the allocation of costs. In matters of water quality, however, the new treaty introduced a substantially broader framework: the two states were to seek improvements where protection against pollution was necessary, require treatment for new wastewater discharges, exchange observations and establish procedures for warning one another of dangerous events. Commission resolutions took effect only after approval by both governments, embedding technical cooperation within a formally bilateral political process (Ministry of the Environment of the Czech Republic 1967: arts. 1–3, 11 and 13–16).

A shared measurement space did not mean that all work was performed side by side. Each state maintained national stations, laboratories and routine series, then exchanged results and discussed discrepancies at expert and plenary meetings. The commission could order coordinated measurements at matching profiles and times; when a result became contentious, experts also collected the same water jointly and divided it for separate laboratory analysis. Parallel national series therefore revealed longer-term trends but remained embedded in different institutional and analytical routines, while split samples helped determine whether disagreement arose from laboratory methods rather than from the river itself.[10]

The regime operated on three connected levels. Annual plenary sessions authorised work programmes and recorded disagreements; expert meetings translated those resolutions into sampling schedules, analytical comparisons and warning procedures; national river authorities and laboratories carried out most routine observations. Their findings returned to the commission as tables, reports, incident files and proposed resolutions. Because commission decisions required governmental approval, even apparently technical changes – an additional sampling round, a common analytical method, or a new border procedure – connected field practice to intergovernmental administration. Cooperation therefore rested less on permanent joint institutions than on repeated procedures through which observations, discrepancies and proposed remedies moved between laboratories, experts, the commission and the two governments.[11]

The first session identified three immediate monitoring problems. Hydrochemical results broadly agreed, bacteriological results did not, and routine visits could miss peaks of seasonal pollution on the Morava and Dyje. The delegations therefore compared laboratory methods, coordinated sampling in place and time, and concentrated monitoring around the sugar-processing campaign. The shared measurement regime thus developed pragmatically, with procedures adjusted in response to specific problems of comparability, timing and pollution detection.[12]

Bacteriological monitoring on the Danube illustrates the first of these problems. Czechoslovak records associated elevated bacterial counts near Bratislava with wastewater entering upstream, while Austrian and Czechoslovak laboratories differed over sampling profiles and the interpretation of results. Hydrological conditions further complicated comparison: high discharge could dilute measured concentrations, low flow could concentrate them, and changes in groundwater movement affected assessments of bank filtration. Psychrophilic and mesophilic bacterial counts made otherwise largely invisible contamination measurable, but their evidentiary value depended on where and when samples were taken and on the laboratory procedures used to analyse them.[13]

Repeated comparison did not automatically settle responsibility. The protocols show delegations postponing judgments, requesting additional sampling rounds or acknowledging divergent results without accepting a common causal account. This pattern is important for understanding environmental cooperation across the Iron Curtain. The commission did

10 SNA, series 41, 1973, box 76, protocol of the fourth session of the Czechoslovak–Austrian Commission for Boundary Waters, Vienna, 25 March–5 April 1973, on coordinated hydrochemical measurements during sugar-processing campaigns. For coordinated and jointly divided sampling, see SNA, boxes 7, 101 and 190, protocols of the first, fifth and seventh sessions. The fifth-session record explicitly concerns twelve jointly collected Danube samples analysed separately by Austrian and Czechoslovak laboratories.

11 Treaty on Boundary Waters, arts. 13–15; SNA, box 7, protocol of the first session, Bratislava, 14–24 April 1970, 1–2, 32–35. The treaty established a commission with one representative from each state, expert participation as required, annual meetings, extraordinary sessions when necessary and governmental approval of resolutions.

12 SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 41, Treaties and Protocols on Boundary Waters, 1970, box 7, protocol of the first session of the Czechoslovak–Austrian Commission for Boundary Waters, Bratislava, 14–24 April 1970, 32–35.

13 SNA, series 41, 1970, box 7, protocol of the first session, 32–35, on bacteriological monitoring and Danube water quality near Vienna and Bratislava; SNA, series 41, 1975, box 132, protocol of the sixth session of the Czechoslovak–Austrian Commission for Boundary Waters, Vienna, 14–25 April 1975.

not produce immediate scientific consensus; rather, it created an institutionalised forum and recurring procedure through which disagreement could be documented, investigated, narrowed, and returned to in subsequent meetings.[14]

4. SEASONAL POLLUTION AND ANTICIPATORY MONITORING

One persistent problem was oxygen depletion during the autumn sugar-processing campaign. Factories processing large quantities of beet produced concentrated organic wastewater over a relatively short season. When low flow and warm water reduced dilution and oxygen availability, these loads could create conditions lethal to fish. One of the commission's important responses was not immediate control at every source, but the conversion of the sugar campaign into a recurring season of intensified monitoring.[15]

At the first session in 1970, the delegations responded to the previous autumn's fish kills with a specific monitoring calendar. Water quality on the Morava and Dyje was to be measured before the sugar campaign, up to three times during it at approximately weekly intervals near the confluence profiles, and twice after it. These were not continuous observations, but they concentrated limited sampling capacity around the period when organic loads were expected to peak. Pollution that had previously appeared as an episodic emergency was thus incorporated into the commission's annual timetable of monitoring and expert work.[16]

In 1971, the commission reviewed water-quality data for the longer period 1960–69 and concluded that conditions in the Dyje and Morava had not improved. Outside the sugar-processing campaign, the Dyje could still be classified as class II, but during the campaign it deteriorated to classes III and IV; conditions on the Morava were assessed even less favourably. During campaign periods, oxygen depletion could become severe enough for fish mortality to occur almost annually in the boundary section. This longitudinal assessment transformed individual pollution episodes into evidence of a recurring seasonal pattern: a predictable deterioration in classified water quality accompanied by repeated ecological damage.[17]

The 1971 record also revealed the limits of bilateral monitoring. Austrian authorities reported fish kills in the Morava on 21 and 28 October, 7 November and 2 December. Oxygen depletion was documented in three of these cases, although no comparable mortality was recorded along the Czechoslovak bank. A major fish kill at the confluence of the Pulkau and Dyje in June was investigated too late for its cause to be established. In a separate incident on 26 April, oil arriving from Austria covered an estimated half of the Danube's surface at Bratislava during the morning and remained visible throughout the day. Together, these cases confronted the delegations with several different problems: recurring seasonal pollution, uncertain causality, uneven observations across the river and sudden accidental contamination.[18]

By 1972–73, the commission was moving from incident lists toward annual assessments and source-oriented remedies. Its discussions included municipal biological treatment plants, water recirculation in sugar factories and improved industrial wastewater treatment. Monitoring did not substitute for abatement, but it supplied the temporal and comparative evidence through which the delegations could ask whether new works or changed factory practice altered conditions in the next campaign.[19]

The protocols show that the delegations did not treat 'campaign pollution' as a catch-all explanation for every fish kill. Austrian biological reports attributed two Morava fish kills in October and November 1973 – between Zwerndorf and Angern and near Drösing – to sediment disturbed by river-regulation works rather than directly to sugar-factory effluent. Czechoslovak observers again reported no comparable mortality on their bank. The incidents therefore broadened the range of causes considered by the commission. Fish mortality could result not only from industrial discharges and low flow, but also from disturbed sediment and river-engineering works. Distinguishing among these causes required attention to timing, location, and observations from both banks.[20]

14 SNA, series 41, 1979, box 373, protocol of the tenth session of the Czechoslovak–Austrian Commission for Boundary Waters, Linz, 26 March–6 April 1979.

15 SNA, series 41, 1970, box 7, protocol of the first session, 32–35.

16 Ibid..

17 SNA, series 41, 1971, box 29, protocol of the second session of the Czechoslovak–Austrian Commission for Boundary Waters, Vienna, 19–30 April 1971, 31–35.

18 SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses, 1972, box 50, 'Protokol o 3. zasedání Československo-rakouské komise pro hraniční vody' [Protocol of the Third Session of the Czechoslovak–Austrian Commission for Boundary Waters], Prague, 13–24 March 1972, 34–42.

19 SNA, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses, 1972, box 50, protocol of the third session, Prague, 13–24 March 1972, 34–38; SNA, series 41, 1973, box 76, protocol of the fourth session, Vienna, 25 March–5 April 1973, 32–37.

20 SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 41, Treaties and Protocols on Boundary Waters, 1974, box 101, protocol of the fifth session of the Czechoslovak–Austrian Commission for Boundary Waters, Brno, 25 March–5 April 1974, reporting the October and November 1973 Morava fish kills and the Austrian biological assessment of sediment disturbance during regulation works.

By the end of the decade, controls at individual pollution sources had reduced some risks but had not eliminated seasonal crises. At its ninth session in 1978, the commission noted that all sugar factories had been inspected during the 1977 campaign, treatment facilities remained under construction, and the Dürnkrut sugar factory had closed after the 1977–78 campaign. Nevertheless, between 13 and 15 December 1978, a major fish kill accompanied by oxygen depletion extended along the Morava to its mouth. Austrian representatives attributed the incident to putrefying organic matter discharged by Czech sugar factories and transported downstream by a sudden increase in flow. They therefore proposed an automatic oxygen-monitoring station. The commission had identified the sugar campaign as a period of heightened danger, but periodic sampling could not detect every rapid change in flow and oxygen conditions. [21]

5. WARNING SYSTEMS, BORDER MOBILITY AND EMERGENCY RESPONSE

Accidental oil and toxic pollution posed a different temporal problem. Scheduled measurements could reconstruct a campaign, but a spill could traverse the relevant river reach before the sampler experts arrived. From the early 1970s the commission increasingly discussed immediate information exchange, emergency sampling, anti-oil equipment and protection of bank-filtered drinking-water resources. Warning made communication speed part of pollution control.[22]

The Cold War border heavily conditioned the speed at which experts could move from one side to another. Article 16 of the 1967 treaty created bilingual border passes, valid for up to five years and allowed authorised personnel to cross away from formal checkpoints and work within 200 metres of the frontier; exceptionally, a pass could permit movement up to twenty kilometres inland. Yet the place, time and purpose of a crossing normally had to be notified to border authorities. On 25 August and 2 September 1971, Austrian personnel working under the treaty were detained after crossing the boundary, prompting an extraordinary commission session in December and new instructions to border guards.[23]

The detention episode raised not only whether authorised experts could cross the border, but also whether they could do so quickly enough to document rapidly changing conditions. A January 1972 memorandum from the Slovak river administration identified three situations in which delays caused by prior notification could make reliable observation impossible: urgent flow measurements, pollution incidents requiring immediate sampling and vessel accidents. It therefore requested permission for personnel to reach the nearest bank without delay. This was a narrow operational suggestion rather than an opening of the Iron Curtain, and environmental personnel remained subject to named duties, passes, spatial limits and official scrutiny, but the mobility of pollution forced both states to make those controls more flexible.[24]

Faster access to the river was not sufficient; downstream authorities also needed prompt warning of pollution incidents upstream. This became clear after toxic contamination near Krems caused a massive fish kill on the Austrian Danube on 3–4 September 1972. The records tentatively attributed the incident to an organophosphorus compound. Austrian authorities did not notify Czechoslovakia because they expected the contamination not to reach Czechoslovak territory at dangerous levels. Czechoslovak officials nevertheless feared possible effects on Bratislava's drinking-water sources. At an extraordinary meeting in Pezinok from 30 January to 1 February 1973, experts therefore drafted a bilateral warning service. An initial alert was to be transmitted immediately by telephone and then confirmed by telex or telegram, specifying the pollutant, its expected concentration and downstream arrival time, and any protective measures already taken.[25]

The new warning procedure was tested only months later – and failed. On 14 August 1973, an

21 SNA, series 41, 1978, box 306, protocol of the ninth session, Piešťany, 3–14 April 1978, 37–38; SNA, series 41, 1979, box 373, protocol of the tenth session, Linz, 26 March–6 April 1979, 37–40.

22 SNA, series 41, boxes 7, 132, 190, 306 and 373, commission protocols concerning oil pollution, monitoring and emergency notification during the 1970s.

SNA, series 41, 1975, box 132, protocol of the sixth session, Vienna, 14–25 April 1975; SNA, series 41, 1979, box 373, protocol of the tenth session, Linz, 26 March–6 April 1979.

23 Treaty on Boundary Waters, art. 16; SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses, 1972, box 50, documents concerning the extraordinary session of 14–16 December 1971 after Austrian personnel were detained on 25 August and 2 September 1971.

24 SNA, series 41, 1972, box 51, Povodie Dunaja, Bratislava–Karlova Ves, memorandum, 26 January 1972, on urgent border crossings for flow measurement, emergency pollution sampling and vessel accidents.

25 SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses, 1973, box 75, records of the Second Extraordinary Session of the Czechoslovak–Austrian Commission for Boundary Waters, Pezinok, 30 January–1 February 1973, reconstructing the Krems pollution of 3–4 September 1972.

SNA, series 37, 1973, box 75, records of the second extraordinary session of the Czechoslovak–Austrian Commission for Boundary Waters, Pezinok, 30 January–1 February 1973, including preliminary guidelines for the warning service.

estimated 50,000 litres of heating oil escaped in Vienna harbour while a damaged tank vessel was being manoeuvred. Austrian efforts failed to contain the spill, but Czechoslovak authorities received no warning. On 15 and 16 August, observers downstream reported large oil slicks, grey foam, brown flocculent sludge and oil covering as much as half the river's surface. One sample contained 84.8 milligrams of oil per litre, and traces of the pollution were still detected near Palkovičovo on 21 August. Austrian representatives later explained and apologised for the failure, citing holiday absences among other reasons. The incident showed that a formal warning procedure was not enough: its operation still depended on available personnel, clear responsibilities and the routine transmission of information.[26]

During the following years the commission tried to close the interval between release, detection, notification and response. Czechoslovakia organised an anti-oil service, Austria planned a corresponding service and both sides discussed more frequent observations and automatic stations. Monitoring thus moved from retrospective annual discussion toward an aspiration for near-real-time response, although periodic sampling and human communication remained central throughout the decade.[27]

These exchanges show that Cold War divisions shaped cooperation less through explicit ideological language than through administrative practice. Hydrological interdependence, treaty obligations, concern for drinking-water supplies and the economic importance of fisheries and river management gave both governments strong reasons to cooperate. Yet the technical language of the protocols did not make the political border irrelevant. Neutral Austria and socialist Czechoslovakia retained different administrative systems, laws, and laboratory practices. Austria's 1977 water-quality regulation was presented to the commission but did not replace bilateral procedures; border guards could still detain authorised experts; and both delegations defended national interpretations of pollution incidents. Cooperation succeeded not by transcending the Iron Curtain, but by creating a narrowly defined technical regime within which limited collaboration remained politically acceptable. [28]

6. MAKING POLLUTION COMPARABLE

Once experts could reach the river and exchange information, a further problem remained: how could their observations become evidence that both delegations regarded as comparable? Changing flows, delayed sampling, episodic discharges and differences in analytical methods meant that two laboratories could examine the same river yet describe its pollution differently. Expanded monitoring therefore did not simply reduce uncertainty; it also revealed how strongly the results depended on when, where and how samples were taken.

Mineral-oil analysis provides the clearest example. At the fifth session in Brno in 1974, both delegations agreed that oil pollution posed a serious threat because Danube water was used for drinking-water supplies. They also possessed unusually controlled evidence: twelve samples collected jointly from the Danube and divided between the Austrian and Czechoslovak laboratories. Yet the Austrian measurements were two to three times lower than the Czechoslovak results. Because the samples had been collected at the same places and times, differences in the river could not explain the discrepancy. Attention therefore shifted to laboratory procedures, including extraction methods, instruments and the interpretation of measured concentrations.[29]

The effort to make such measurements comparable continued over the following sessions. At the seventh session in Prague in 1976, experts adopted the n-pentane method for determining extractable substances, with spectrophotometry available as a control. Standardisation was therefore more than a technical adjustment: it made Austrian and Czechoslovak measurements more directly comparable. Before the delegations could assess the scale and source of pollution, or discuss responsibility for it, they first had to agree on how reliable evidence would be produced.[30]

26 SNA, Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses, 1973, box 75, Egon Turek to Ján Krajči, 22 August 1973, concerning the oil spill of 14 August and Czechoslovak observations of 15, 16 and 21 August 1973. The file records the estimate of 50,000 litres and a sample containing 84.8 mg/l oil.

SNA, series 37, 1973, box 75, Egon Turek to Ján Krajči, 22 August 1973, on the Danube oil pollution of 14 August 1973 and the failure of notification procedures.

27 SNA, series 41, 1976, box 190, protocol of the seventh session, Prague, 22 March–2 April 1976; SNA, series 41, 1978, box 306, protocol of the ninth session, Piešťany, 3–14 April 1978; SNA, series 41, 1979, box 373, protocol of the tenth session, Linz, 26 March–6 April 1979.

SNA, series 41, boxes 190, 306 and 373, late-1970s protocols concerning downstream notification and coordination between Austrian and Czechoslovak hydrological authorities.

28 This interpretation is based on the contrast between the protocols' technocratic language and the operational record of border controls, notification failures and divergent national assessments. See especially SNA, boxes 50, 51, 306 and 373. Austria's 6 May 1977 water-quality regulation was reported at the ninth commission session: SNA, box 306, protocol of the ninth session, Piešťany, 3–14 April 1978, 35–37.

29 SNA, series 41, 1974, box 101, protocol of the fifth session, Brno, 25 March–5 April 1974, section 'Udržiavanie kvality hraničných vôd' [Maintaining the Quality of Boundary Waters], on divergent mineral-oil results from twelve jointly collected Danube samples.

30 SNA, series 41, 1976, box 190, protocol of the seventh session, Prague, 22 March–2 April 1976, on the

Standardising laboratory methods did not solve the problem of when and how often samples should be taken. In 1978, Czechoslovak experts argued that six Danube observations per year could not capture annual variations in water quality and proposed monthly sampling from 1979. Austrian representatives agreed that more frequent monitoring would be useful but opposed concentrating too narrowly on extractable substances. They also noted that brief oil peaks could occur between sampling dates and therefore escape even a monthly schedule. At the tenth session in 1979, the two national assessments still diverged: Czechoslovak specialists evaluated Danube water quality more negatively, and no agreement was reached on whether monitoring should remain at six observations per year or increase to twelve. The dispute had shifted from how a sample should be analysed to how frequently – and for which pollutants – the river should be observed. [31]

Because neither standardised methods nor more frequent periodic sampling could fully represent a changing river, the commission relied on several forms of evidence. Separate national series provided long-term coverage; coordinated sampling aligned observations in place and time; split samples tested laboratory comparability; incident reports documented events missed by scheduled visits; fish mortality connected measured conditions to ecological harm; and warning messages followed the expected movement of pollutants downstream. No single indicator represented pollution as a whole. Bilateral governance therefore depended on comparing these different forms of evidence and explaining why they did not always agree. Proposals for automatic oxygen-monitoring stations addressed the same problem. Pollutants could appear, move and disperse between visits, while oxygen levels could change rapidly with river flow and organic load. Continuous instruments promised a denser record of these changes, although they could not by themselves establish the source of pollution or responsibility for it. By 1979, the commission had created a durable system for making mobile and variable pollution observable and comparable. Austrian–Czechoslovak cooperation was therefore more than pollution control: it was a system for rendering unstable pollution administratively stable enough – as a measurement, classification, report, warning or recorded disagreement – to support bilateral action. Its achievements lay as much in disciplined comparison and accumulated institutional memory as in reducing discharges.[32]

7. CONCLUSION

The Czechoslovak–Austrian commission did not eliminate industrial wastewater from the Danube–Morava–Dyje system. Its central achievement was to make mobile pollution increasingly observable, comparable and actionable across a guarded frontier. This regime emerged because liquid pollutants repeatedly moved faster than either national administration could observe and interpret them. Recurrent fish kills and oxygen depletion during sugar campaigns, bacteriological anomalies near drinking-water resources, oil slicks moving downstream from Vienna and sudden toxic incidents exposed the limits of unilateral monitoring. The 1967 treaty expanded an older water-management framework, but the operational regime was built incident by incident through seasonal schedules, coordinated and split sampling, warning chains and negotiated rules for expert movement. Pollution became a bilateral administrative object through this repeated work of following, recording and comparing its movement.

Seen at the scale of individual incidents, the bilateral files connect treaty-level histories of river governance with national histories of pollution. They show what happened after a pollutant began to travel: who noticed it, which observation counted, how quickly an expert could reach the river, why two laboratories disagreed and how one year's failure reshaped the next year's programme. This contributes to waste history by showing that monitoring was itself part of liquid-waste infrastructure. Flow, temperature, dilution, sediment and sampling time altered both ecological effects and what observers could detect. Dead fish, low oxygen, bacterial counts, oil films and laboratory readings did not speak for themselves; they had to be translated into dates, locations, classifications, reports, warnings and recorded disagreements. A transboundary environment was therefore not shared simply because water crossed a political border. It became administratively shared through repeated efforts to make observations mutually usable.

The case also refines the history of environmental cooperation across the Iron Curtain. Austria and Czechoslovakia had strong common interests in drinking-water protection, fisheries, river management and pollution control, and the commission sustained a durable technocratic relationship. Yet cooperation neither erased the border nor produced scientific consensus. Authorised experts could still be detained; urgent access required negotiated exceptions; warning chains depended on national personnel and routines; and laboratories and delegations continued to defend different results and causal interpretations. The commission worked by institutionalising limited permeability: it created controlled channels through which experts,

n-pentane method and spectrophotometric control for determining extractable substances in water.

31 SNA, series 41, 1978, box 306, protocol of the ninth session, Piešťany, 3–14 April 1978, 35–37; SNA, series 41, 1979, box 373, protocol of the tenth session, Linz, 26 March–6 April 1979, 37–40.

32 SNA, series 41, 1979, box 373, protocol of the tenth session, Linz, 26 March–6 April 1979, on automatic measuring stations and intensified Danube observation.

samples, measurements and warnings could cross while national administrations, sovereignty and disagreement remained intact.

By 1979, the commission had assembled a durable monitoring regime and had also made its limits visible. Six or twelve annual observations could miss brief pollution peaks, while automatic oxygen stations promised a denser record without resolving source or responsibility. The decade therefore did not mark a linear advance from ignorance to control. It marked a shift from reacting to visible damage towards anticipating when pollution might move, together with a growing recognition that no single sample or indicator could represent the river as a whole. Measurement followed waste, but never fully caught it. The commission's historical achievement was to create procedures through which two neighbouring states divided by the Iron Curtain could act together on pollution that neither could fully observe, explain or contain alone.

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REFERENCES

ARCHIVAL AND OFFICIAL SOURCES

Slovak National Archives, Bratislava (SNA). Ministry of Forestry and Water Management of the Slovak Socialist Republic, Office of the Minister, series 37, Technical Commissions for Boundary Watercourses and series 41, Treaties and Protocols on Boundary Waters.

Slovak National Archives, Bratislava (SNA). Water Management Research Institute (VÚVH), research files and lists of completed projects, 1951–1969.

PUBLISHED WORKS

Bernauer, T. and P. Moser. 1996. 'Reducing pollution of the River Rhine: The influence of international cooperation'. *The Journal of Environment & Development* **5** (4): 389–415. Crossref

Blackbourn, D. 2006. *The Conquest of Nature: Water, Landscape and the Making of Modern Germany*. New York: W.W. Norton.

Boško, K. 1961. 'Voda je vzácna surovina [Water is a precious resource]'. *Práca*, 18 March: 1.

Boško, K. 1968. 'Čistota vôd Slovenska [Water quality in Slovakia]'. *Životné prostredie* **2** (5): 250–253.

Brain, S. and V. Pál. 2018. 'Introduction'. In V. Pál and S. Brain (eds), *Environmentalism under Authoritarian Regimes: Myth, Propaganda, Reality*, pp. 1–10. London: Routledge. Crossref

Bucksch, R. 1970. 'Fische in Not [Fish in distress]'. *Österreichs Fischerei* **23**: 58–59.

Daubner, I. 1964. 'Duní Dunaj a vlna za vlnou sa valí [The Danube roars and wave follows wave]'. *Príroda a spoločnosť* 10: 3.

Gille, Z. 2007. *From the Cult of Waste to the Trash Heap of History: The Politics of Waste in Socialist and Postsocialist Hungary*. Bloomington: Indiana University Press.

Hamlin, C. 1990. *A Science of Impurity: Water Analysis in Nineteenth-Century Britain*. Berkeley: University of California Press.

Hünemörder, K.F. 2010. 'Environmental crisis and soft politics: Détente and the global environment, 1968–1975'. In J.R. McNeill and C.R. Unger (eds), *Environmental Histories of the Cold War*, pp. 257–76. Cambridge: Cambridge University Press. Crossref

International Association for Danube Research. n.d. 'History'. https://iad.gs/

International Commission for the Protection of the Danube River. 2009. Flood Action Plan for the Morava River Basin. Vienna. https://www.icpdr.org/sites/default/files/FAP04_Morava.pdf

Janáč, J. 2020. 'Building hydrosocialism in Czechoslovakia'. *Global Environment* **13** (3): 610–633. Crossref

Janáč, J. and E. van der Vleuten. 2016. 'Transnational system building across geopolitical shifts: The Danube–Oder–Elbe Canal, 1901–2015'. *Water Alternatives* **9** (2): 272–91.

Kirchhof, A.M. and J.R. McNeill (eds). 2019. *Nature and the Iron Curtain: Environmental Policy and Social Movements in Communist and Capitalist Countries, 1945–1990*. Pittsburgh: University of Pittsburgh Press. Crossref

Laakkonen, S. 2001. 'Cold War and the environment: The role of Finland in international environmental politics in the Baltic Sea region'. *Ambio* **30**: 437–44.

Melosi, M.V. 2011. *Precious Commodity: Providing Water for America's Cities*. Pittsburgh: University of Pittsburgh Press. Crossref

Ministry of the Environment of the Czech Republic. 1967. Treaty between the Czechoslovak Socialist Republic and the Austrian Republic on the Regulation of Water-Management Questions on Boundary Waters. Signed Vienna, 7 December. https://mzp.gov.cz/system/files/2024-10/OOV-smlouva_HV_Rak-20131003.pdf

Ministry of the Environment of the Czech Republic. 2009. Voda České republiky v kostce [Water in the Czech Republic in brief]. Prague. https://mzp.gov.cz/system/files/2025-03/Voda_CR_v_kostce-2009.pdf

Moser, C.A. 1970. 'Alptraum zwischen March und Thaya [Nightmare between the March and Thaya]'. *Österreichs Fischerei* **23**: 8–10.

Mucha, V. 1958. 'Význam čistoty povrchových vôd pre zdravie národa [The importance of surface-water quality for the nation's health]'. *Naša Veda* **5** (9): 379–80.

Mucha, V. et al. 1966. *Limnológia československého úseku Dunaja* [Limnology of the Czechoslovak section of the Danube]. Bratislava: Vydavateľstvo SAV.

Pál, V. 2023a. 'Like industrious bees: Paper waste and recycling in Communist Hungary, 1950–1990'. *Environmental History* **28** (2): 335–60. Crossref

Pál, V. 2023b. 'Toward socialist environmentalism? Scientists and environmental change in modern Hungary'. *Environment and History* **29** (2): 239–59. Crossref

Pál, V. 2024a. 'The second Hungarian conquest of the Carpathian Basin: High modernism and the ecological crisis in the Eastern half of the Habsburg Empire during the nineteenth century'. *Agricultural History* **98** (1): 50–70. Crossref

Pál, V. 2024b. 'Trouble with the bottle: Beverage containers and the widening waste crisis in socialist Hungary'. *Journal of Contemporary History* **59** (2): 293–312. Crossref

Povodí Moravy. 2022. '70 let česko-rakouské spolupráce na hraničních vodách [Seventy years of Czech–Austrian cooperation on boundary waters]'. *Zpravodaj Povodí Moravy* 1: 32–33. https://www.pmo.cz/download/zpravodaj-1-2022.pdf

Pritchard, S.B. 2011. *Confluence: The Nature of Technology and the Remaking of the Rhône*. Cambridge, MA: Harvard University Press. Crossref

Suchovský, Š. 1958. 'Otázka vážna i pre nerybárov: Otrávené rieky [A serious matter even for non-anglers: Poisoned rivers]'. *Práca*, 5 August: 5.

Tarr, J.A. 1996. *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective*. Akron: University of Akron Press.

Water Management Research Institute. n.d. 'Basic information'. https://www.vuvh.sk/en/about-us/basic-information/

White, R. 1995. *The Organic Machine: The Remaking of the Columbia River*. New York: Hill and Wang.

Winiwarter, V., M. Schmid and G. Dressel. 2013. 'Looking at half a millennium of co-existence: The Danube in Vienna as a socio-natural site'. *Water History* **5** (2): 101–19. Crossref