

Findings of the peer review of the considered documents that relate to the UPL toxic spill which occurred in KZN, and which resulted in major environmental impacts.

Professor Jason Weeks

Background

A fire which occurred at the unlicensed UPL warehouse located in Umganu Road in Cornubia on the 12th July 2021 resulted in a considerable quantity of potentially toxic material entering the environment. During the fire an unknown quantity of material stored at the locality was released through several routes; viz. as incomplete or complete combustion by-products, as particulates in air and subsequent deposition to the local environment, but by far the largest environmental pathway was via the dispersion of the fire water used to extinguish the fire. An estimated 300,000 l of fire water was used alongside the catastrophic release of a further 1,000,000 l of water from two storage tanks that failed structurally during the fire. A total volume of ca. 1.300,000 litres of water was dispersed to the environment during the incident. This additional volume of water washed the materials stored in the warehouse comprised predominantly of pesticides, including herbicides, fungicides and non-specific insecticides, as well as a range of specific target products, including miticides, nematicides, acaricides, rodenticides and surfactants, fertilizers and a range of other fumigants and attractants into the drain system and ultimately into the local catchment. There remains a degree of uncertainty as to the exact nature and quantities of materials stored at the site at the time of the incident, but it is likely that a significant quantity was destroyed during the fire which may have burned at temperatures between 600°C and 650°C.

It is noted that the products stored within the warehouse are empirically designed to kill a wide range of plant, invertebrate and mammalian pests at significantly lower concentrations than those released in the pulse of material washed through the receiving environment. The ongoing toxicity determined in the receiving environment is a consequence of ongoing exposure to lethal doses of the released compounds acting on non-target species.

Findings of the review

My finding following an extensive and exhaustive peer-review of the available evidence in the form of numerous documents, reports and other data (64 reports and other documentation and a meeting of specialists that took place on the 11th of October, 2021 – see Annex I) confirms the preliminary finding as indicated in a previous statement.

It is the opinion of the reviewer that based on an overview of the reported evidence (using the methodology described below - see Annex II and the outcome of the interactive session with the available experts – see Annex III) that ***the recommendation to open the beaches around the Umhlanga estuary could be supported for recreational use and surfing. The ongoing risk to human health is considered low to negligible.***

Whilst there remain some uncertainties on the fate of the chemicals released during the spill, subsequent efforts to remediate and remove any ongoing sources of contamination from the site and upper reaches of the tributary appear effective. The recommendation is based on a consideration of the available data with an overall outcome of:

- **Moderate – in that further research is likely to have an important impact on confidence in the estimate of effect and may change the strength of the recommendation.**

The evidence reviews and final statement was structured to assist in prioritising a recommendation.

A judgment on the strength of the evidence alongside the certainty in the strength of the interpretation of the evidence has driven an overwhelming outcome of Moderate based on the overarching quality of the reported information considered by weight and considering any associated measures of uncertainty. ***Whilst the reviewer agrees that the ongoing risk posed to recreational users is low to negligible, the indication to continue a closed exclusion zone 1 km south and 1 km north of the Umhlanga estuary mouth to such recreational and surfing activities is a sensible conclusion given the significant uncertainty on the fate of the unaccounted chemicals.***

Furthermore, the suggestion to restrict/ prevent harvesting of marine vertebrates or invertebrates from the region should remain in place i.e., all collection is prohibited until the determined levels of toxicity decline or until ongoing chemical/ biological monitoring of appropriate species that may be collected for consumption indicates a low risk of continuing toxicity/ health concern. Monitoring of toxicity, and concentrations of “indicative” determinants in selected biota/ sediments is recommended to continue for the foreseeable future until evidence indicates that continuing toxicity of discharges from the estuary are negligible.

The evidence statement for the overall summary of available reports is deemed “Moderate”.

The evidence statement is used as a narrative to provide an overview of the evidence synthesis as a means of bringing together what is known in relation to the incident and address any conceptual or empirical question – “is it safe to reopen the beaches around the Umhlanga Estuary”? A summary of the reviewed evidence is presented in Table 1 of Annex I.

This expert review has necessitated a quality and relevance assessment of the various reports and studies associated with informing this decision (the methodology is reported in Annex II) but entailed an extensive consideration of the evidence quality according to generally accepted criteria (within that approach to evidence) and a review specific to the evaluation based on the fitness for purpose of the review. A Weight of Evidence approach has helped the decision where the overarching outcome has been Moderate throughout.

Key recommendations as made in the reports were considered reliable enabling the explicit decision to be made based on the review of the specific method, and specific focus and context of each report. This approach has been applied to the review of quality and relevance in this appraisal process.

The use of an expert consultation and the additional evidence presented during this session enabled a reduction in the ambiguity of reporting and the apparent contradiction in some cases. To date, the available data provides considerable assurance in reaching the finding.

Following the request to review the available evidence there was a requirement to establish answers to some empirical questions in order to inform the finding.

The approach was to connect the sequence of events and understand the time frame of each activity or event during, immediately post and subsequent activities beyond the initial incident in order to understand the decision process and relevance and value of any intervention. The focus of a meeting of the specialists was to consider any unknowns to reduce the overall uncertainty in my finding. Through the consideration of the source - pathway – receptor conceptual model approach (see footnote¹). Additionally, the following questions were considered at the meeting:

What current activities are ongoing at the site? And are any steps being taken to further lessen future impacts?

Does the site still pose an ongoing hazard to the environment especially the safety of beach users?

Do we have a mass balance of the materials to determine how much of the material lost from the site has been accounted for?

How can we be reassured that the materials that were dispersed from the site during the incident no longer present an ongoing hazard (i.e., do we know their ultimate fate)?

What happens in future storm/flood events, or when the lagoon is dry?

These additional questions were addressed during the meeting of experts (see Annex III).

¹ **Footnote**

Using a conceptual model

The conceptual model looks at the source(s), pathways and receptors for input into the “marine” environment from all sources. It should consider the source, i.e., where the pollution can come from. The next step is to think about how the pollution can travel through the environment - the pathway. This should be as comprehensive as possible and not just the obvious pathways of air, land and water, there are many more such as animal dispersal and people. Finally, we need to consider the receptor of the pollution, who or what could be affected. For this, we need to be thinking of our selected environmental receptor(s) the beach, protected habitat etc. When using this model, we need to consider for each source that there are usually multiple pathways and receptors. In addition, some of our receptors may eventually act as additional pathways so the chain can continue past a basic source, pathway, receptor model.

Applying the model

This model can be used ultimately to implement controls or mitigation practices. The best place to put controls in place is at the source. Can the contribution be reduced in anyway? Assuming that source itself cannot be controlled is there any control that could be placed on for example, how to intercept the pollutant from getting into the environment and travelling through the pathway to the receptor. If you have done everything to stop the pollutant from entering the environment, we can start looking at the receptors. You can use this to protect receptors having identified the primary source of etc. impacting on overall water quality.

If you know where pollution can go and what it can affect, you can put measures into place to prevent the pollutant from getting into the pathways you have identified and/ or protect the receptors. Using this principle in reverse may also help to assist in identifying where the pollution may have originated from and take the necessary steps to remediate.

Overall, the source, pathway, receptor model can be used when you are assessing environmental risk and controls to minimise environmental performance. This exercise can be used to identify areas that need further action and or to help you develop robust emergency procedures (Disaster recovery) to enable the assessment of all of potential risks to the receptor?

A summary of the findings and indicative recommendations

The focus of this review was to assess the evidence confirming the recommendation to permit reopening of the beaches for recreational use including surfing. The findings of the experts were reviewed collating and corroborating the outcomes of the extensive data collection and robust interpretation of the results leading to the finding reported above.

Whilst the reviewer focused on this primary objective the following observations and recommendations are provided for onward consideration.

- It is considered likely that a significant although unquantified volume of the stored bulk material was decomposed/ lost through combustion processes during the initial fire. Therefore, any robust determination of the extant quantity of material lost to the environment is extremely difficult to predict. Mass balance calculations would be extremely difficult to undertake based on materials recovered. Therefore, there remains a potentially unknown quantity of material “unaccounted for”. It may be that the pulse of toxic material washed through the system and out to sea for onward dilution/ dispersion. But the evidence of ongoing toxicity suggest that a residual quantity of material was deposited in various media within the estuary itself. It is recommended that biological monitoring continues of appropriate media and that toxicity determinations are continued for the foreseeable future.
- It is uncertain whether this unaccounted burden of chemicals may reappear at some time in the future; possibly as a consequence of a flood event, a storm event, drought etc. It is likely that the nature of the vast majority of the organic compounds released will ultimately facilitate their environmental degradation.
- It is recommended that a collective review of the actions/ decisions and events post event are mapped and considered in an open and constructively critical assessment of steps that may be improved for managing any future such incident.
- The use of modelling tools to determine the necessary dilution, toxicity and dispersion of chemicals within the environment should be considered/ adopted in future scenarios.
- A disaster-recovery/ continuity plan should be developed to mitigate future similar incidents. Identifying who is responsible for what actions and when, clearly identifying required resources and mobilising technical specialists and advisors at the soonest opportunity. Including developing a registry of recognised experts.
- Biological monitoring should be considered to ensure ongoing safety for shellfish consumers.
- Consideration/ recognition of the role of firewater in potentially spreading chemicals into the environment. Developing or adopting best practice and future considerations on limiting environmental damage during firefighting. Including the consideration of necessary spill management, containment, drain blocks, mobile bunds etc.
- Identifying and developing contractual relationships with certified and competent analytical laboratories to enable rapid sample analysis. The quality of the evidence and the assumptions around exposure all hinge on the quality of the laboratory determinations. Understanding the methodological limitations of the reported information is fundamental to the decision-making process.

- Consideration of a well-maintained accessible pool of equipment to be used in future disaster recovery mitigation scenarios.
- Going forward and given the unprecedented nature of this incident it is important to instigate and develop awareness and develop a plan to mitigate future incidents including a process of inspection and training for fire firefighters and other responding emergency services. Including the use of combined exercises and scenarios.
- Ultimately there is a degree of uncertainty as to where the released chemicals may have distributed in the environment. On the basis of the evidence, it is unlikely that there is an identifiable human health concern. But further studies on the fate of the materials may be warranted recognising the complexity of the estuary's biology and respecting its protected designation.

Annex I

Table 1. A list of the reviewed documents, a summary of the review outcome, and a determined score in terms of the reported information (the criteria were; no evidence, weak evidence, moderate evidence or strong evidence). The confidence in the reported evidence is classified as high, moderate, low or very low. Very limited evidence has met the highest confidence due to insufficiency in reporting.

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
Jacques De Villiers	28/09/21	Source table Africa (FINDINGS OF A JOINT PRELIMINARY INVESTIGATION INTO THE COMPLIANCE PROFILE OF UPL SOUTH AFRICA (PTY) LIMITED CORNUBIA, KWAZULU NATAL)	E001	A provisional report - see E002	Moderate	Moderate
		Master Report - Compliance Profile V2 16.09.2021 J RIDL FINAL 27-9-2021	E002	<i>FINDINGS OF A JOINT PRELIMINARY INVESTIGATION INTO THE COMPLIANCE PROFILE OF UPL SOUTH AFRICA (PTY) LIMITED CORNUBIA, KWAZULU NATAL.</i> This reports the findings of the preliminary investigation by the multi departmental investigative team at the time of finalising the report	Moderate	Moderate
Jacques De Villiers	29/09/21	SAMPLING OF ESTUARY AND BEACH, WATER AND SEDIMENT, FOR PESTICIDES, METAL AND ECOLOGICAL TOXICITY mer 2021 Forbes N	E003	A significant document that outlines the approach and the time line of subsequent activities including sampling and contains an explicit description of	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				the activities undertaken at the site given the uncertainty of the situation.		
		2 Verdoorn GH COMPARATIVE INTERPRETATION OF ACUTE AND CHRONIC TOXICITY OF MSMA AND ARSENIC FOR BEACH SEDIMENTS AND SEA WATER	E004	A summary of beach and water sediment determinations and a trend report.	Moderate	Moderate
		3. Gulumian M Health Risk Assessment of contaminated UPL site beach report	E005	An extensive determination of the risk posed to human health from exposure to Arsenic/MSMA. The author concluded that there was no possible risk of adverse effects from acute oral exposure. No possible risk of adverse effects from chronic oral exposure. And reported no possible cancer risk from dermal exposure to inorganic arsenic. MSMA dermal toxicity has been shown to be negligible. Also reporting there is no possible risk of adverse effects from oral	Moderate evidence	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				exposure from Tebuthiuron. I caution against the use of the word “no” risk and this should be replaced with low or preferentially negligible risk. There is no situation where no risk is an option.		
		Apex MER GP NIOH Report Beach Re-Opening_A19519_23 September 2021. Signed and Sealed	E006	UPL FIRE INCIDENT: SPECIALISTS' CONSOLIDATED REPORT ON OPENING OF BEACHES AROUND THE UMHLANGA ESTUARY; a summary of the findings at that time and an approach to reopening the beaches	Moderate Evidence	Moderate
		CURRICULUM VITAE Gerhard Verdoorn	E007	CV	Strong evidence	High
		CURRICULUM VITAE M Gulumian	E008	CV	Strong evidence	High
		CURRICULUM VITAE S Chester	E009	CV	Strong evidence	High
		UPL Cornubia - FINAL Product Volumes and Classification 05-08-2021	E010	A list of final product volumes and classification	Weak	Weak

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
Jacques De Villiers	04/10/21	2 Sky side Compendium Report (updated weekly)	E011	A detailed and extensive summary of air quality samples, report and recommendations	Moderate	Moderate
		1996 Water Quality Guidelines for Coastal Marine Waters	E012	Published South African Water Quality Guidelines for coastal marine waters Volume 1 Natural environment	Strong	High
		2021-09-06 Arysta - UPL Warehouse Fire ESA Report	E013	A summary report identifying data gaps, summarising the available analytical data at the time of reporting and identifying and utilising the source pathway receptor model.	Moderate	Moderate
		Arsenic in the ocean paper (Chapter 3 Arsenic)	E014	A published book chapter by Neff on arsenic in marine waters. Published, presumed peer-reviewed.	Moderate	Moderate
		UPL warehouse fire MER Briefing Memo UPL Fire and Spill	E015	An initial list of short- and longer-term recommendations on dealing with the spill	Moderate	Moderate
		MER Recommendations estuary mouth and beach reopening 22 Jul 21 corrected	E016	A brief summary recommendation on status of the estuary and beach opening	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
Jacques De Villiers	04/10/21	Estuary and Marine sampling sites (MER UPL Centre)	E017	An image of the estuary and coastal sampling points	Moderate	Moderate
		uMhlanga_UPL_27Jul21	E018	A PowerPoint presentation of the summary findings and activities being undertaken in response to the spill	Moderate	Low-Moderate
		Copy of Verdoorn 2021a_Nicky analytical report estuary GH Verdoorn interpretation and comments 18 Aug 2021(1) (Excel)	E019	An interpretation by Dr Verdoorn on the significance of the laboratory findings.	Moderate	Moderate
		Verdoorn 2021b_Report Dr Gerhard H Verdoorn 24 August 2021	E020	An interpretation by Dr Verdoorn on the significance of the laboratory findings.	Moderate	Moderate
		Copy of Verdoorn 2021c_INTERPRETATION OF ACUTE AND CHRONIC TOXICITY OF PESTICIDES FOR BEACHES AND SEA WATER FOCUS ON MSMA 24 Aug 2021(Excel)	E021	An interpretation by Dr Verdoorn on the significance of the laboratory findings.	Moderate	Moderate
		Recommendation on opening of beaches around the Umhlanga Estuary Verdoorn 2021d	E022	An evaluation of the available data recommending an approach to reopening the beaches.	Moderate	Moderate
		Water quality guideline 2018	E023	South African Water Quality Guidelines for coastal marine waters Vol 1 Natural	Moderate	High

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				Environment and Mariculture use		
Jacques De Villiers	05/10/21	FEEDBACK TRACKER_BEACHES PEER REVIEW_PROF J WEEKS	E024	Internal quality control document not assessed	-	-
		4 Coastal sampling points (Jpeg)	E025	An image of the coastal sampling points	Moderate	Moderate
		Copy of 4 Talbot results_004944y21 (Excel)	E026	A detailed list of determinants. Analysis is based on samples as received, no evidence of chain of sample custody. No indication of which methods were accredited by SANAS and which were not, all or none?	Low - Moderate	Low - Moderate
		4 UIS and Element Results	E027	Analysis test report of samples. The data is reported by an analytical laboratory and analytical methods described. It is noteworthy that not all analysis were undertaken to an accredited standard and that the laboratory is not certified for drinking water analysis and that many of the samples received were beyond	Low - Moderate	Low - Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				sampling time receipts. There is limited information on chain of custody of samples collected.		
		Certificate of analysis c 004944_21	E028	A detailed list of determinants following GC-MS. Noted that inappropriate sample vials were used. Analysis is based on samples as received no evidence of chain of sample custody. No indication of which methods were accredited by SANAS and which were not, all or none?	Low - Moderate	Low - Moderate
		e INTERPRETATION OF ACUTE AND CHRONIC TOXICITY OF PESTICIDES FOR BEACHES AND SEA WATER FOCUS ON MSMA 24 Aug 2021	E029	An interpretation by Dr Verdoorn on the significance of the laboratory findings.	Moderate	Moderate
		e Report Dr Gerhard H Verdoorn 24 August 2021	E030	A commentary by Dr Verdoorn interpreting the significance of reported analytical outputs.	Moderate	Moderate
		f Apex Letter. RE Beach Sampling and Re-Opening. A19519. 25 Aug 2021	E031	A summary report recommending the continued closure of the beaches	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
		g Apex Environmental. Letter to KZN Sharks Board	E032	Advisory note on safety of workers attending to drumlines.	Moderate	Moderate
		Estuary and marine sampling sites MER_UPL Centre (Duplicate?)	E033	A pdf containing images and locations of which sample location, identifying which samples were collected, when and where.	Moderate	Moderate
		25-08-21 S30 Weekly Report Final	E034	A weekly summary of activities as coordinated across the various entities including updates on samples collected	Moderate	Moderate
Jacques De Villiers	05/10/21	01-09-21 Weekly Report Final	E035	A weekly summary of activities as coordinated across the various entities including updates on samples collected	Moderate	Moderate
		Final 22-09-21 Weekly Report	E036	A weekly summary of activities as coordinated across the various entities including updates on samples collected	Moderate	Moderate
		29-09-21 Final Weekly Report	E037	A weekly summary of activities as coordinated across the various entities including	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				updates on samples collected		
		Lab Test Report c 210902 VM24719 (2)	E038	A report of more than 60 pesticides/ herbicides determined by LC-MS/MS in collected samples. There were no reference standards Available. Screening was for presence/ absence using data published in the open literature.	Low-Moderate	Moderate
		a Recommendation on beach opening Dr Gerhard H Verdoorn 2 September 2021 (1)**	E039	A detailed independent analysis of the available date with an indicated statement on reopening the beaches	Moderate	Moderate
		Apex Letter. Beach Re-Opening and Sharks Board. A19519. 3 September 2021. vers 3 (5)	E040	A LETTER DETAILING THE ONGOING LEVEL OF RISK TO HUMAN HEALTH IF THE BEACHES WERE TO BE REOPENED BASED AROUND THE USE OF THE DATA COLLATED.	Moderate	Moderate
		b MER UPL Estuary Marine Beach sampling_2 Sept 21_small (1)	E041	A detailed report considering the toxicity to fish and invertebrates in the estuary and inshore marine	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				environment attributing the observed mortality and inherent toxicity of the estuary to the UPL warehouse incident		
		c 2021-08-27 Element 21-12114 Report	E042	Analysis test report of 59 samples. The data is reported by an analytical laboratory and analytical methods described. It is noteworthy that not all analysis were undertaken to an accredited standard and that the laboratory is not certified for drinking water analysis and that many of the samples received were beyond sampling time receipts. There is limited information on chain of custody of samples collected.	Low - Moderate	Low - Moderate
		Revised recommendation MG 4 September 2021	E043	Calculation by Prof Gulumian on the determined risk posed by ingestion of soil contaminated with inorganic arsenic. I challenge the use of the phrase "no possible risk	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				of" to be replaced with negligible risk as a more standardised and accepted terminology. Also, recognising the additional recommendation of Prof Gulumian.		
		g Apex Environmental. Letter to KZN Sharks Board (2)	E044	A letter recommending appropriate use of PPE and communicating the level of anticipated risk to workers during the recovery of drumlines.	Moderate	Moderate
		f Apex Letter. RE Beach Sampling and Re-Opening. A19519. 25 Aug 2021 (1)	E045	An indication to consider a precautionary approach to reopening the beaches.	Moderate	Moderate
		d INTERPRETATION OF ACUTE AND CHRONIC TOXICITY OF ARSENIC ANALYTICAL RESULTS 2 SEPTEMBER 2021 (1)	E046	A clearly described approach to considering both acute and chronic toxicity using an established approach, relevant standards and approach.	Moderate	Moderate
		MER SOW	E047	An outline scope of work detailing focus areas for describing the effects of the UPL spill on the local environment.	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
		Apex Human Health Risk Assessment Scope of Work 8 Sept 21	E048	Determination of a human health risk assessment to determine the nature and extent of any potential adverse human health impact (acute and chronic exposure)	Moderate	Moderate
		20210723 Baseline sampling (002) (Jpeg)	E049	An image of the UPL baseline spillage sampling locations	Moderate	Moderate
Fuad Davids	07/10/21	4 River sampling sites_ (002)	E050	Visual depiction of sampling locations along the catchment	Strong	Moderate
		Appendix 4 Water Science report	E051	Summary weekly activity list for 16 September 2021	Moderate	Moderate
		Copy of 6 Annexure 2 Compounds selected as targets for analysis human and environmental health effects and potential risk phrases 17 August	E052	A DETAILED LIST OF COMPOUNDS OF CONCERN TO BE ANALYSED FOR DISSIPATION AND DECOMPOSITION (BREAK DOWN) TRENDS, AND POTENTIAL RISK PHRASES	Moderate	Moderate
		5 Summarised Results of the Initial Sampling Event (PowerPoint)	E053	An overview of initial downstream chemical concentrations in water, sediments and soils for a selected range of	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
				contaminants in samples collected downstream of the incident. Concentrations were compared against internationally accepted thresholds for human toxicity. Summary conclusions supported.		
Fuad Davids	07/10/21	1 GT1231 UPL SOP for river cleaning Ver 2	E054	Describes the method for cleaning downstream from the UPL site	Moderate	Moderate
		2 Carbon barriers SOP	E055	An SOP for the provision of carbon barriers	Moderate	Moderate
		Copy of mount Edgecombe (Excel)	E056	Corrupted document not assessed	-	-
Jacques De Villiers	08/10/21	Copy of UPL Cornubia Inventory List - 29-09-2021	E057	A list of chemicals housed in the warehouse at the time of the incident	Weak	Weak
		Assessment of additional plant protection product volumes in the UPL-Ltd Cornubia Inventory Verdoorn. 29.10.21	E058	A considered evaluation of the list of final product volumes and classification undertaken to ascertain their likely toxicities, persistence and environmental fate.	Moderate	Moderate
		EDTEA. Add Volumes. 07.10.2021	E059	An augmented list of stored products from the warehouse.	Moderate	Weak

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
Fuad Davids	08/10/21		E060	Sent email containing same docs as Jacques	-	-
Jason Weeks	08/10/21	Meeting Agender Monday, 11 October 2021 at 14:30 South African time. Duration up to 3 hours.	E061	Outline of workshop/ discussion agenda	-	-
Fuad Davids	08/10/21	Email correspondence Dear Jason, I checked with Jacques and we are pretty sure that there is no asbestos. I will send the meeting invite now and I will attach your outline. We are quite fine to use it as is.	E062	A dialogue to ascertain/understand if there was any asbestos released during the incident.	-	-
Fuad Davids	06/10/21	From: Raj Sewsunker < Madhankumar.Sewsunker@durban.gov.za > Sent: Wednesday, 06 October 2021 09:12 To: Andrew Mather < Andrew.Mather@durban.gov.za > Cc: Bruce Degier < Bruce.Degier@durban.gov.za > Subject: RE: URGENT: UPL spill and fire response Hello Andrew, My sincere apology for the delay in providing the requisite info. The staff that had attended the incident were off duty on their rest days and returned on duty this morning. In response to the question regarding the approximate quantity of water used by the fire department on the fire for the duration of	E063	Indicative estimate of the total volume of firewater and storage water released during the incident: 300,000 firewater 500,000 storage tank* 500,000 storage tank* Ca. total release 1.300,000 litres of water dispersed during the incident. *Assuming both were full.	Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
		<p>the incident: Approximately 300 000 litres used by the fire department for the entire duration of the incident.</p> <p>It is important to note though that there were 2 water storage tanks on site that were feeding the Sprinkler installation and fire hydrants inside the warehouse. Each tank contained 500 000 litres of water. When the roof collapsed, the entire plumbing inside the warehouse that was connected to the 2 tanks had sheared off causing the entire contents of the 2 tanks to empty out into the warehouse causing a huge flood of water that had washed away whatever was in its path in the warehouse down the drain, 1000 000 litres of water.</p> <p>Second question of the maximum temperature of the flames: We unfortunately cannot provide an estimate but safe to say that it was hot enough for the firefighters to retreat and hot enough to weaken the steel roof structure causing it to collapse.</p>		<p>The lowest point at which carbon steel will melt is 1130°C, (although 0% carbon steel won't melt until 1492°C). Regardless of the type of steel, it will usually be completely liquid by approximately 1550°C. It is unlikely that these temperatures were reached during the fire. Given the evidence on the integrity of the structural steel frame which can withstand approximately 425°C before it begins to soften and between 600°C and 650°C, the steel will lose half of its strength, and will pose a risk of failing (depending on the load it bears). It may be considered that the fire sustained a temperature of at least 600-650°.</p>		
Fuad Davids	12/10/21	Catchment map jpeg/ and UPL Site status ppt as used at the meeting of specialists	E064		Moderate	Moderate

Source	Date received	Title	Code	Summary of document	Scoring of evidence	Confidence of the reported evidence
	15/10/21	Meeting of specialists in order for Prof. Weeks to gain clarity on activities during his peer review of the beach reopening report.	E065/66	Agenda/ minutes of the meeting of specialists.	-	-

Methodology adopted for the overview of the reported evidence.

In order to reach a level of confidence in making a recommendation on the decision to reopen the beaches, as reviewer I needed to satisfy myself on the quality of the available evidential reports and the interpretations of the chemical determinations undertaken on a variety of collected environmental samples. In addition to the consideration of the significance of any ongoing ecotoxicity determinations. It was also important to establish a temporal view of what occurred at the time of the incident and the subsequent events and activities thereafter. Moreover, my initial concern was to establish any ongoing risk to both human and environmental health in the immediate vicinity of the site. In order to accomplish this stated task consideration of “all” available evidence needed to be undertaken. This documentation proved to be extensive. Sufficient confidence in the reliability and credibility of the scientific evidence as supplied addressing any concerns on the significance and importance of each specific piece of that evidence in relation to the overall conclusion and recommendation made as a whole were required to be met. The reliability of the evidence including its accuracy, integrity and finally its credibility were considered. The approach adopted is described below.

Reviewing research evidence

Reviewing such scientific evidence is an explicit, systematic and transparent process that can be applied to both quantitative (determined and observational) and qualitative information. The key aim of my review was to provide a summary of the relevant evidence to ensure that the authorities can make a fully informed decision about its recommendations. It was my task to summarise the evidence and its limitations so as to agree or disagree with the current interpretation and make appropriate recommendations, even where there remains uncertainty.

Evidence in the form of reports, and data have been identified and provided from a range of sources. This evidence is itemised (see Annex I) and was both extensive and exhaustive in its breadth and depth of coverage. The most relevant documents containing the most appropriate information to answer the review question were selected and summarised in the full report. The evidence review involved 6 main steps:

- Developing a review protocol
- identifying and selecting relevant evidence
- critical appraisal
- extracting and synthesising the results
- assessing quality/certainty in the evidence

and finally,

- interpreting the results.

Identifying and selecting relevant evidence

The process of selecting relevant evidence is common to all evidence reviews. The same rigor was applied to all data received, as supplied by stakeholders. Care was taken to ensure that multiple reports of the same study were identified and ordered to ensure that data extraction was as complete as possible. A simplified process of evaluating the relevance of an individual piece of evidence/report was to ensure that each met basic inclusion criteria (added value to informing the decision). Once screened full versions of the documents were obtained or requested for assessment. Studies

that failed to meet the inclusion criteria in terms of relevance once the full version has been checked were excluded at this stage.

The study selection process includes full details of the reason for the inclusion or exclusion of any reported evidence. Each study if excluded after checking the full version is listed in Annex I, along with the reason for its exclusion.

Ensuring relevant records were not missed

The review was based around the consideration solely of the received evidence as recorded in Annex I. All data was quality assessed in the same way as if a published study. Any grey literature was also quality assessed in the same way as published literature, although because of its nature, such an assessment was more difficult.

Assessing quality of evidence: critical appraisal, analysis, and certainty in the findings

Assessing the quality of the evidence required a systematic process of assessing potential biases through considering of both the appropriateness of the study design and the methods undertaken within the study (critical appraisal) as well as the certainty of the findings.

The approach adopted is documented in the full review together with the reasons for the choice. If additional information was needed to complete the quality assessment, this request was communicated.

Critical appraisal of individual reports

Every document was appraised using the following checklist.

Certainty or confidence in the findings of reported information

The certainty or confidence in the report (evidence) findings was considered using the following features for the reported evidence:

- study limitations (risk of bias) – the internal validity of the evidence
- inconsistency – the heterogeneity or variability in the estimates of treatment effect across studies
- indirectness – the extent of differences between the intervention and outcome of interest across reports
- imprecision – the extent to which confidence in the effect estimate is adequate to support a particular decision
- other considerations – bias, the degree of selective use of evidence in the studies.

the following features for the reported evidence were additionally considered for each:

- methodological limitations – the internal validity of the evidence
- relevance – the extent to which the evidence is applicable to the context in the review question
- coherence – the extent of the similarities and differences within the evidence
- adequacy of data – the extent of richness and quantity of the evidence.

Each report included in the evidence review has been critically appraised.

Analysing and considering reported analytical data

Consideration of the appropriateness and quality of the reported information from analytical or toxicity determinations considered the reported analytical methodology, the appropriate use and reporting of standards and the presentation and synthesis of the results from the analytical laboratories.

Analysing results from predictive models

There is currently no general consensus on approaches for synthesising evidence from studies on predictive models e.g., dispersion/ dilution etc. A narrative summary of the quality of the evidence as given, and based on the quality of the criteria as used to inform the model outcome was evaluated.

Analysing results of qualitative evidence

Qualitative evidence as assessed occurs in different forms or formats necessitating different methods for synthesis. A narrative summary was considered sufficiently adequate.

Evidence statements have not been considered for qualitative reports as the synthesis of qualitative data as such do not report on the impact of an intervention or decision on outcomes. Instead, if such evidence is commented upon it will be based on a summary of the evidence, its context and quality, and the consistency of key findings and themes across such reports.

The certainty or confidence of the reported evidence

The certainty or confidence of the reported evidence has been classified as high, moderate, low or very low. The contextual setting for this, can be interpreted as follows:

- **High** – further research is very unlikely to change the recommendation.
- **Moderate** – further research is likely to have an important impact on confidence in the estimate of effect and may change the strength of the recommendation.
- **Low** – further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the recommendation.
- **Very low** – any estimate of effect is very uncertain and further research will probably change the recommendation.

Summary of the evidence

A short summary narrative of the evidence is reported in Annex I; this annex also identifies and describes any gaps in the evidence. A final evidence statement is also provided as an aggregated summary of all of the relevant reports, regardless of their findings. This considers the balance of the evidence, and its strength (quality, quantity and consistency, and applicability). The evidence statement summarises the key aspects of the reported information but also highlights where there is a lack of evidence (note that this is different to evidence for a lack of effect).

The evidence statement is structured to assist in prioritising the recommendation. The statement informs whether or not there is sufficient evidence (in terms of strength and applicability) to form a judgement on the overarching quality of the reported information as to;

- whether (on balance) the evidence demonstrates that a decision, is likely to be effective or ineffective, or is inconclusive
- the size and likely effect and associated measure of uncertainty

The evidence statements for each report include summary information about the:

- content of the report, key findings (for example, what, how much, where?) and comparisons, or factors of interest
- number of samples analysed, and setting(s) (for example, location)
- outcome(s), effect (or correlation) and the size of effect (or correlation) if applicable
- strength of evidence (reflecting on the appropriateness of the study design to answer the question and the quality, quantity and consistency of evidence)
- applicability to the question, people likely affected by the incident or decision.

The evidence statement will also summarise when relevant information about:

- whether the intervention has delivered
- what affects the intervention achieving the desired outcome.

Additionally, where there is no evidence identified for a critical or important outcome such is also included using the following criteria:

No evidence (Note that no evidence is not the same as evidence of no effect.)

Weak evidence.

Moderate evidence.

Strong evidence.

These terms have been used consistently in the review and their definitions reported.

Weight of Evidence

The evidence statement is used as a narrative to provide an overview of the evidence synthesis as a means of bringing together what is known in relation to the incident and address any conceptual or empirical question – “is it safe to reopen the beaches around the Umhlanga Estuary”? This expert review has necessitated a quality and relevance assessment of the various reports and studies associated with informing this decision. In considering how such a decision is reached there is a distinction between the generic judgement of evidence quality according to generally accepted criteria (within that approach to evidence) and a review specific to the evaluation based on the fitness for purpose of the review. A Weight of Evidence approach has helped in pooling the reports that are being used in evaluating evidence by enabling explicit decisions to be made on the consideration of the generic method, a review of the specific method, and a review of the specific focus and context of the report. This approach has been applied to the review of quality and relevance in this appraisal process. By being explicit about these quality and relevance judgements on the appropriateness of the evidence then allows the empirical decisions to be made.

<u>MINUTES OF MEETING</u>			
<u>Session</u>	Meeting of specialists in order for Prof. Weeks to gain clarity on activities during his peer review of the beach reopening report.		
<u>Date:</u>	11 October 2021		
<u>Time:</u>	14h30– 17h30 (South Africa Time)		
<u>Venue:</u>	Microsoft Teams		
<u>Attendees:</u>	Alfred Matsheke (EDTEA)	Joyce Hammond (eThekwini)	S Lamberth
	Andrew Mather (eThekwini)	Kenneth Boyers (UPL)	Santosh Bachoo
	Andy Blackmore (KZNWildlife)	Khalid Mather (UPL)	Sean Chester (UPL)
	Anthony Forbes (UPL)	Leon Pretorius (UPL)	Tandiswa Jacobs (DFFE)
	Cameron McLean (eThekwini)	Lucian Burger (UPL)	Thembeke Mthuli (KDM)
	Fuad Davids (HSG)	Mahabeer S	Victoria King (UPL)
	Gerhard Cilliers (DFFE)	Mark Graham (UPL)	Yugeshni Naicker (EDTEA)
	Gerhard Verdoorn (UPL)	Mary Gulumian (UPL)	
	Grant Walters (DFFE)	Nicolette Forbes (UPL)	
	Greg Mullins (eThekwini)	Norman Brauteseth (UPL)	
	Jane Tennet (HSG)	Omar Parak (EDTEA)	
	Jason Weeks (IEH)	Quentin Hurt (UPL)	
	Jeremy Ridl (HSG)	Rupert Sebire (UPL)	

	Agenda item / Discussion point	Comment / Actions
1.	<p>Introductions</p> <ul style="list-style-type: none"> - Tandiswa Jacobs welcomed all attendees and commenced a round of introductions amongst attendees. - Fuad Davids noted that the meeting is being recorded for the purposes of minute taking and the recording will be available once the meeting is closed. - Prof. Weeks thanked all specialists for availing themselves to attend the meeting and commended the quality of specialists and reporting that has been produced. 	

	<p>Approach</p> <ul style="list-style-type: none"> - Prof. Weeks provided a background on the approach that he is taking during the peer review of the beach opening document - This meeting is to provide feedback from the specialists on the tasks that have been conducted since the incident and approaches implemented to ensure that a repeat situation does not happen should a flooding or flushing situation occur. - Source, pathway and receptor approach, <p>Agenda</p> <ul style="list-style-type: none"> - The agenda that was distributed and utilised more for steering the discussion as not all agenda items required attention 	
2.	<p>Introduction to the “incident” an immediate step taken during and immediately thereafter</p> <ul style="list-style-type: none"> - Tandise Jacobs, as head of the estuarine, coastal and marine cohort provided a background to the incident of 12 and 13 July 2021. - Tandise provided the main concerns at this time, including environmental, health and ecological matters. What was further alarming also was the fish kill and other marine living resources. - Following the release of the UPL Specialist’s beach opening report, the Cohort felt that they did not have the necessary expertise in terms of determining if it is/ was safe to open the beaches and allow recreation and bathing, thus they requested a peer review of the report. - Current status: <ul style="list-style-type: none"> o The beaches are currently still closed for bathing and recreation. o The embargo on harvesting marine living resources is in place since 16 August 2021. o The formulation of an integrated remediation strategy is still awaited from UPL’s specialists. 	
3.	<p>Current site Status</p> <ul style="list-style-type: none"> - Vicki King, specialist for UPL, shared a presentation with all attendees demonstrating the steps taken by UPL’s environmental team and additional measures that have been taken to ensure that a flooding or flushing of the water course does not occur. - Incident actions include: <ul style="list-style-type: none"> o Containment o Clean up (<i>still in this phase</i>) 	

	<ul style="list-style-type: none"> ○ Remediation ○ Impact Assessment ○ Rehabilitation and Monitoring <p>These tasks may occur concurrently.</p> <ul style="list-style-type: none"> - The rehabilitation action plan has not been provided as yet due to the team still grappling with the best solution. With the complexity of the chemistry this will possibly be an ever-changing plan. - The team, with regards to action plan development, uses science as well as observations to drive remediation and rehabilitation; they are also busy with revegetation trials; they are engaged with the authorities to provide input; there is also continuous and ongoing discussion especially with Dr. Verdoorn due to the complexity of the chemicals. - It is difficult to say the quantity of what products were burnt in the fire and / or what has washed away in the fighting of the fire. Therefore, assumptions have been determined for the modelling. - It was noted that the situation is a dynamic, complex and is a constantly changing situation. - The presentation is available on request. - Prof. Weeks thanked Vicki for the presentation and the information contained therein. This provided him with a lot of background and status quo information which will assist with his determination and peer review of the beach opening report. 	
	<p>Questions</p> <ul style="list-style-type: none"> - Following the presentation, Prof. Weeks determined that much of the information required had been provided in this presentation. Therefore, it was agreed that Prof. Weeks would ask any further questions and specialists could respond as necessary. <p><u>Air</u></p> <ol style="list-style-type: none"> 1. Is it possible to determine the dispersion activity? <ul style="list-style-type: none"> ○ It was noted that it is difficult to determine the quantity of products, temperature of the fire etc., therefore specialists have been working on an unknown quality. 2. Is it possible to assume a percentage that has likely been spread into the environment? <ol style="list-style-type: none"> a. Lucian: <ul style="list-style-type: none"> ○ It was difficult to assume a percentage, but firstly a 50% percentage was initially utilised. ○ However, this was adjusted and the following figures used: 	

It is likely that 65% compounds could have been involved in the fire, therefore 35% could have been involved in the water flow.

Further it was estimated that 1-10% of the pesticides didn't burn but went up with the bloom.

3. Was there continued deposition considered at the time?
 - a. Lucian
 - Did look at and identified approx. 60 compounds that could have been released. This is comprised of criteria pollutants, dioxins, POH's, gaseous austrations, fallout, pesticides. Also looked at more complex structures.
 - Total deposition pattern which could then be used for sampling locations. Air concentrations could only be compared with the records from several days later.
 - Estimated that the fire was fierce for first few hours, flaming conditions for approx. 48 hours and smouldered for 6 days.
 - The pollutants that have been calculated reflect these conditions and cover air concentrations and depositions.
4. Does the on-going monitoring suggest that there is no continuity of this?
 - a. Lucian:
 - Yes, however, earlier on there could have been evaporation due to the residue.

Estuary & Tributaries

1. Approx. what percentage of substance/ physical material /sediments has been carried on down the tributary?
 - a. Nicky
 - The substance came through on 15/07/2021. There was flow through the system due to a rain spike.
 - The estuary was open at the time so flow went in to the sea – this continuing feed from the top to the bottom has continued over a time until the team started removing substances.
 - There was a lot of dilution that occurred through the system.
 - It is difficult to quantify.
 - There was a large pulse, shown by the color and biotic response, which tapered off due to movement in the system and marine dilution. There has not been a same sort of response again.
 - In the partitioning between water and sediment much of the products are still soluble, moving in the system

and sitting in the water. At an estimated 3.5-4:1 ratio (water to sediment). It is believed that this is contributing to the dilution of the materials.

Salinity

1. What is the salinity of the habitat/ catchment area?
 - a. Nicky
 - Rather variable
 - The estuary is an intermittently open estuary which does close naturally periodically.
 - The estuary has been open since the end of August and should be closed through the winter.
 - The salinity
 - Bottom waters 15-21 with freshwater over the top. There is a gradient (top to bottom)
 - Top waters still have quite a saline content.

2. Is there a likelihood that we will get a limited flow / closure of the estuary, and a concentration of contaminants where this may impact the beach area, when the estuary reopens?
 - a. Nicky
 - The tributary that was contaminated is one of a matrix of tributaries. Therefore, a large dilution effect from the rest of the catchment occurs. This will raise water levels if mouth was closed and would still have a diluting effect.
 - Nicky can provide catchment map showing the other tributaries.
 - Sampling has occurred after two natural breaches and three times in an open mouth situation.
 - Still a lot of toxicity in the system and immediate beaches to the river mouth and estuary. However, this is related to toxicity in sea organisms e.g. sea urchin eggs.

 - b. Gerhard
 - One hypothesis is that we should see more pesticide residue in the water than compared with the sediments. Due to the pesticides were already in commercial formulations and therefore suspended in the water.
 - At a site visit last week it was noted that there was a notable smell and visible evidence of an emulsifying agent in the system.
 - There is an increase in the concentration of the pollutants at the inlet of the estuary and then an arm

going towards the south end of the estuary, where there is a definite spike in the contamination levels of pesticides in suspension in the water.

- Granular insecticides did not seem to burn off and are in high concentration compared to others. From a chemical perspective from the results with the blind calculations the results could be observed at site.

Ground-water

1. Is there any borehole or abstraction points or drawing of any aquifers occurring?
 - a. Rupert
 - Fortunately, the area is a well-developed rural area with only a few farm homesteads left.
 - The bulk of the area is supplied with bulk potable water supply.

Environment

1. As the area is a sensitive habitat, are the impacts continuing?
 - a. Mark (fresh water)
 - Continuing and at regular spots of freshwater and sediments a range of toxicity tests from a trophic level have been conducted, there are still residuals in the system that are showing high toxicity.
 - Ostracods in the sediments are class 5 toxicity through the entire system,
 - Risk region two above the estuary is showing a reduction in results.
 - Residual toxicity in the Ohlanga itself, which is contributing some stressors into the system. These haven't been identified but are present.
 - Various tests and monitoring are still being conducted.
2. Is there a single group or element that is accounting for issues or is it just due to the mix that has occurred?
 - a. Mark:
 - At this stage it is simply looking at the chemistry and looking to see which of those are giving the most problems.
 - It appears that the herbicides are probably most problematic
 - But residuals are still at too high a level that we cannot differentiate.
 - b. Nicky (Estuarine)

	<ul style="list-style-type: none"> ○ MER are keen to identify where the toxicity is coming from. There is a full suite of test being completed in the estuary, sediment and water including toxicity tests. ○ Biologically sampling is being conducted monthly. ○ There has been a bit of change in the toxicity results over the last 3 months. ○ Observation: Toxicity is still high, but the time to death is changing. <p>3. Have samples been taken upstream from the sites?</p> <ul style="list-style-type: none"> a. Nicky & Mark <ul style="list-style-type: none"> ○ Yes, there have been sites on the main steam of the Ohlanga River, both above and below the spill. b. Gerhard <ul style="list-style-type: none"> ○ There have been surprising results where chemicals which should typically react in one manner have not reacted in that matter. <p>4. What was the basis of selecting the products/ chemicals which have been tested?</p> <ul style="list-style-type: none"> a. Gerhard: <ul style="list-style-type: none"> ○ In the documents that have been provided the reasoning has been provided, this included consulting the products list for the following: <ul style="list-style-type: none"> ▪ Quantity of the product. ▪ Potential haemo-toxicity ▪ Environmental toxicity ▪ Which of these has the potential and long-term impacts ○ A matrix has been utilised to monitor and guide this decision. ○ As a scientist we are more interested in the trend rather than an individual result. ○ This matrix did not include products which would not 'survive' due to half-life, radiation, water exposure etc. ○ Wetland serves as buffer to serious pollution and to prevent polluting of estuary and beaches. b. Nicky: <ul style="list-style-type: none"> ○ Testing is being conducted for approx. 55 pesticides ○ Only 4 were only in traceable levels. ○ Even though only 4 were present, they are still aware of any other pesticide that might be present. They only reported on the detectable pesticides. 	
--	---	--

	<p>5. Are there materials taken or consumed or recreationally taken from the beach area?</p> <p>a. Nicky:</p> <ul style="list-style-type: none"> ○ There is some commercial harvesting of bivalves (oysters) to the north of the estuary, only one spot to the south, however, most people do not. ○ North of the river there is several spots where mussels and other specimens are taken, some bioaccumulation of metals and pesticides have been found in these specimens. ○ With respect to reef organisms, some initially did pass in the initial flush however these does not seem to be a further issue and no further signs of distress have been evidenced. ○ All beaches are closed currently. There is a moratorium on collection of marine specimens in place. ○ New data have only come in and are still being analysed. ○ The 2nd data point might change perspective, however Dr. Verdoorn and Prof. Gulumian still need to analyse. <p><u>Questions for Prof. Weeks</u></p> <ul style="list-style-type: none"> - No questions were directed to Prof. Weeks. 	
General & Closure		
	<p><u>General</u></p> <ul style="list-style-type: none"> - Prof. Weeks thanked all attendees and the specialists for their contributions and input into the discussion. - Vicki was requested to forward the presentation to Fuad Davids. - Nicky was requested to forward the catchment map to Fuad Davids. - Tandiswa Jacobs thanked all participants for attending and for their contributions and closed the meeting <p><u>Closure</u> Meeting closed at 16h15 (South African time)</p>	<p>Vicky will send to Fuad and he will forward to Prof. Weeks and Tandiswa</p>