

Residual Chemical Toxicity in Used Steel Drum Containers:

Health Impacts on Steelpan Builders

by

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Abstract

Residual Chemical Toxicity in Used Steel Drum Containers: Health Impacts on Steelpan Builders is a study from an insider's perspective about residual toxic chemicals in the traditional steelpan musical instrument building. Steel drums originally were meant to be just storage containers for oil and industrial chemicals, but they emerged as the raw materials to make steelpans in the 1930s. Toxicity problems arise because steelpan making in backyards cannot be classified under a hazardous workplace regulation, therefore steelpan makers are not obligated to observe environmental guidelines. I decided to investigate the core of this problem, by doing collaborative action research with two Trinidad and Tobago based individuals: one a steelpan builder and the other a steelpan tuner. My third collaborator is a steelpan player/ educator based in Canada. I wanted to include persons who experienced consequences of the toxins found in their workplaces, or individuals who are acquainted with persons who may have died from toxins in the workplace. The study results showed that there is validity in the accounts of interviewees whose stories proved consistent through data triangulation for reliability. The research findings showed that the process of building steelpans was very similar in different settings and in various locations. The study also showed that there are environmental impacts on the biosphere from steelpan building and the people most affected by toxins are the steelpans builders themselves. Results from the study indicate the need for further collaborative research with medical professionals collecting data by way of blood samples, health records of steelpan workers and residents living close to steelpan manufacturing areas. This approach will help determine if those who are deceased may have been inadvertently harmed by their work in steelpan-making, and

provide the basis for proper interventions to buck the trend. Pan Trinbago should place emphasis on getting the message out to its constituent members regarding the prevention of industrial hazards and accidents through proper outfitting of steelpan making facilities. As the world governing body of steelpan, Pan Trinbago should endorse EnviroPan, with its focus on green concepts for steelpan in the form of a directive to all globally affiliated steelpan associations. This is to ensure steelpan-makers have access to clean raw materials when utilizing used steel drum containers for their craft. EnviroPan has designed a mobile modern steel drum cleaning facility to assist with proper waste chemical storage and disposal, followed by an enclosed high pressure steam cleaning processes for the safety of steelpan frontline workers and the nearby residents. Pan Trinbago should explore and promote EnviroPan: Green Seal for Steelpan as the certification standard for the global industry and assist in disseminating these findings through the EnviroPan Project.

Keywords: Residual chemical, steelpan, toxicity, environmental sustainability, steelpan builders, steelpan tuners, stakeholders, steelpan administrators, steelpan education, health.

Foreword:

The environmental framework and vision I have for steelpan is directly related to the mandatory course, Interdisciplinary Research in Environmental Studies, and the other fundamental courses taken in combination with my Individual Directed Studies (IDSs) and Field Study courses in the Faculty of Environmental Studies (FES).

My environmental vision for steelpan is to have a cleaning process for steelpans already made, and an extreme cleaning process for used steel drums that are about to be made into steelpans, but were previously used to store and transport dangerous toxic chemicals. This means adopting a new paradigm to create the shift from the norm to environmental sustainability for steelpan through research and an educational framework combined with a proper environmental practice. Mitigating the issues relating to residual toxic chemicals in steelpans can be achieved by considering the physical environment, along with a modernized steelpan education as two distinct components for delivering the steelpan as a green product. The EnviroPan project was successfully launched at the International Conference on Pan (ICP) 2015 in Trinidad and Tobago, and expanded at the Caribbean American Heritage Month (CAHM) celebrations in Boston, Massachusetts, USA, (2016). My vision includes education that provides a move towards sustainable cultural sensitivity where participants tell steelpan stories through theatrical thoughts and actions in public presentations.

Introduction:

My Plan of Study (POS) was constructed with Environmental Sustainability Education for Steelpan with the accompanying research proposal to underscore the dangerous practices associated with steelpan building, tuning, arranging and playing in a panyard. Therefore this paper is the fulfillment of a desire to bring about radical environmental changes in conjunction with the three-co-researchers whose lives have been impacted and affected by toxic chemicals relating to steelpans. Making and playing steelpans was a popular pursuit for youths in the rundown sectors of Port of Spain, Trinidad, and music making with discarded steel drums in the world. It was started by homeless teenagers out

of the necessity to continue their African rooted drumming culture. The Caribbean history shows that the culture was under attack by the colonizers whose purpose it was to remove all traces of African practices by any means necessary. Laws were passed to prohibit assembly for drumming in the community. In the article, *The Banning of the Drums*, by Kei Miller, it says,

In about 1740, across the Caribbean, the drums were banned. Of course this wasn't so much a banning of drumming, as it was a banning of blackness. People had been taken out of Africa. Now it was time to take Africa out of them. Drums not only represented a continent and a vibrant culture; it was a living language loud enough to speak across plantations and in whose syncopated vocabulary, revolts could be plotted. Importantly, the white planters did not understand the language of drums and so these drums had to be banned (Miller, 2014).

The steelpan came to life because of the intended death of the African skin drums, followed by the attack on the tamboo bamboo drum and the introduction of iron bands. Steel drum were made with discarded drums and the problem associated with the discarded steel drum containers, is that they had residual chemicals at a very toxic level after they were made into steelpans. My research was conducted to explore whether residual toxic chemical in used steel drum containers have an impact on the health of steelpan builders.

The major paper is organized in four sections that show the origins of steel drums and steelpan, the history of ongoing industrial accidents in the steelpan-making cottage industry, the opportunities for the EnviroPan Project and some recommendations for a 21st century steelpan building practice. The empirical and secondary data, with three supporting case studies will demonstrate the need for Environmental Sustainability Education (ESE) for Steelpan, clean steel drum containers and proper workspaces to protect steelpan workers and nearby residents from spurious exposure to toxic fumes and

smoke plums. The secondary data also support the histories and existing practices in steelpan building and provide an environmentally sustainable model for steelpan as a beneficial value as listed in my learning objective 1(a) of my POS. This objective investigates the traditional methods of steelpan building and learning of ways to detoxify used steel drum containers before and after they are used to make steelpans.

The need to adopt cleaning methods that minimize problems related to the storage and disposal of rinsate must be addressed to prevent ground water contamination during the early stages of the steelpan building process. Rinsate is the diluted residual chemical mixed with diesel fuel and water after the drums are washed. Learning Objectives 3(a) also addresses how health concerns for steelpan professionals could be mitigated within the industry through the EnviroPan Project, whose main goal to provide education, certification and monitoring of the steelpan-making practices.

Learning Objectives 3(b) pertains to methods of disseminating the research findings through courses for the diploma in Environmental Sustainability Education (ESE). Courses such as Activist Video Making, help in presenting the stories by adopting concepts found in Popular Education for Social Change; Food, Land and Culture combined with Ecology, Ethics and Education. These form the basis and the guide for the development of the EnviroPan curriculum with some recommendations presented at the end of the case studies. The final Learning Objectives (3c), enhances EnviroPan presentations strategy, which is a combination of performance and story-telling, based on rudiments learned during Community Arts Practice classes. All these learning objectives were critical for me in formulating the research questions, devising a methodology for

gathering and analysing the data from the literature review, the interviews, preparing the statistics and reviewing the case studies to provide answers for the research questions.

The Research Problems:

Steel drum containers were built for the sole purpose of storing and transporting various such as food products and edible oils, petroleum products and toxic chemicals. Used steel drum containers that at one time stored very toxic chemicals are the main raw materials for making steelpans instruments the traditional way. The residual chemicals in these drums create health problems for individuals whose work involves making steelpans with them. For example, inadequately cleaned used steel drum containers continue to retain some of the toxicity that contaminates the workplaces with toxic fumes. Also the improper disposals of the residual chemicals fluids permeate the ground water and pollute streams and water bodies. Then the smoke plumes from burning of the steel drum in the manufacturing process spreads the contaminants around. High decibels noise and sound pressure levels in residential neighbourhoods also contribute to the environmental problems for this cultural art form. The environmental problem of residual chemical toxicity in steelpans is relevant more widely as well, because pesticides, insecticides and herbicides may remain undetected in the instruments and may be spread, affecting many people. There are known instances of chemical poisoning during steelpan manufacturing, but there is also a silence that needs to be broken. Research and education is the best way to do so.

My research question then is, “Do residual toxic chemicals in used steel drum containers impact the health of steelpan builders? The environmental problem of residual chemical toxicity in steel drum containers is relevant for a study, because pesticides, insecticides

and herbicides remain unnoticed after the instruments are made and delivered to the end users. The level of transmittal to the end users is yet to be determined, because many individuals erroneously believe, “those in first contact would have already averted the immediate threat to end users’ health with the basic cleaning, washing and burning of the residue in the steel drum.” (personal conversation, Pattie Joseph, 2016). I believe the basic cleaning; washing and burning only transform the residual chemicals into another form, such as caking, that continues to deliver the poisons at a different rate, but still maintaining the potentially lethal dose.

Research Methodology:

The research question, Do Residual Toxic Chemicals in Used Steel Drum Containers Impact the Health Problems of Steelpan Builders? There are four sections to the paper that are listed below.

Section I – This deals with the origins of steel drum containers and the intended purposes for storage and transportation. It also addresses the origins of the steelpan musical instruments with its Circle of Fifths and its relationship to an original concept of the three “Rs” in environmental practices.

Section II – Introduces the prevalence of industrial accidents in backyard steelpan manufacturing operations, and the need for the EnviroPan Project to help establish a grassroots led environmental steelpan-making practice for the global steelpan industry.

Section III – My Environmental Framework and Vision for steelpans.

Section IV – New paradigm recommendations for 21st century steelpan making.

Section I

Original Purposes of Steel Drums:

This section deals with the origins of steel drum containers and its intended purposes for storage and transportation. It also addresses the origins of the steelpan musical instruments with its Circle of Fifths and its relationship to an original concept of the three “Rs” in environmental practices. The original metal barrel or steel drum as it was called was invented in 1905 by Henry Wehrhahn with the definite purposes to store and transport products safely. According to the American Oil & Gas Historical Society (AOGHS), the story about the origins and usages of steel drums is related to the Iron Clad Manufacturing Company, in Cochran’s Mills, Pennsylvania.

Henry Wehrhahn assigned his 1905 patent invention to his employer, Elizabeth Jane Cochran, who went by the name Nellie Bly. Nellie also patented a milk can and stacking garbage can. She proudly claimed that, “I am the only manufacturer in the country who can produce a certain type of steel barrel for which there is an immense demand at present, for the transportation of oil, gasoline, and other liquids Nellie Bly Oil Drum (American Oil & Gas Historical Society [AOGHS], n.d.).

Thus this piece of evidence shows that from the early 1900s steel drums have been used to store and transport various types of substances, not just oil as the story of discarded oil drums seem to suggest. Research by Rossing and Hansen, Science of Steelpan: What is Known and What is Not, presented at the International Conference on the Science and Technology of the Steelpan (ICSTS) 2000, supports the fact that steelpan pioneers began having access to used and discarded 55-gallon drums around 1938. “Thousands of 55-gallon oil drums left on the beach [in Trinidad] by the British and American navies provided ample raw material for experimentation” (ICSTS 2000, p. 17). Another bit of evidence to support the wide use of steel drums as rigid storage containers for dangerous chemicals is found in a statement by Bill Clark, a knowledgeable representative for New

Pig Corporation, an American spill and containment company specializing in steel drum among other things. Clark noted the following,

Thickness of the steel drums is dependent on the size of the container and the container's dangerous goods "Packing Group" rating. The thickness ranges from 0.9mm for a 5-gallons/ 30 litre drum, to 1.5mm for a 55 gallon/ 200 litre drum. Steel drums are built to US DOT (Department of Transportation) standards, and the US DOT standards are based on the UN model Regulations on the Transport of Dangerous Goods (Clark, 2014).

Steel drum containers with dangerous goods rating are raising serious concerns vis-à-vis residual chemical contents, because they have become the most sought after steel drums by steelpan builders. The reason is because the metal thickness and rigidity allows for building better soprano and alto steelpans. Steelpan builders need drums like these that can withstand excessive hammering without bursting at the seams in the process, and steelpan players like these drums because they produce the best quality sound over a longer period of time before requiring retuning. Therefore with these factors in mind, residual toxic chemicals will constantly be a major concern for the steelpan industry if purchasers and end users remain oblivious of the environmental impact of their instrument.

Origins and Approaches in Steelpan Making:

Steelpans are conversions of steel drum storage containers that are made into musical instruments. The traditional approach to making steelpans begins with using steel drums that were once chemical storage containers, and this brings immediate concerns for toxic contamination to people and place. The contemporary approach begins with new steel drums that never stored any chemicals, and since these drums are purpose built for steelpans, they are very expensive for the average steelpan builder.

According to Gay Magnus, director of the steelpan section of the Jamaica Symphony Orchestra, “Steelpans were created on the Caribbean island of Trinidad in the 1930s, but steelpan history can be traced back to the enslaved Africans who were brought to the islands during the 1700s” (Steelpan Information, Magnus, n.d.)



A Four Pans set of steelpans (Cello range) made by Tommy Crichlow of Toronto. Photo credit: Michael Joseph, 2014.

Who Invented Steelpans from Steel Drum Containers?

There are conflicting accounts concerning who invented the steelpans, and since no one person is credited with ownership, some bits of oral history and information may continue to change with the passage of time. A story on the National Library System of Trinidad and Tobago (NALIS) website acknowledges that,

Steelpan making started out as a backyard endeavor among homeless teenagers in Laventille living in tenement yards on the eastern hills overlooking Port of Spain, Trinidad, where the descendants of slaves from the Yoruba tribe of Nigeria lived. Their ancestors were among the enslaved people in the Trans-Atlantic Slave Trade, who brought their culture, religion, foods preferences and language and fought to retain some semblance of their cultural origin for posterity (NALIS, n.d.).

The original language of the slaves gradually disappeared because of the extreme oppression of slavery, but their religious songs and cultural practices remain and are still celebrated presently in many regions across the Americas. The skin drums are patterned

after the manner of the original African drums before the onset of enslavement, and according to Yolande Behanzin-Joseph-Noél in his article, African Survivals in the Secular Popular Culture of the Americas, “The Africans used sheepskin and hollowed-out logs drawn tightly over the wider end to make the skin drums” (D. Diène (ED.), p. 333).

In Trinidad, their music became very popular even for slaves of other African cultures on the island. Their chanting songs and the drumming practices spoke the language of their ancestors and their desire for freedom as a form of resistance to slavery and later to colonization. The Trinidad and Tobago National Library System of the government writes, “Music in African culture is used as a form of communication. It also plays an important role in religious events” (NALIS, n.d.).

From this experience of animal skin drums, which were banned by the British colonizers and enforced by brutal laws, the drumming culture was forced to make a paradigm shift to bamboo drums known as tamboo bamboo. This musical style was also subsequently banned and outlawed, but the resistance grew stronger and the people were classified by the “upper class” of society as vagabonds, hooligans and law-breakers (Best of Trinidad, n.d.). They were branded this way to prevent growth, but the movement grew stronger with every downward press of the oppressor class, and over time, the quest for social justice brought political power, cultural recognition and economic advantages to the movement in small increments, but environmental justice eluded the movement, and so today, it is still a missing dimension of the growth process in steelpan, especially for the residents who are living near piles of steel drum containers and steelpan making yards. With the banning and outlawing of their skin drum music and later their bamboo drums, the teenagers took to dry riverbeds, and quarries to cultivate their rhythmic expressions

using paint pan, metal dustbins, trashcans and automotive brake drums to spontaneously make iron bands to accompany themselves on Mardi Gras-styled Cannes Brulee parades. The Cannes Brulee parade was the origin of carnival parades, and it was also associated to the burning of the sugarcane.

The burning canes or cannes brulées (French) was Canboulay in the local Creole language. The popular Canboulay consisted of a procession with lighted torches (flambeaux) accompanied by singing, dancing and drumming. (History of Carnival, n.d.)

The plantation workers celebrated harvest time in dance with the accompanying music achieved by the men beating out African rhythms on metal. These metal beating groups were known as iron bands. According to Kim Johnson in a newspaper,

A steelband called Alexander Ragtime Band that played in the 1939 version of St. Peter's Day (Fisherman's Day) celebration in the village of Carenage in Trinidad and Tobago. Alexander's Ragtime Band was the earliest form of iron bands, which led to the development of the modern steelband (Johnson, n.d.).

Teenage boys continue experimenting by building crude steelpans in open spaces under trees in backyards, but the incessant noise generated from the hammering infringed upon the neighbourhoods' residential rights to undisturbed enjoyment of their homes, so they had to retreat to more remote areas to work in the open air. This open-air workshop concept was also their way to enable the release of toxic fumes from used steel drum containers into the open air, because if they operated in an enclosed area such as a large room, they would have been overcome by the residual chemical toxicity found in the used steel drum containers.

Proceedings of the International Conference on the Science and Technology of the Steelpan ICSTS, 2000, Vol. 1 stated,

The Caribbean steelpan is probably the most important new acoustical instrument to develop in the 20th century. In addition to being the foremost musical instrument in its home country, Trinidad and Tobago, steelbands are becoming increasingly popular in Europe, North America, and some Asian countries as well. ... Many claims have been made about the invention of the tuned steelpan. Undoubtedly, it resulted from a lot of trial and error on the part of musicians and inventors such as Bertie Marshall, Anthony Williams and Ellie Mannette (Rossing T. UWE J. Hansen. ICSTS, 2000, p. 17).

Before the current 55-gallon drums now in use for steelpans, the pioneers of steelpan used the much smaller biscuit drum that only carried four notes. Biscuit drums were strictly food clean drums compared to the “discarded oil drums”. It was narrower in diameter and made with a thinner gauge metal. These food grade storage containers were in a sense, prototypes of the modern steelpan, but the very limited number of musical notes spurred interest for the pioneers to be more creative and more inventive. The biscuit drums remained the standard until around 1938 to 1939, at the onset of the World War II.

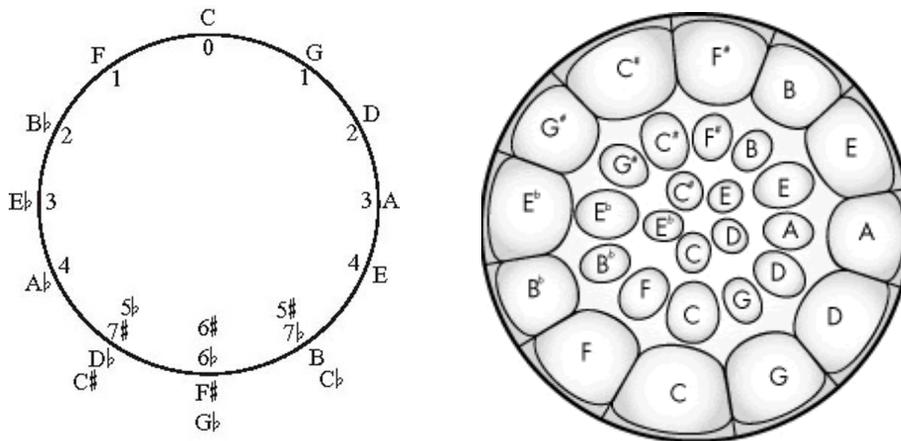


Materials for making traditional steelband instruments. From left to right: Biscuit drum, caustic soda drum, garbage can and paint can, 55 gallon drum. The pan maker uses a sawed-off sledge hammer to beat the pans into shape. Image credit: David R. Dudley, 2006.

According to Rossing and Hansen,

Thousands of 55-gallon oil drums left on the beach by the British and American navies provided ample raw material for experimentation. Although the basic designs have pretty well stabilized, steelpans are still evolving (Rossing T. UWE J. Hansen. ICSTS, 2000, p. 17)

Most modern steelpans are built upon the theory of the Pythagorean Circle of Fifths, a concept explored and adapted for steelpan by Anthony Williams, a steelpan pioneer.



<i>Left image: The Circle of Fifths, Image Courtesy - (Dummies.com n.d.)</i>
<i>Right image: C-Lead or Soprano steelpan, Image Courtesy - Steel Island n.d.</i>

The soprano steelpan or C-Lead pan goes beyond the elementary application of The Circle of Fifths concept, because it adds one and a half octaves above the circle. The C-Lead is also called a soprano pan, and is the closest physical representation of the theoretical circle envisioned by Pythagoras. The difference being the inversion of the layout of the circle, placing the “C” and all sequential notes in an ascending pattern from the bottom as seen in the images above. This design opened the way for better steelpan learning opportunities for musicians and non-musicians alike.

The steelpan graphic above shows the notes areas, which are referred to a dents, as seen from the bottom of the instrument. Each dent has a defined border that is hardened by precise hammering and grooving to prevent cross talk or vibration leakage across the playing surface of the instrument. Each note is then tuned with discreet hammering touches from these artisans to produce a fundamental tone and specific harmonics to

rings somewhat like a bell when struck. Steelpan tuners speak a language that is expressed in tones and overtones.

In the process of making steelpans, the metal on the playing surface has to be tempered in fire to harden the entire surface, then the dented areas for the notes has to be beaten up and down repeatedly to relaxing the note so that it will vibrate easily with the gentle touch of the player's sticks (personal conversation, Clarke, 2015).

It is critical to note that all steelpans are not created equal due to the fact that they are handcrafted musical instruments, made with different note-layout standards for different purposes. It is therefore very difficult, or almost impossible to replicate steelpans through an industrial manufacturing process. "Early soprano steelpans were called the Ping Pong. It was a small hand-held pan cut from a paint tin or carbide container"

(TTConnect.gov.tt, n.d.).



*Photo shows early soprano and second pans, first pans were called Ping Pong pan. Circa 1952
Photo credit: Getty Images*

In the bass range, the number of steelpans moves from four to a maximum of twelve drums, and considering there are numerous bass sets in a steelband, One can understand the implications of washing and burning all those steel drums in a back yard operation.



*A modern Six Bass set of pans for a single player – These also come in configuration of 7, 9 & 12 drums
Photo credit: Michael Joseph*

Research Data Collection:

The data was collected following the process according to (Sagor, p. 10). I gathered data through my literature review, video interviews, phone conversations, a focus group with steelpan stakeholders, questionnaires and surveys that were correlate to each research question that surfaced during the formulation phase.

It is important to note that there is a great void of steelpan-related environmental literature, so I supplemented with environmental information taken from websites of steel drum manufacturing companies to equate with some of the environmental needs I was pursuing. For instance, Greif, a multinational company that manufactures steel drums for storage and transportation of goods, has established a subsidiary drum reconditioning company called Earth Minded, Life Cycle Services, with three locations, one in Toronto, one in Mississauga and one in Vaughn. Steel drum reconditioning is a critical solution for steelpan making because it provides the clean drums required to eliminate the issues related to residual chemical toxicity in used steel drums.

Data Analysis:

The data collected verified the existence of residual toxic chemicals in used steel drum containers. It also confirmed that steelpan builders are experiencing toxic poisoning in the process of building steelpans due to their approach to working with hazardous materials. Data did not show that the people residing close to backyard steelpan-making facilities are susceptible to the same level of toxic intake experienced by the steelpan builders that I investigated. It is my assumption that the wind carries toxic smoke plumes towards homes scatters around the steelpan-making facilities and the volume of wind-borne toxins affect all living entities around the steelpan yards. My observations of steelpan builders dumping liquid chemicals unto the ground and in woodpiles led me to the assumption that there will be consequences for ground water supplies. This ground water concern has not been thoroughly studied at this time, but key players within the steelpan industry know about this form of liquid dumping and have kept silent.

Reporting the Results:

The results of the study will be reported through the EnviroPan Project website www.ese4steelpan.tv. Disseminating is also delivered through cultural performance seminars and workshops, as done during the presentation of awards ceremony for the Caribbean American Heritage Month (CAHM), June 29, 2016, in the Boston City Hall. The academic mode of delivery is the modern curriculum for of the EnviroPan Project; EnviroPan: The Black History of Steelpan, Environmental Sustainability Education (ESE) for Steelpan and EnviroPan: Green Seal for Steelpan. These are pragmatic approaches to steer the steelpan industry towards the paradigm shift in education for

solving the problem of residual chemical toxicity in used steel drum containers and steel pans.

Action Planning:

Environmental Sustainability Education (ESE) for Steelpan takes a critical look at the popular narrative about building steel pans the traditional way from discarded oil drums. ESE for Steelpan intends to retell the story to show that various kinds of chemicals are stored in steel drum containers that are used to make steel pans. ESE for Steelpan provides a strategy in the designing and delivery of the new paradigm shift away from the traditional, and into the 21st century approach with sustainability as the major focus through environmental education.

Research Goal:

The goal of my research is to bring together, steelpan builders, tuners, arrangers, and players, along with academics and other steelpan stakeholders such as community-based organizations to discuss issues relating to toxic steel drums containers used to make steel pans. This participatory action methodology allows for a broader conversation ongoing gathering and dissemination of information, and to create analyses for re-imagining the new paradigm that shifts away from the traditional way of doing things.

There have been stories of deaths of steelpan builders occurring from their interactions with toxic steel drums. During my time at the ICP 2015, I was introduced to Roger Thomas, whose father, Leroy Thomas died from exposure to residual toxic chemicals while in the process of making a steelpan from a toxic steel drum container. I recently

heard from Pattie Joseph, my younger sister, about another steelpan builder who died because of his exposure to the toxins coming from his job as a steelpan builder that required him to frequently open used steel drum containers that once had residual toxic chemicals. My co-researchers also spoke about their knowledge of individuals who experienced ill health, and those in the steelpan-making community that may have died because of their work with toxic steel drum containers and inadequate protective work wear. A major issue expressed by Clarke, one of the Trinidad and Tobago-based co-researchers was the concern that these toxic steel drums are not always disposed of properly by the wholesalers according to established environmental guidelines. He goes on to say,

There is a practice among some irresponsible chemical wholesalers who are in possession of toxic storage steel drums; they would call around to steelpan builders, offering the toxic drums for basically no charge in an effort to rid themselves of the burden of these toxic steel drum containers (personal conversation Clarke, 2016).

The history and operating guidelines for proper residual chemical disposal is set by Trinidad and Tobago, Environmental Management Authority describing their role as follows,

The Authority began operations in June 1995 and now facilitates cooperation among Government Agencies, NGOs and community-based organizations. The EMA is mandated to write and enforce laws and regulations for environmental management, to educate the public about the nation's environmental issues and to control and prevent pollution, as well as conserve natural resources. The EM Act also required the establishment of a tribunal, known as the Environmental Commission, a superior court of record that hears appeals on decisions taken by the Authority (EMA, 2016).

Steelpan makers and the administrators of Pan Trinbago know of the issues relating to toxicity in used steel drums containers, but there appears to be no legal requirement in Trinidad and Tobago to warn or provide guidelines to those whose work involves the use

of toxic steel drum containers. Therefore steelpan workers are not covered, or obligated to follow workplace safety laws or environmental guidelines, thus compromising a situation that allows for a very deficient workplace where there is a history of injuries that creates known health hazards and untimely deaths.

This paper continues its exploration of the health consequences for steelpan builders that ignore or disregard the facts pertaining to residual chemical toxicity found in used steel drum containers that make steelpans. My critiques to the toxicity in steelpans is written with the assumption that, there may be specific ethical and moral challenges expats insiders to the steelpan industry may face from steelpan persons residing in Trinidad and Tobago. One ethical challenge is the notion that, foreigners know best, and locals know little about what is good from them. This is a prevailing attitude that can be used to disrupt a practice riddled with health concerns and may present unfounded fears that could slow the flow of economic sustainability for the steelpan builders and tuners. It could even start hypothetical comments such as, “Who is this person, and are they trying to tell us how to run the steelpan business in Trinidad? Also, “Who give them the authority to change how we make our steelpan?” All these assumptions have some bearing as to why there is a silence relating to toxicity in steelpans. Finding ways to open the discussion was once a concern for me when I had when I had to present EnviroPan: Green Seal for Steelpan at the International Conference on Pan (ICP) 2015, but I located myself as someone born into the heart of the culture, but just living abroad with an environmental consciousness reflecting an insider’s researcher viewpoint. According to Adler,

It is crucial for social researchers to clarify their researchers’ roles especially for those utilizing qualitative methodology to make their research credible. The

researchers that undertake qualitative studies take on a variety of member roles when they are in the research setting. These roles can range from complete membership of the group being studied (an insider) to complete stranger (an outsider) (Adler & Adler, 1994)

The reason why I am well positioned to carry out this research as an insider is as Bonner and Tolhurst states, “I have a greater understanding of the culture being studied, ... having an established intimacy with steelpans, which promotes both the telling and judging of the truth” (Bonner and Tolhurst, 2002). Another reason from Smyth and Holian, is, “because I am an insider with a great deal of knowledge it will take an outsider a long time to acquire” (Smyth & Holian, 2008).

DeLyser and Hewitt-Taylor found a disadvantage as an insider could be in my case, “my bias brought into the research because of my greater familiarity that can lead to my loss of objectivity” (DeLyser, 2001; Hewitt-Taylor, 2002). These reminders are relevant to me as an insider researcher, undertaking ways to benefit the global steelpans industry by mitigating the residual toxic chemicals in used steel drum containers. Therefore my role and motivation in this paper is to be as objective as possible by setting aside any personal biases towards accepting the “status quo” of silence among steelpan industry leaders and administrators. The moral challenge I had was to ensure that I take a responsible approach to preserve the economic well-being of the steelpan industry workers, and even suggest ways to help it grow from the environmental sustainability model used by major corporations.

Collaborative Action Research:

To address my focus on Environmental Sustainability Education (ESE) for Steelpans, it was very important for me to give consideration to the following statement by Richard Sagor,

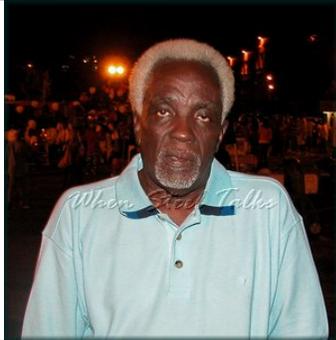
In education, the worlds of research and practice are both separate and unequal, for the teacher who ignores research is likely to be seen as anti-intellectual or unprofessional, whereas the researcher who ignores the classroom bears no such label. (Sagor p. 4)

I chose Sagor’s approach to collaborative action research in his book, *How to Conduct Collaborative Action Research*, because it allowed my three co-researchers in the steelpan industry to participate as teachers and subject matter experts (SMEs) with unique insight from their lived experiences. They also provided perspectives of their peers, with whom they would have frequent interactions from time to time. This provides my research with data from a unique standpoint, which allows me to bring my perspective as a steelpan player/ researcher to be synthesized with members within the steelpan industry.

My co-researchers photographed below are Gerard Clarke and Wilfred Joseph, my elder brother; who both reside in Trinidad and Tobago. The other co-researcher is Rudy Martin Joseph, my steelpan mentor (no relation) whom I met about ten years ago. Rudy is a steelpan player who resides in Oshawa, Ontario, Canada.

	 <p><i>Wilfred Joseph, Steelpan builder and tuner, April 2016</i> <i>Photo credit: Michael C. Joseph</i></p>	
<p><i>Gerard Clarke, steelpan tuner, July 2016</i> <i>Photo credit: Michael C. Joseph</i></p>		<p><i>Rudy Martin Joseph, Steelpan Player/ Tuner, 2016</i> <i>Photo Credit: Michael C. Joseph,</i></p>

Gerard Clarke worked as an apprentice steelpan builder in Trinidad under two master tuners at different times. The first period from 1982 to 1987 was spent with Herman Guppy-Brown, and later he spent three years with Bertram “Birch” Kelman.

	
<p><i>Herman Guppy-Brown, November 30, 1948 to December 3, 2015, Photo provided by Herman Guppy Brown Jr.</i></p>	<p><i>Bertram “Birch” Kelman, Chaconia Medal Gold Photo credit: When Steel Talks, 2012</i></p>

Guppy-Brown, who is recently deceased in December 2015, was positioned at the top of the professional tuners’ ladder and so is Kelman. Kelman is a current holder of Trinidad and Tobago’s, Chaconia Medal Gold for culture, the highest civilian award. I was privileged to meet with Brown in the summer of 2014 in Trinidad and with Kelman numerous times since 2008. In my one-hour meeting with Brown in his steelpan building yard, I learned a lot about steelpan but regretfully we did not have much time to speak about the environmental issues related to steelpan building. Clarke said, since Guppy-Brown’s death, his son, Herman Guppy-Brown, Jr., uses a breathing respirator to filter out toxins when he is making steelpans (personal conversation, Clarke, 2016). This was not his father’s practice, so it seems to suggest, as rumour has it, that Guppy-Brown death was related to the toxins from his steelpan-making practice.

Clarke is now among the renowned tuners in the world and this puts him in high demand, traveling to many countries for steelpan tuning. I have been fortunate to spend time with

Clarke here in Toronto on two occasions during the past year where we speak extensively about the ongoing environmental issues in the steelpan industry. He is a very valuable co-researcher for EnviroPan, and I am happy to share some of the credit for this work with him and the other co-researchers.

The other Trinidadian collaborator is Wilfred Joseph, my elder brother. Wilfred is a steelpan builder who has been involved in steelpan building since the late 1990s. Wilfred has been apprenticing under “Birch” Kelman, and when I last spoke with Kelman, he expressed his opinion about Wilfred’s skills this way, “Wilfred has acquired great knowledge and understanding about steelpan, he is conversant with the industry and is able to function in steelpan tuning now” (personal conversation, Kelman, 2014).

Kelman is also in great demand internationally and facilitates steelpan-tuning in many countries. The following online statement by the premiere steelpan website, When Steel Talks, has this to say about Kelman,

The “unknown” man behind the sound of bands, having tuned for every known and progressive steelband in Trinidad & Tobago, i.e. Solo Harmonites, Renegades, Phase II Pan Groove, Southern Marines and Silver Stars, Bertram “Birch” Kelman (pictured above) has devoted decades of his life to the steelband movement. Himself a renowned panist¹, inventor and member of the National Steelband which performed at Expo ’67 in Montreal, Canada, “Birch” is simply one of the finest steelpan tuners ever. (When Steel Talks, 2012).

Rudy Martin Joseph is the other co-researcher; he is also my steelpan mentor. Rudy as he prefers to be called, is skilled as a player, in tuning and teaching. I chose him as a co-researcher because he is one of the longest serving steelpan industry members with a wealth of history, skills and is capable of teaching others. These three co-researchers bring added value to the EnviroPan research project, and their cases studies pertain to the

¹ [Panist are persons skilled in playing steelpans].

issues of residual toxicity in used steel drum containers, and the way it has affected them. There are no records detailing the frequency of industrial accidents relating to steelpan-making, but in the next section we will have a look at the outcome for some steelpan builders, tuners, arrangers and players with a view to better understand what is actually happening to the people engaged in steelpan building, tuning and playing steelpans.

Section II:

Industrial Incidents Among Steelpan Builders, Tuners and Residents:

The daily occurrences of an improper practice cannot be classified as accidental; instead it is more of a design. It should be reclassified as an improper practice, because it is repeated numerous times daily as a standard practice. This cumulative effect requires a corrective approach through the design of a strategic assessment for the steelpan industry. The large numbers of steelpan-making facilities in Trinidad and Tobago alone is emblematic of the need to conduct an environmental assessment similar to the types carried out when major Canadian projects are assessed, only this is in hindsight with a forward looking feature. Material presented in the Bram F. Noble book, Introduction to Environmental Impact Assessment (EIA) helped me conceptualize a curriculum for steelpan EIA. This would be the foundational approach to address professional steelpan builder and tuners steeped in the traditional method of steelpan-making. Environmental Sustainability Education (ESE) for Steelpan will increase the awareness and need to make the change required.

In general, the problem of residual toxic chemicals found in used steel drum containers that make steelpan relates first to opening the drum, which is the most critical time when the chemical is escaping from the drum. Then the second problem is connected to the improper disposal of the residual chemicals and rinsate created from the washing of the drum. Rinsate is defined as the mixing of water or other liquid to wash or rinse a chemical from a container, Steelpan makers use diesel fuel to wash out residual chemicals found in used steel drums containers before converting the drum into a steelpan. The third concern is about the way the burning of the residual chemicals is conducted and its effects on the workers and the residents in the neighbourhoods. The following case studies add relevance to the need for change to save the health and lives of workers and resident nearby.

Case Study #1:

This case study is relevant here because this reflects an environmental story with a health and medical linkage to the practice of steelpan building by EnviroPan's co-researcher Gerard Clarke. Clarke is a prominent member of the steelpan industry. He is a notable steelpan builder/ tuner who has risen very high in the ranks of the steelpan industry because of the skills and abilities he demonstrated during his personal and professional life. I first connected with Clarke in the online steelpan forum, When Steel Talks (WST) sometime in 2011. I have read his forum comments, which are very encouraging. Here is an instance where online forum participants were inquiring of tuners to have their instruments prepared: A reply by [Gerard Clarke](#) on August 14, 2014 at 7:49pm.

Peter, I am a product of Herman [Guppy]-Brown having spent five years of apprenticeship at his place in the lane after the bakery from 1982 to 1987. Learning

steelpan preparation alongside Kenneth, Clinton and "Doggie" under Brown's supervision. He has been a friend from 1970. I am located in West, Trinidad. I have just returned from Pan Alive work in [Toronto] Canada and other parts of Canada, but stopping of in Grenada for their panorama, as I prepare a band there (Clarke, WST, 2014).

In my research interview conducted with Clarke in Oshawa, Ontario in July 2015, I asked him how significant is environmental thoughts in his practice as a steelpan builder/ tuner? He expressed the importance in relation to a personal experience that almost cost him his life. Clarke said,

When he was apprenticing under Herman Brown during the period 1982 to 1987, he noticeably became ill and had to have some blood work done at his doctor's request. The results of the tests showed that during the two-hour per day exposure in steelpan building, 4:00 to 6:00PM, Monday to Friday, he was being poisoned from the toxic substance in sufficient quantities to begin weakening his body significantly. Clarke said, "I was experiencing something like tasting the chemicals in the used drums constantly in my throat, even when I was away from the steelpan-making location, ... Clarke began wearing a face mask similar to the type used by spray painters (personal conversation, Clarke, 2015).

In another conversation with Clarke, he described the primitive way the steelpan builders protect themselves by observing the wind and staying an arbitrary safe distance alone,

After we open the drums, we put it far away from us," he showed a distance of approximately 10 to 20 metres, "then we'll pour diesel fuel in the drum, put newspapers inside the drum, then we light it and watch the fire change into different colours as the residual chemical and diesel interact during burning. Some of us will wear a mask, but sometimes the quality of the mask itself is not a good enough solution" (personal conversation, Clarke, 2016).

This method of burning the drum is a practice that has been largely responsible for many cases of ill health, and even the above-mentioned deaths for some steelpan builders, and to some extent the residents. The problem is that these industrial accidents are not reported under the proper classification for workers in hazardous materials. So there is no data from insurance coverage or claims for workers and therefore no compensation expected. The EnviroPan Project sees this as a case for environmental justice for the

steelpan builders, tuners and the residents in the vicinity, because it affects a particular group of people who are marginalized and without a voice.

Case Study #2:

Environmental Problems with Diesel Rinsate, Diesel Fuel Exhaust and Smoke Plumes:

In 2008, while visiting my elder brother, Wilfred Joseph in his workplace, in a steelpan-making yard in Trinidad, I observed him pouring out a black viscous residual chemical found in a used steel drum container unto a woodpile. This woodpile would later be used to burn the steelpan at the tempering stage. He continued by washing out the drum with diesel fuel, a couple times creating rinsate, which he poured into the woodpile, adding another layer of toxicity to the chemical soup in the woodpile. After witnessing this environmental practice and confirming with him that this is done with each steelpan, I had a desire to find a better way to help make the steelpans-making process more environmentally friendly.

I observed how Wilfred's health was impacted from building steelpans in the manifestation of a reddening of the membrane around his eyes. These were very evident during my visit to Trinidad for ICP 2015, and when I inquired about the condition, he attributed it to the toxic dust that rises up in the yard from the hammering process while he was sinking the steel drums. He has since ended his steelpan building practice at that particular location, and his eyelids appear much healthier when I last saw him in April 2016.

Diesel Rinsate Storage and Disposal Problem:

Diesel rinsate is not properly stored and disposed of properly after its use. The rinsing of steel drums with diesel fuel and water is a standard practice that is done all across the global steelpan industry. Environmental problems are inherent because the rinsate is not stored nor transported properly. Rinsate is usually poured down surface drains that lead into sewers or streams that affect the ground water and so this practice is unacceptable. The issue of diesel rinsate will continue to be a major concern that plagues the steelpan industry because it is an accepted practice in washing out steel drums. The following statement from the North Dakota Department of Health, recommends the cleaning of underground storage tanks and the rinsate from Underground Storage Tanks (UST) that previously held diesel fuel,

It is recommended that all Underground Storage Tanks be thoroughly cleaned using a suitable cleaning device such as a high-pressure steam cleaner. The rinsate generated by this step can be containerized or passed through an oil-water separator. The water from the separator can be discharged to a municipal sanitary sewer or directly to a municipal waste treatment pond after obtaining permission from the appropriate state and/or local official(s) (ndhealth, n.d.).

Carcinogenic Effect of Diesel Exhaust Fumes:

The US Center for Disease Control and Prevention presented in the Abstract of their Current Intelligence Bulletin 50 Carcinogenic Effects of Exposure to Diesel Exhaust, (CDC, 1988),

This bulletin presents recent information on the potential carcinogenicity of diesel exhaust. Included are discussions of recent animal studies that confirm the relationship between cancer and exposure to whole diesel exhaust. Also discussed is epidemiologic evidence that associates lung cancer with occupational exposure to diesel engine emissions. On the basis of the results of these studies, National

Institute of Occupational Health and Safety, recommends that whole diesel exhaust be regarded as a potential occupational carcinogen in conformance with the Occupational Health and Safety Administration, Cancer Policy (CDC, 1990).

Diesel exhaust fumes result from the functions of a combustion engine, where fuel, air and spark interact to create combustion. This combustion entails the release of exhaust fumes. That means that the same applies in the context of burning steelpan in fire fueled by diesel, only that the interaction is not concentrated in a combustion chamber with a filtered exhaust, but all the elements are there; diesel fuel, air and fire that creates the condition to produce fumes that can do the same damage or more as diesel exhaust fumes. So when diesel fuel is poured onto the woodpile and used as the fuel for tempering the steelpan, the fumes and smoke plume rising out of the fire produce carcinogenic outcomes that spread throughout the steelpan-making facility, and beyond into nearby homes. This process is carried out numerous times per day and in many locations producing a cumulative effect spoken about above.

Since this practice of washing the steel drums with diesel fuel and subsequently burning it produces a carcinogenic outcome that is repeated numerous times per day in making each steelpan, then it stands to reason that the cumulative impact upon the steelpan builders, tuners and the immediate community is also stacking up causing severe impact on their health. One of the obvious challenges is that the missing labeling on the used steel drum containers means that it is often impossible to identify or name the chemical the barrel contained, which would make it difficult for any specific medical treatment to be applied. The US Environmental Protection Agency provided an article to educate readers of the negative aspects of ground water contamination with excerpts as follows:

Ground water contamination is nearly always anthropogenic; the result of human activity that impacts the environments. Virtually any activity whereby chemicals or

wastes may be released into the environment, either intentionally or accidentally, has the potential to pollute ground water. When ground water becomes contaminated, it is difficult and expensive to clean up. ... Hazardous waste should always be disposed of properly, that is to say, by a licensed hazardous waste handler or through municipal hazardous waste collection days. ... Similarly, many substances used in industrial processes should not be disposed of in drains at the workplace because they could contaminate a drinking water source. Companies should train employees in the proper use and disposal of all chemicals used on site (US EPA, n.d.)

An environmental educational approach is required to help industry members develop better practices. EnviroPan: The Green Seal for Steelpan intends to help fill the environmental gaps in steelpan-making facilities using approaches in the course Theory and Methods of Impact Assessments.

Resources from the literature review according to Ulf Kronman's book, Steel Pan Tuning, "In Trinidad, the steelpan is usually heated over a burning car tyre." (p. 41). Steelpans are also made by wood burning fires and with natural gas burners. There are challenges to each method regarding which one is the best, but there is no conclusive evidence from research to prove one method of burning is better than the other. There are two pertinent comments below from articles concerning how to burn the steel drum with car tires,

If you are afraid that your neighbours or the fire brigade will be alarmed by the large amount of black smoke from the burning tyre, it also works with a large log fire, but the heating will take some more time, about 10 minutes. ... A documentation of the appropriate temperature and heating time is still lacking. I have heard about many different methods and times: 10–15 minutes on a log fire or 1.5 min on a burning tyre. One author claims that it takes 35 minutes to temper properly at a temperature of 350 degrees Fahrenheit (Morin, 1988, p. 42,43).

Some scholars have indicated their preference for either wood or natural gas, but since burning rubber tires was the original way, many steelpan-makers had stuck to that

practice as the principal way for a long time, although it has been proven to be environmentally unfriendly and obviously a very dirty and polluting practice.

A statement from Anthony Achong, the editor of International Conference on the Science and Technology of the Steelpan, Vol. 1, 2000 says,

Apparently, a wide variety of techniques are used by various pan makers. ...in which the fire is made from wood, (or even old rubber tires) or a gas flame. The fire generally proceeds for up to ten minutes, through several colour changes of the metal, after which the pan is cooled (ICSTS, Vol. 1, p. 21).

Throughout the history of steelpan making, one could see the environmental impacts that have been occurring when the steel drum storage containers that stored dangerous chemicals are burned during the steelpan building process. The degree of harm is exponential because of the growth in the global steelpan industry. Chris Tanner, Associate Chair, Depart of Music, Miami University writes,

The greatest growth of steel pan happening in the secondary school. “For instance, in southwest Ohio, over the twenty two years I have lived here the number of steel bands in secondary schools has increased from three to around twenty,” Chris says. “In essence, a new steel band in this area as been initiated, on average every 15-16 months since the early to mid-1990s. I imagine that this growth will continue at a similar rate for years to come (Steelpan Collective, n.d.).

Even with this growth, there is still no organized effort to reduce or mitigate the issues that are causing harm. A statement from Greif, a global manufacturer of steel drum storage containers with plants and offices on every continent: across the globe, provides further evidence that steelpan workers are dealing with hazardous materials, without proper working conditions and doing environmental injustices to residents in nearby communities.

Greif manufactures standard and specialty steel drums in a range of sizes and thicknesses with a choice of linings, configurations and covers to transport materials for the chemical, paint and coatings, food, pharmaceutical and hazardous

waste industries. Our world-leading production processes enable fast turnaround and efficiency. Greif also supplies specialty application pails for products requiring a high degree of cleanliness. These steel pails transport materials for various industries, such as specialty chemicals, paints and coatings, pharmaceuticals, flavors and fragrances (Greif, n.d.)

Case Study #3:

Rudy Martin Joseph is my steelpan mentor; the third and final co-researcher with the EnviroPan project. In this case study, I will show how his current health has been a major concern for him and those around him. He is associated with steelpans in many capacities, and over the years he was exposed to the same chemicals as the steelpan builders and tuners. Panman Rudy as he is called, started out at age 14 as a player with Casablanca Steel Orchestra, a very large band from the Belmont area in Port of Spain. At that time he was exposed to music theory, and being active in the period of the pioneers of steelpan, Rudy's musical roots were guided under the tutelage of one of Trinidad's best musicians, Arthur DeCoteau. He became the lead soprano pan player for the steelband's elite stage side. A stage side is a section of the band with the best players who are quick learners, capable of teaching others the songs for concert engagements and private events. These are prestigious and highly valued members of the steelband and are referred to as the steelpan crack shots. Rudy also played in the smaller All Aces Steelband, another stage side based near his home in Bossierre Village, Maraval, north of Port of Spain. I had an extensive conversation with Selwyn "Eagar" Mavers, a notable steelpan tuner residing in Petit Valley, a village in North West county of Trinidad. Eagar made a very interesting comment by saying, "I always recall, that it was hearing Rudy play steelpan that motivated me to be just like him. I wanted to be a player so badly, that I would hang around the All Aces steelband, but they would not allow me to touch the

pans. I would also leave Newtown Boys School and visit Invaders Steelband panyard to watch Ellie Mannette tune steelpan and that was when I decided to focus more on making and tuning steelpan.” (personal conversation, 2014).

So Panman Rudy has been an inspiring musician from a very long time ago, and a short list of some notable events he played for in small steelpan ensembles and as a soloist includes; the launching of the Trinidad Hilton hotel, the occasion of the Official Independence of Trinidad and Tobago from Britain, August 31, 1962 in front of the parliament building, The Red House at the lowering of the Union Jack and the hoisting of the Trinidad and Tobago, red, white and black flag. Rudy played for the Royal visit of Princess Margaret, sister of Queen Elizabeth II to Trinidad and Tobago, 1955. Rudy also toured Europe and played as an entertainer in the Bahamas for many years. It was while on these tours and with no tuner around to tune his steelpans, he developed the additional skill as a tuner and went on to make and sell mini-steelpan to tourists in the Bahamas. Panman Rudy is now 83 years old and although facing some health issues, he continues to be my steelpan mentor.

Panman Rudy taught a small group of six budding steelpan tuners from January to June 2014 as a gift he gave back to the steelpan community in Toronto, and it was towards the end of that six months teaching period that his health noticeably began to deteriorate. Rudy was diagnosed with lung cancer in 2015 and continue to receive medical treatment to manage his health. He enjoys having the group of steelpan members around him, which he considers as family. He continues to share his knowledge and experiences, and wants to see me complete my Master in Environmental Studies, and address the issue of toxicity in steelpans. He is also encouraging me to produce a second project called “The

Grandmasters of Steelpan”. This is a television show I am conceptualizing that would feature steelpan industry members above 70 years of age who are teaching the art form to younger industry members.

Rudy’s health is an opportunity to learn more about the life and health issues faced by members of the steelpan industry who have been active for many years. I will be asking for his permission to participate in the follow up EnviroPan health research. The question in my mind returns to the issue of whether his illness is linked to residual chemical toxicity in used steel drums that made steelpans?

EnviroPan Project Proposed Solutions:

The proposed solution to the problem of residual chemical toxicity in used steel drum containers for steelpans is to follow the EnviroPan Project proposals for steelpan-making by implementing mandatory industry-wide Environmental Sustainability Education (ESE) for Steelpan in three modules: Module one – comprised of EnviroPan: The Black History of Steelpan, module two - Environmental Sustainability Education (ESE) for Steelpan and module three – EnviroPan: The Green Seal for Steelpan. This process is covered through a curriculum with an intensive two-week course of thirteen lessons, or done over a semester as a college course for certification. Certain parts of the course will not be applicable to existing steelpan builders, tuners and arrangers because of the years in the industry. The physical building and tuning elements are removed for the professional industry members, ensuring that they are given the option to take all three modules, or just the second and third modules, exempting them from EnviroPan: The Black History of Steelpan.

As we prepare to review the three case studies, one would assume that there are proper guidelines for workplace training, appropriate hazardous work wear and proper facility design with environmental guidelines for better operating practices be implemented to save workers lives and protect the residents who live very close to steelpan industries. The solution for closing the gap, specifically in Trinidad and Tobago is to prevent industrial steelpan making accidents through education as developed by The EnviroPan Project.

The EnviroPan Project will determine how best to access the resources to collaborate with medical professionals affiliated with the National Insurance Board (NIB), the Trinidad and Tobago equivalent of the Ontario, Workplace Safety and Insurance Board (WSIB), an independent trust agency that administers compensation and no-fault insurance for Ontario workplaces.

What is Sustainability for Steelpans?

Sustainability for steelpan is research and development for steelpans to meet the needs of today's steelpan industry without compromising the needs of future generations.

How to Attain Steelpan Sustainability?

Steelpan sustainability is attained through the EnviroPan Project; A tri-modular educational program pedagogy designed around EnviroPan: The Black History of Steelpan, Environmental Sustainability Education (ESE) for Steelpan, an intensive certification program, and EnviroPan: Green Seal for Steelpan, all approaches to making

steelpan through a “green” practice incorporating zero fossil fuel usage and renewable energy solutions. This program will be delivered over a thirteen-week period, and on completion of these modules, the participants will be tested and receive an EnviroPan Green Steelpan Seal certificate. The certificate testifies to the fact that the holder has successfully completed the requirements of the program and is now allowed to place the EnviroPan: Green Seal for Steelpan logo on their stationery, their website and on instruments they manufacture. The following are synopses of the three modules for the EnviroPan Project.

1. **EnviroPan: The Black History of Steelpan** will be the first module for students to learn the history of steelpan. The black history takes into consideration the origins of drumming practices and instruments used since the Trans-Atlantic African Slave Trade experience. It explores the social and political barriers to early drumming cultural practices in Trinidad. It looks at the resistance movement of the blacks and the socio-political events that led the transition from animal skin drums to plant-based bamboo drums, followed by iron bands and finally, the early steelpan and its modern unsustainable counterpart. It presents an analysis of the Trinidad steelpan movement and steelpan as an invigorated global cultural phenomenon. It looks at the results of the Caribbean carnival movement that inspired Brooklyn, Labour Day, West Indian Carnival, Toronto Caribbean Carnival and steelpan panoramas in the United Kingdom and other European, African and Asian urban centres where the Caribbean culture is re-exported.

2. **EnviroPan: Environmental Sustainability Education** - EnviroPan:

Environmental Sustainability Education is the second module that provides students with the basics delivered according to the environmental framework and courses I completed while doing my Master in Environmental Studies program at York University. This will be a feeder program to the Faculty of Environmental Studies, York University. This course will be designed for steelpan with a compressed structure around Theory and Methods of Impact Assessments.

3. **EnviroPan: Green Seal for Steelpan** - EnviroPan: The Green Seal for Steelpan

is the final module that will be taught to ensure the proper application of the knowledge and use of this environmental seal for all intents and purposes. The emphasis will be placed on the seal as confirmation that the best practices were implemented and will be adhered to in the new paradigm or standard for the elimination of toxicity in steelpans. The seal will require recertification after the initial three years to ensure the values are retained and developed in the passage of time. Participants will be guided in preparing a soprano steelpan, which does not have to be perfect but the application of the practices are to be proven through an examination as a physical sense of manufacturing will deepen the impression for teaching and learning pedagogies.

The following five criteria for EnviroPan certification are considered because they comprise recurring themes throughout the research, and exploring the relationship they have with sustainable development for steelpans requires a consideration with a view towards structured implementation:

- I. Social benefits to steelpan making in an environmental context
- II. Political approaches to advancing the steelpan movement
- III. Economic gains derived by implementing 21st century practices
- IV. Cultural rebirth and adoption for steelpans in a scaled context
- V. Environmental benefits for steelpan with sustainable development

Environmental Sustainability Education (ESE) for Steelpan:

Environmental Sustainability Education (ESE) for Steelpan aims to explore environmental practices that offer better methods and healthier solutions for making steelpans within a self-regulating industry. ESE for Steelpan aims to educate the industry in sustainability for steelpan rooted in social justice, environmental justice and sustainable development.

The need for social justice and environmental justice relates to the exploitative behaviours of both large and small steelpan organizations where the steelpan player and the nearby residents are the least important persons. This exploitative approach amounts to a bullying approach, in that the people must take what they get from the big and powerful steelpan organization. It removes human dignity and is largely responsible for the transient nature of players, who move from steelband to steelband until they find a fair working relationship. The Brundtland Report on Sustainable Development states the following,

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. ... Deep structural changes are needed in the ways that societies manage their economic, social, and environmental affairs; and hard choices are needed to move from talk to action (Drexhage and Murphy, IISD, 2010).

Quantitative Data for Steelpan and Its Cumulative Toxic Relationship:

Steelpan toxicity is a widespread problem, but it is impossible to know how many steelpans are built and tuned each year. The reason why it is hard to know the actual number is because no data is required or collected by the Pan Trinbago, the world governing body of steelpan, and because this is generally a backyard operation, accountability is unimportant to the steelpan builder and tuners. Also if a steelpan is spoiled in mid-building stage, it may just be thrown to the scrap heap for recycling steel garbage. Therefore, this is not an exhaustive quantitative analysis of steelpans in circulation in Trinidad and Tobago. In fact, there are many omitted in this brief analysis for the Panorama competition 2016. The following is the breakdown according to the listed categories:

Band Category	Amount of Bands
Medium conventional bands	14
Large conventional bands	17
Small conventional bands	29
Single Pan bands	32

Table 1. A Breakdown of the steelpans required for steelband categories in Trinidad (Source: Michael C. Joseph)

This is a hypothetical example of the process of building steelpans for steelband performances for a carnival season, and it requires that burning be done numerous times per day. This in actuality is achieved during the course of a year, from after carnival celebrations to the preparation for the next carnival season. So the time frame in reality is approximately eight to ten months. There is an indeterminate life cycle for steelpans that is based on the maintenance and upkeep of the instrument. Steelpans that are physically located near the sea will experience rapid decay through rusting and oxidation caused by sea salt and blowing wind. Another factor that will affect the life cycle of steelpans are

related to the type of storage condition, transportation and handling. The EnviroPan Project took these factors into consideration for designing the contemporary needs of an environmentally managed steelpan storage and transportation system.

Medium Steelbands:

For a medium size steelband of 60 players with a conservative average of four steelpans per players, there will be around 240 steelpans for each steelband. The example in the table below has seventeen steelbands, and it can be replicated to reflect the various sizes of steelbands.

Number of steelpan players	60		
Average steelpans per player	4		
Amount of steelpans in a Steelband	240		
Number of steelband competing	17		
Minutes in fire to make steelpans	10	10 multiplied by 240	2,400 min. = 40 hrs.
Number of medium size steelbands	14	40 hrs. by 14 bands	560 hrs.
Number of days of continual burning		560 hrs. divided by 24	23.33 days

Table 2. A Breakdown of the steelpans required for Medium size steelband in Trinidad (Source: Michael C. Joseph)

Each drum will be in the fire for approximately 10 minutes each, exposing the steelpan builder and the residents to multiple occurrences per day for five or six days per week for one medium size steelband. This adds up to create a significant problem for the steelpan builders, tuners and residents. Totaling the sample in minutes per steelpan, we would have 240 x 10 minutes = 40 hours, or constant exposure for 8 hours/ day for 5 days. Then

for a total of 14 medium size steelbands = 240×14 amounts to 3,360 steelpans, and each steelpan requiring 10 minutes burning for a total of 33,600 minutes, divided by 60 minutes to total 560 hours, divided by 24 hours for a total in this category requiring 23.33 days of burning.

Large Steelbands:

Converting the sample for a large steelband of 120 players, we can safely double the numbers. $480 \text{ steelpans} \times 17 \text{ steelbands} = 8,160$ steelpans for this category, requiring 1,360 hours of burning or the equivalent of 56.67 days of continuous burning to outfit the seventeen steelbands.

Small Steelbands:

There are 51 small bands of 30 players averaging 4 steelpans per player that approximates 120 steelpans. Therefore the total number of steelpans in this category is 6,120. Therefore using the same approach in tabulating the required time for burning 6,120 steelpans would be 42.5 days.

Single-pan Steelbands:

Single-pan is the last category with 31 steelbands and with an average count of 25 steelpans would equal 775 steelpans in total. This means 7,750 minutes of burning is required, equaling 129.17 hours, divided by 24 hours to total 5.38 days of steelpan burning for the category.

This breakdown above applies to the Trinidad and Tobago Panorama competition, and will also apply across other Caribbean islands. Therefore the problem of burning residual toxic chemical is cumulative at worst.



The seed idea for EnviroPan: The Black History of Steelpan may initially appear to be routine, but this has been annual presentation presented to Toronto homeless communities, because homeless teenagers in Laventille, Trinidad, created the steelpan. There is also some significance for the first two international disseminations events occurred in Trinidad and Tobago in 2015, the home of the steelpan, and then in Boston, Massachusetts, USA, in 2016; the home of the current Administrator of US Environmental Protection Agency (EPA), Gina McCarthy.

EnviroPan: Green Seal for Steelpan provides the guidelines and solutions to regulate best practices for environmental steelpan production through education. It began during the public discussions at the International Conference on Pan on August 6, 2015 in Trinidad, and had its second international expression in the City of Boston, Massachusetts, USA, when the author was invited to speak about his research findings at the Presentation of Awards Ceremony for the Caribbean American Heritage Month, in the Mezzanine of the Boston City Hall, June 29, 2016. After the presentation, the author was presented with a Civil Citation from the organizing Committee, signed by Martin J. Walsh, Mayor.



*Michael Joseph receiving the Citation in Boston.
June 29, 2016, in the Mezzanine of Boston City Hall
Photo credit: Unknown*

The EnviroPan Project is taking its message across international borders to ensure greater care and concerns are taken in making steelpan. This will lead to greater recognition of steelpan as the earliest played environmental musical instrument created in the 20th century.

Advantage of New Steel Drums for Making Steelpan:

The other way of making steelpan is by using new steel drums that were made specifically to become steelpan. These drums are fashioned the same way as the used drums, with the only difference that there is no need to wash the drums before they are marked and sunken into their required depth according to the type of instrument to be made. However, some aspects of the traditional methods compromise the environmental integrity of the steelpan-making process at the burning of the drum stage. I believe this is an area where Environmental Sustainability Education (ESE) for Steelpan can make a difference by keeping contaminants away during the burning of the drum.

International Conference on Pan (ICP) 2015:

I attended this conference that was jointly hosted by the St. Augustine Campus of the University of the West Indies and PanTrinbago, the world governing body on steelpan. The conference brought together persons involved in all aspects of steelpan organized around the main theme, Towards the Globalization and Development of the Steelpan with the following seven sub-themes:

- Sub-theme 1: History and Development of the Steelpan
- Sub-theme 2: Science and Technology
- Sub-theme 3: Social Dimension
- Sub-theme 4: Education
- Sub-theme 5: Performance
- Sub-theme 6: Economic and Industrial Development
- Sub-theme 7: Steelpan Organizations (ICP, 2015)

This conference provided me access to an audience of over four hundred steelpan delegates and presenters for my presentation under the Education sub-theme. It was enlightening to hear their varied perspectives and concerns for steelpan as listed sub-themes. I was able to gather conference notes from other steelpan builders, educators and researchers in many countries and heard their concerns first hand regarding the approach to the traditional steelpan-making practice. I noted that the practice of making steelpans in other countries mimicked the Trinidadian model with minor variances. There is also a lack of environmental guidelines for steelpan building in general, and I was amazed that my EnviroPan presentation was the only one of its kind.

The research that produced EnviroPan: Green Seal for Steelpan is my way of providing relief from the toxicity of used steel drum containers to make steelpans. This method will help steelpan makers, their immediate neighbours and unsuspecting visitors to panyards across the global steelpan industry, to experience a toxic free environment and promoting a healthier experience than what is available at present.

My research has shown that the most essential type of facility needed for steel drum cleaning is based on a model recommended by Transport Canada webpage (Transport Canada, FAQ on Drum Reconditioning). Since this type of facility is missing in the Caribbean, getting clean used steel drums in Trinidad and Tobago will continue posing problems with toxicity to steelpan builders, and the concerns for the health and wellbeing of the neighbouring community will also continue to have dire consequences for all stakeholders.

Relevant Comments After EnviroPan Presentation at ICP 2015:

At the International Conference on Pan (ICP 2015) after my presentation was done, Cliff Alexis affirmed with his comments to support my presentation about the environmental requirements in the USA regarding his steelpan manufacturing operation at the Northern Illinois University steelband program. Alexis' example was, "While moving drums from point A to point B, a small chemical spill occurred in the soil that required him to notify the university's hazard material team. The team stopped his steelpan building operations until the chemical could be determined for environmental safety measures and a proper clean up process completed." A US schoolteacher also commented after my ICP presentation and spoke about his experience seeing high school students getting

contaminated through steelpans. He said, “As the students were moving steelpans from the steelpan builder’s delivery truck to the school’s band room, they had an encounter with residual chemicals that was still dripping from the drums. Their hands and clothing were messed up so he had to instruct them to discontinue and get washed up immediately because he did not know what type of chemical it was in the drum” He concluded by saying, “This is unacceptable.” (ICP, Unknown) Pan Trinbago’s secretary, Richard Forteau, responded in defense to the idea of toxic steelpan in schools by saying, ““We at Pan Trinbago, ensure that all steelpan that go into the school program are clean drums.” This implies that they know of the residual toxic chemicals in used steel drums, but they do not have any written guidelines on prevention.

Limits of Human Knowledge and Steelpan:

Although steelpan development began during the 1930s based its revolutionary ideas from making music with “discarded oil drums”, and establishing a large-scale global musical environmental phenomenon. It is significant to note that my foray into environmental research for steelpan broke new grounds for further considerations by identifying steelpan-making as an advance environmental study that is connected to an existing cultural practice rooted deeply in the African heritage with its socio-economic and political linkages.

Recommendation:

The facts presented in this paper show that there are real problems with residual toxic chemicals in used steel drum containers, and the following recommendations are a great start point to resolve the problems with toxicity and steelpans.

1. Recommendation for the installation of steel drum reconditioning facilities in places where steelpan are made to thoroughly clean the chemicals out of the drums before an instrument is made.
2. Recommendation to steelpan associations to provide instructions on environmental management principles to steelpan builders, tuners, arrangers and players to implement compliance to begin within one year thereafter.
3. The need to create a testing standard for identifying which types of residual chemicals are in steelpan that are already made to perform an instruments cleaning regimen to certify that the instrument is thoroughly cleaned according to the emerging EnviroPan: Green Seal for Steelpan standard.
4. Implement a monitoring process to include the residents who live near to steelpan-making facilities as stakeholders protecting their health and interest from wind-borne toxic chemicals.
5. Establish a supplementary medical-related research to build on the EnviroPan Project to provide medical data as evidence to sustain or disprove incidents of poisoning are caused by the residual toxic chemicals in used steel drum containers and its linkage to the deaths of steelpan builders, tuners, arrangers and players.
6. Implement appropriate signage at every steelpan site that is yet to meet the compliance standards according to the local environmental management authority guidelines. These signs will drive the steelpan organizations to achieve compliance much sooner, so visitors to their physical site can be properly notified of the

expressed concerns of residual chemical toxicity where the steelpan music is made of played.

7. Establish genuine efforts to support steelpan manufactures and steelbands in the implementation the EnviroPan Project with festival incentives.
8. Implementation of some standardized rinsate storage and disposal system would be a solution to transport the properly collected rinsate from the steelpan making facility to a larger storage facility according to modern environmental guidelines to treat rinsate before it impacts the environment.

The EnviroPan Project modular approach is designed to educate the global steelpan industry for better environmental practices. EnviroPan aims to align its practices in accordance with environmental agencies such as the Trinidad and Tobago Environmental Management Authority, the US Environmental Protection Agency and the Canadian Environmental Assessment Agency to provide an educational guidance package to achieve best practices in environmental stewardship for steelpan building, tuning, arranging and playing. I will develop the socio-cultural, socio-political, socio-economic and environmental sustainability goals for steelpan in keeping with the opportunities to present in the international arena for steelpans.

Conclusion:

It is no easy task to alter practices where individuals have been immersed in following a wrong course of action for decades. Building steelpans from used steel drum storage containers does present problems with residual toxic chemical. I believe the evidence presented is overwhelmingly sound, and my rebuttals are factual with little room for

doubt. However, I must understand there may be some unwillingness to accept change is for the best outcomes for the social, cultural, political, economic and environmental streams. The key to the problem lies in removing the residual toxic chemical from the source of raw materials, then it will be possible to create the new paradigm shift towards an environmental solution.

The EnviroPan Project is designed to provide education that focuses on plants, animals and humans life in relation to steelpan. These needs are primarily to be considered when manufacturing steelpan, and by taking precautions to protect steelpan builders, tuners, arrangers and players, the nearby residents will also be protected from the dangers of ill health caused by steelpan building and tuning.

If we can lay the groundwork to prevent environmental missteps through self-regulation within the steelpan industry, then appropriate monitoring by environmental management agencies and individuals monitoring themselves within the steelpan culture may understand the true purposes of ESE for Steelpan. Collaboratively, we can work together to raise awareness of these critical issues that would strengthen our common ties within the global steelpan industry and community. So when this new paradigm shift is achieved, it will be analogous to a corresponding shift in the tectonic plates below the ocean floor that will produce the great tidal wave of consistency benefitting the biosphere, thereby giving hope to all living thing within its range. That shift if accepted will sound like real music to every ear.

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