‘Waking the dead’: Preserving obsolete audiovisual formats in New Zealand heritage libraries and archives

by

Amanda Mills

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Abstract:

Physical preservation of obsolete audiovisual (AV) formats is complex. Many aspects must be considered around storage, care, and access of these items before any preservation methods can begin. There has been much written about AV preservation from an international viewpoint, but little looking from a local New Zealand perspective. This study approaches issues surrounding preservation of AV formats from a New Zealand heritage viewpoint, with preservationists from three heritage libraries and archives interviewed to determine issues, processes, and solutions with these formats. A qualitative, case-study methodology using semi-structured interviews was used to frame this research, and compare the different approaches of the three institutions. Five AV preservationists from the three institutions participated in this research, with each participant providing valuable insight into the different processes around AV preservation. Results suggest that institutions are approaching issues about preservation with care, and concern, as many formats are already obsolete, with playback equipment rapidly becoming irreplaceable, or unobtainable. The importance of keeping these formats is a key component of AV preservation too, as without them, information is lost, and may never be recovered. Results impact on libraries and archives with obsolete AV materials by providing advice, or answers about preserving these formats when there are complex issues surrounding them.

Keywords: audiovisual, preservation, obsolete, equipment, formats, content

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"**The culture of prevention should be as important in a heritage institution as the culture of user services"** (Edmondson, 2016, p. 66)

1. Research problem

1.1 Problem statement

Physical audiovisual (AV) materials housed in local heritage archives and libraries are numerous, with the majority on obsolete or obsolescent formats. This is of increasing concern: content on these formats is in danger of being lost due to damage to or deterioration of original carrier, and the increasing chance of playback equipment becoming obsolete. A limited timeframe to preserve the content of these items has been widely stated in a number of publications (Casey, 2015, UNESCO, n.d., Library of Congress, 2012) and this is most often estimated between 15 to 20 years (Casey, 2015, p. 17). After this time, there are no guarantees that equipment will still be able to play back original carriers, or that these formats (some fragile, chemically unstable, and easily damaged) will not have degraded beyond playback quality. Casey also comments that increasing costs of digitally preserving these formats will become "prohibitively expensive" due to difficulties in acquiring equipment, or any working parts, as manufacture slows, or stops altogether (2015, p. 15-16). However, the need to save this material is a reality, and motivation to find preservation solutions pivot around recovering 20th Century history, as "saving the sounds of human culture for those who come after us is a powerful reason to preserve" (Peoples & Maguire, 2015, p. 2). This connects with the importance of keeping obsolete formats after digitally preserving content, as, Edmondson (2016) states, "many archives have now regretted the premature destruction of originals after making copies… inferior in quality or longevity. Discarding an original… should never be undertaken lightly" (p. 67). Keeping original formats safeguards against loss of content, which does occur with digital obsolescence, while discarding them indicates future re-digitisation to a higher quality standard cannot happen.

The study examines preservation of obsolete physical AV formats within larger New Zealand heritage libraries and archives that have extensive collections of these materials. The research looks at a local, New Zealand

perspective: much has been written from a holistic, international viewpoint, with examinations of similar collections occurring worldwide (Zimmer, 2015; Laas, 2011), but little has been written from a New Zealand position. As there is much material in local heritage libraries and archives on deteriorating, obsolete, or obsolescent AV formats, it seems appropriate to consider how this material is being preserved (both carrier and content) for future use and access, beyond the two decade timeframe established by Casey (2015), International Association of Sound and Audiovisual Archivists (IASA) (2014), UNESCO (n.d.), and Library of Congress (2012).

This research investigates preservation methods of obsolete AV formats, and what measures are taken to ensure physical carriers, and associated content, is available for future use. The focus here is on physical formats, and digital preservation is out-of-scope for this study. Digital re-formatting is a (vital) consequence of preservation, and digital preservation is addressed in terms of digital obsolescence, as “digital files have to be constantly managed and refreshed in the face of bit rot, software and hardware evolution and other threats… losses can be sudden and total” (Edmondson, 2016, p. 54). Digital files frequently require re-formatting, as “digital preservation conceived as a permanent solution for safeguarding the audio archive… may well be inoperative within a relatively short period of time” (Rodriguez-Reséndiz, 2016, p. 187). Although undoubtedly important, wider aspects of digital preservation require broader discussion, and are ideal for further research.

Physical AV formats are widely understood to be problematic, due to deterioration or degradation, chemical instability, and the increasing obsolescence of playback equipment. Formats once considered replaceable (for example film prints, shellac discs, or magnetic tape), are now thought of as “artifacts requiring… different handling and understanding,” and thus demand a new status as materials requiring protection (Edmondson, 2016, p. 54). Casey (2015) agrees, saying “media collections could soon be considered highly endangered” (p. 14), and an IASA task force in 2003 stated that “in the mid- to long- term there is a major risk that carrier degradation combined with playback obsolescence will defeat the efforts of archivists to

ensure the survival of the content in their care" (Breen, Flam et. al. para. 11). These issues are experienced by curators and conservators of AV collections worldwide, but local examination of these issues presents opportunities to identify particular challenges.

It is hoped a number of benefits will emerge from this research, and impact on heritage libraries and archives in New Zealand with obsolete AV formats by identifying preservation methods for both format and content. These institutions may be national centres of heritage materials, regional, or community-based libraries and archives, who may lack funding, staff experience or expertise relating to AV preservation, and are possibly unaware of steps to protect physical formats or digitally capture content. This study aims to provide advice or solutions to challenges faced by these institutions.

1.2 Key terms for definition

1.2.1 Obsolescence

AV formats or playback equipment become obsolete (cease to be functional) when technology no longer exists to play the format back, or when production stops for that format or equipment. Edmondson (2016) describes continuing problems of AV obsolescence as due to "carrier decay, combined with the seeming inevitability of continuing format change," and "image and sound content can survive and continue to remain accessible only through migration" (p. 54).

1.2.2. Carrier and format

Carrier and format are often used as interchangeable terms when describing audiovisual objects. The term carrier the item that holds the information, "the physical component of an analog recording" (Carrier, 2015, p. 224). Format refers to different configurations of media in AV collections – for example, magnetic formats, or mechanical formats, which are comprised from different media, or specific types of carriers.

1.2.3 Preservation

Content preservation means future access. Edmondson terms preservation as fundamental, the “totality of things necessary” to guarantee permanent access to AV materials and content, and something which is ongoing, as “nothing has ever *been* preserved – it is only *being* preserved” (2016, p. v).

1.3 Research objectives

The objectives here are to identify, and find potential solutions to issues, relating to the preservation of obsolete AV formats. A number of questions emerge relating to this study that surround these issues.

1.4 Research questions

The main questions around preserving AV formats in heritage libraries and archives include

- What are the options, processes and measures taken to protect AV content, and ensure physical formats survive?
- What AV formats are considered obsolete or obsolescent?
- What are the specific issues New Zealand heritage libraries and archives face regarding preservation of obsolete AV formats?
- Why should these formats be kept if they are unable to be played back? What is the impact of not keeping these formats?

The broader AV preservation field also looks at the point of obsolescence. Sub-questions surrounding obsolescence include

- When does obsolescence occur?
    - When playback equipment is no longer produced, or when more recent, or stable formats are used?
    - Does obsolescence occur when formats are no longer used to carry information, or are no longer produced?

2. Assumptions and limitations

2.1 Limitations

Preservation of obsolete AV materials is only undertaken within a few heritage libraries and archives in New Zealand, and this research involves a small number (three) of relevant institutions. It must be noted that one institution is undergoing restructuring, so issues of staff availability arose when approaching the institution for interviews, and access to audio preservationists was declined due to a restructuring of the institution, although permission was granted to speak to a film preservationist. While this presents a gap in expertise from one institution, other sound archivists from parallel institutions provide valuable information on audio preservation, and fill gaps to a certain extent. Every institution has different methodologies, so being unable to discuss audio preservation with one institution means important information will be missing. Another limitation was the unforeseen unavailability of one staff member from a second institution, a preservationist working primarily with magnetic tape formats. Again, this gap of knowledge and expertise was disappointing, however, preservationists interviewed all provided valuable information that covers challenges with preservation of obsolete AV formats. This will lessen any impact of gaps in expertise, as their expertise is in the same (or related) area.

The scope of this research is the physical preservation of AV formats that are either obsolete now, or facing obsolescence in the next 10-15 years (Casey, 2015, p. 17; National Film and Sound Archive of Australia, 2015). While digital preservation is not covered in the broader sense, it is referred to in relation to obsolescence of digital files, and challenges that emerge when faced with files that can no longer be played back. National heritage libraries and archives are target institutions for this research as they are preserving material for access for future generations. Broadcast archives and libraries are out of scope, as they do not preserve material to preservation standards for future safekeeping. Also out of context are born-digital materials, as these have their own challenges, which do not involve obsolete physical AV formats.

2.2 Assumptions

The following assumptions are made in this study:

- Local heritage archives and libraries have AV materials they want to preserve
- National heritage institutions canvassed can provide expert help
- Institutions have some way of starting a preservation program
- Institutions have a basic knowledge of AV preservation (physical and digital)
- Preservation of physical obsolete AV formats in heritage libraries and archives is important.

3. Literature review

AV format obsolescence is often skimmed over in literature: mentioned but rarely approached directly. Although literature reported on here relates to wider themes in AV preservation, obsolescence of AV formats is not explicitly discussed in much of the textual material examined for this research. Obsolescence of media and playback equipment is a continual challenge, one "exacerbated in recent years by the rapid demise of technologies supporting audiovisual analog formats," (Xie and Matusiak, 2015, p. 100). Obsolescence underpins all consideration of AV preservation, and is a prime reason for digitisation, especially when playback devices for these formats are no longer produced, posing a "serious threat to accessing content and to digital reformatting" (Xie and Matusiak, 2015, p. 100). Literature included here examines these issues through case studies, qualitative and quantitative research, and overviews surveying particular aspects, although approaches look predominantly internationally rather than locally. Information surrounding AV preservation concentrates on challenges and issues, and while plenty of recommendations are given, few solutions are provided.

The majority of the following sources have been published within the last decade. Some exceptions apply, notably Harrison (1992), Seadle (2004),

Johansen (2001), Paton (1998), Jackson (2001), and the IASA's *The Safeguarding of the Audio Heritage: Ethics, Principles and Preservation Strategy* (also known as *TC03*) (2005), considered a significant document on preserving audio heritage. Early papers provide a point of comparison to illustrate what challenges remain (or have been removed) since publication, or what (if any) developments have been made. Presently, material examining a New Zealand perspective in this area is lacking, although a related thesis from Victoria University's School of Information Studies shows local research into related areas.

Studies selected here identify common threads around the wider AV preservation field. These papers are presented as mostly qualitative research, using interviews (Widzinkinski, 2010) and case studies (Seadle, 2004; Koch, Simon, Gomez-Sanchez, Mendel, & Wiedmann, 2008; Schüller, 2008a; Orio, Snidaro, Canazza & Foresti, 2009; Mattock, 2010; Van der Reyden, 2010; Laas, 2011; Norris, 2014; Zimmer, 2015 and Smith, 2016) to present information and research findings, though Schüller also uses quantitative analysis in his investigation into AV archiving in Austria (2008a, p. 36). Li, de Leon, and Fujinaga (2008) use a scientific approach to investigate digital preservation through optical methods. A further (and often used) methodology is the historical overview, where specific areas of AV preservation are assessed or presented (Rodriguez-Reséndiz, 2016; Seadle, 2004; Gracy, 2013, Walsh, 2008). Finally, a unique perspective comes from Casey (2015), who frames a case for preservation as a fairytale, to illustrate how "media preservation has reached a crisis point for content carried on physical audio and video formats," admiting that "outside the fairytale… the signs are ominous" (p. 14).

3.1 Frameworks in AV preservation research

Identifying theoretical frameworks, ethics or principles within literature on AV preservation is often challenging, as much of this material takes a historical, viewpoint approach, though some include (or indicate) theories, concepts, or philosophies. Seadle (2004) uses anthropological theory in discussing sound recording preservation, recognising "the variety of micro-cultures that need to

interact in order to accomplish the technical task of preserving any significant amount of recorded sound" (2004, p. 97). Archival theory is touched on by Gracy (2013), and Zimmer (2015): Gracy comments that film libraries and archives have archival aims to "preserve… for posterity" (2013, p.381), while Zimmer frames his examination of the Kirby wax cylinder collection around hegemonic power, and archival responsibility. Baker, Doyle and Homan (2016) examine the popular music archive's role through the framework of national identity, particularly "the preservation and construction of national popular music histories", and consider the music archive as "authorized institutions at the intersection of personal, social, and industrial memory" (p.11).

Several authors (Mattock, 2010; Usai, 2013; Norris, 2014) refer to Walter Benjamin's concept of the aura, found in his 1936 essay *The Work of Art in the Age of Mechanical Reproduction*. Benjamin (1936) states that art is "reproducible" (p.3), though admits that "even with the most perfect reproduction, one thing stands out: the here and now of the work of art" (p. 5), calling its singularity "the aura" (p. 10). Norris describes the aura as "the uniqueness that lends a piece of art its authority… reproduced copies cannot reproduce aura" (2014, p. 171). For Benjamin, 'art' is any form of artistic expression, and Norris (2014, p. 171), Mattock (2010, p. 75), and Usai (2013, p. 10) apply it directly to preserving obsolete AV formats, though Usai comments that due to the lack of aura in a copy there is "no incentive to treat the copy… as an artifact" (2013, p. 10).

Further theoretical frameworks relating to AV preservation emerge. Norris (2014) applies three philosophies to the field: autographic and allographic authenticities, Eastern and Western preservation values, and Platonic and Aristotelian authenticities. These concepts are applied to the two preservation threads for AV formats, with allographic, Eastern-style, and Platonic concepts supporting "reproduction and content change that is considered authentic," while autographic, Western-style, and Aristotelian concepts reinforce the idea of preserving original media, as "reproduction and format change are considered inauthentic and unacceptable" (Norris, 2014, pp. 175-176). These

philosophies consider obsolescence by inherent vice, as deteriorating media shifts conservation priorities, and “without quick decisive action, works can be lost” (Norris, 2014, p. 174).

Edmondson (2016) approaches AV preservation frameworks by relating philosophies and practices such as storage, digitisation standards, formats and carriers to preservation properties, and amalgamating these as a “theoretical synthesis of the defining values, ethics, principles and perceptions implicit in the field” was lacking (p. 2). Edmondson’s philosophical framework asks “why do we do the things we do, and why do we do things the *way* we do them”, then provides description on the actualities of AV preservation rather than applying other theories or constructs from varying institutions (2016, p. v).

A further approach is an examination of ethical codes. IASA’s *TC03* claims not to be a Code of Ethics, but does consider ethical consequences resulting from “technical aspects of recording, preserving and accessing sound documents within the framework of the technical development” (2005, p. 3). While using a format-specific approach, Bradley (2008) observes unique dilemmas faced by passive preservation of formats, and acknowledges that ethics are not faultless in dealing with issues surrounding AV preservation. This is relevant to the preference for content preservation over carrier preservation, as audiovisual recordings “are clearly more than a physical object” (p.40). While recommending a code of ethics for guidance in preservation, restoration and AV transfer, Bradley also admits that while *TC03*, and IASA’s *Guidelines on the production and preservation of digital audio objects* (*TC04*) provide information on the issues faced in these fields, they are not “unequivocal” guidelines (2008, p. 36).

3.2 Preservation of AV materials

Preserving AV materials is key: Johansen (2001) states they are “important historical material” that has been “made during an important time in your history” (p. 418). Schüller (2008b) agrees, terming them “the media of modernity,” and maintains that “no adequate understanding of the past 100

years would ever be possible without them" (p. 5). Gwang-Jo Kim, writing the foreword for Edmondson (2016) goes further saying they "transcend local borders and language barriers" (p. vii).

Earlier papers look at AV preservation in a pre-digital era. Harrison (1992) recognises these challenges, calling preservation "active: you have to do something to the material" (p. 213). Harrison's examination deteriorating AV formats indicates a serious consideration of the challenges presented, and acknowledging materials "have an uncertain life expectancy," and require migration (or transference) "at regular intervals for preservation," (p. 217). Paton (1998) examines preservation re-recording of audio formats in archives, calling it "necessary for working with older recordings" (p. 188). Many changes have occurred since Paton's article, most significantly digital preservation. However, planning and implementation processes that Paton lists (collection examination, understanding of preservation re-recording, transfer technology formats, and final considerations such as estimation of time, cleaning, the cost of preservation, staffing and storage) remain pertinent and valid concerns for physical and digital preservation in 21st century preservation processes (pp. 189-190).

As one of the key texts on AV preservation, Edmondson (2016) examines obsolete formats in meticulous detail, taking a philosophical approach to preserving them. Edmondson states that AV materials are "*no less* important, and in some contexts *more* important, than other kinds of documents or artifacts. Their… vulnerability to rapidly changing technology does not lessen their importance" (2016, p. 9). IASA's *TC03* (2005), another crucial text in the area, focuses on audio carriers, and acknowledges they are "more vulnerable to damage caused by poor handling, by poorly maintained or malfunctioning equipment and by poor storage than conventional text documents," and acknowledges that analogue formats are "being phased out" due to the carriers and playback equipment no longer being produced (p.4). IASA proposes that safeguarding information on these carriers can occur by preserving the carrier and copying the information contained in them (2005, p.5). IASA's *Handling and Storage of Audio and Video Carriers (TC05)*

(2014), examines passive preservation measures for passive preservation of audiovisual carriers, including environmental factors, handling and storage, looking to “optimise conditions for the preservation of physical and chemical integrity of traditional… audio and video carriers” (2014, p. 5). IASA recommend digitisation for long-term preservation of primary information, as “the digital domain offers the possibility of lossless copying when refreshing or migrating recordings,” whilst acknowledging questions of future authentication of the sound (p.5).

Schüller (2008b) comments on obsolescence of moving image formats, concluding that while film materials can be preserved as originals, “it is not possible for audio and video recordings in the long term” due to carrier and playback equipment fragility and instability, which “swiftly [ceases] production” (p.5). Due to this, Schüller states, preservation has to focus on “safeguarding the content, not the original carriers” (2008b, pp. 5-6). Usai (2013), agrees that format obsolescence is concerning, observing “the two main obstacles facing moving image archivists and curators are the need to periodically migrate the digital files, and the rapid obsolescence of the equipment used for storing them” (p. 11). Bereijo (2004) also studies preservation of film and magnetic material, observing that “it is necessary to know the natural features of these materials” as they are often challenging for preservation (p. 232). This relates especially to nitrate media, which is destructive and unstable, with chemical deterioration often rendering the film at risk (p. 325). Walsh (2008) examines film too, noting that the shift from earlier preservation methods of “copy and destroy” to “preserving the original artifact” lies in improved knowledge of “long term storage behaviour of film” (p. 38). However, as digital copies capture more and more information from the original film, Walsh sees a return to the idea of disposing of original film copies, as they may no longer “*need* to be kept” (2008, p. 40).

Bradley (2008) also notes the instability of carriers, as “the loss of the carrier does result in the loss of the inscribed audio content” – although preservation of the carrier does not mean automatic preservation of content (p. 38). Xie and Matusiak (2015) also note the importance and urgency of preserving

obsolete AV formats, reporting studies of European and American AV collections indicate “if analog audiovisual materials are not reformatted in the next few decades, their content may be lost” (p. 96). Quoting Smith and Brylawski, they add to the sense of urgency: “it is alarming… nearly all recorded sound is in peril of disappearing or becoming inaccessible within a few generations” (p.v in Xie and Matusiak, 2015, p. 96). Johansen (2001) is blunt, advising that “there is no eternal life for your collection… we all know the tragic fate of audiovisual source. The duration of the material is limited” (p.417). Casey (2015) argues more broadly for AV preservation measures, and considers the increasing inaccessibility of recorded media, carrier degradation, playback obsolescence, and AV material becoming the fastest growing segment of (U.S) archives “a perfect storm” of obsolescence, large numbers of carriers, and degradation of formats (p. 14). Fading knowledge of, and experience with, playback equipment and techniques required to repair it also alarming, as “some preservationists believe that there may not be enough working audio and video playback machines left to digitize everything currently held in archival vaults” (Casey, 2015, p. 16).

Koch, Simon, Gomez-Sanchez, Mengel and Wiedmann (2009) take a different approach, examining the ILKAR project, which holistically aims to preserve obsolete formats by improving “methods to identify and treat especially endangered cylinders and tapes… [and] methods to retard the decay process of storage media” by integrating them into workflows of holding institutions to provide practical solutions for these fragile formats (2009, p. 41). Van der Reyden approaches AV preservation scientifically, identifying causes of (and reactions to) inherent vice, but admits “recognition that moving images and recorded sound… are highly vulnerable… has come to our collective awareness relatively late,” indicating the risk of being unable to preserve material is great (2010, pp. 8-9).

The Library of Congress (2012) take a more structured approach to preservation, presenting *The National Recording Preservation Plan* as a call to arms to preserve (physically and digitally) AV materials in institutions in

America for public access[1]. Monkman (2016) focuses on preserving audio formats in archives and libraries, saying sound is “frequently neglected in favour of visual media” (p.1). Acknowledging the number of formats sound is recorded on adds complexity to wider audio preservation (including their differing ‘ideal’ format conditions); Monkman sees this challenge “[affecting] all formats” of grooved, magnetic, optical and digital media (2016, p. 2). Monkman concedes the main issues relating to audio preservation are digitisation and authenticity, to ensure both future access and usability, and also the value and truth of the item in question (p. 9). In this age of digitisation, Monkman suggests, “a… broader definition of authenticity may be needed” (2016, p. 10). Edmondson (2016), too, considers archives important in preservation of obsolete technologies as “places where obsolete technology and processes are… maintained and nurtured so that material in all audiovisual formats can be restored and… faithfully reproduced” (p. 55). He calls the disparity between the life of the carrier and the technology needed to play it a “dilemma” (Edmondson, 2016, p. 65).

Case studies presented here are an eclectic mix. Laas (2011) and Schüller (2016) examine AV institutions and collections in Europe, with Laas discovering physical AV preservation in Iceland institutions marginal, and a “matter of… concern” (p. 142). Schüller concedes "the pace by which all dedicated audio and video documents are becoming obsolete is breathtaking” In European collections, and sees preservation as key in recovering content on AV formats, (2008a, p. 5). Smith (2016) observes collaborative efforts for audio preservation, and notes the US National Recording Preservation Act of 2000, which drew “significant attention to the many challenges related to… preservation” (p. 485).

Zimmer (2015) approaches audiovisual preservation from a more traditional, culturally historical angle, examining the Kirby Collection of wax cylinders at the University of Cape Town, and finding that these ethno-musicological recordings have either deteriorated and cannot be played. The deterioration

[1] It is estimated there are 46 million sound recordings alone in US institutions (Library of Congress, 2012, p. 1).

(cracks, scratches, and mould) of these cylinders is due to an absence of correct storage (temperature and humidity controlled), and poor handling, which Zimmer states "[embodies] a total loss of useable information," (2015, p. 104), and adds to the "sensitive and complex" archival discourse in South Africa (2015, p. 102).

Wright (2009) investigates the BBC's preservation planning strategies for their broadcast archives, noting AV formats require digitisation due to format obsolescence, media deterioration and damage (p. 14). The suggestion here is that preservation strategies are useful, as they look further than just digitisation – preservation must be about "all the processes needed to maintain content," while consideration is given to types of collections and their required access condition for making more informed decisions (p. 14). Baker, Doyle, and Homan (2016) observe closer to home, examining the National Film and Sound Archive of Australia (NFSA) as an institution of popular music history preservation and conservation and admitting "obsolescence of legacy formats and of technology" limits archival ambitions for material re-use (p. 15).

There is little research undertaken to examine New Zealand perspectives on AV preservation of obsolete formats. Thompson (2008) observes preservation strategies of heritage institutions in New Zealand towards digital materials in physical form, commenting "physical preservation can be best thought of as an interim measure, as ongoing accessibility requires the continuing existence of operating environments" (p. 11). Thompson's qualitative study has a narrow focus regarding format, but reveals how local heritage institutions treat material, and preserve it digitally, although further developments have occurred since this research.

3.3 Deadlines for preservation

A pressing concern often raised within the literature is the length of time remaining to digitise physical AV formats. Casey (2015), IASA (2014), UNESCO (n.d.), and The Library of Congress (2012) all indicate there a "short time" (Casey, p. 14), or an "ever decreasing time" left to successfully complete this work (IASA, p. 6). Some authors have given a time limit on these

estimations, with 10-15 years a frequent estimation (IASA, 2014, p. 6; UNESCO, n.d., para 6). The NFSA's *Deadline 2025* (2015) document narrows down the estimate further by providing a specific date, 2025, but also admits "at current rates of investment, only 30% of magnetic tape can be saved in time" (p. 3). This is a serious situation: magnetic formats will become inaccessible, and equipment rendered obsolete as "the last generation of fully experienced analogue-to-digital- transfer broadcast engineers will be retired" (National Film and Sound Archive of Australia, 2015, p. 4). *Deadline 2025* is a noteworthy document, but only focussing on one format diminishes the need to preserve all material on other obsolete or obsolescent formats.

3.4 Digital preservation

Digital preservation and curation is a major thread in AV preservation literature. Rodriguez-Reséndiz examines digital preservation of audio recordings to locate solutions and commonalities of processes, as "digitization is a measure that serves to preserve documents recorded on analogue supports" (2016, p. 183). As one of the few writers concentrating specifically on AV format obsolescence, Milovanović (2008) focuses on digitisation of analogue audio, specifically coarse groove (78rpm) discs, and notes inherent vice issues relating to format obsolescence, and recommends digitisation, to "dramatically improve accessibility of vintage sound materials" (p. 49). Evens and Hauttukeete (2011) also see great benefits from digital preservation, as it "ensures permanent access to digital information," and "deterioration of analogue carriers of information, lack of storage and playback infrastructure… has led to digitization" (p. 158).

Most literature relating to digital preservation warns of digital obsolescence. IASA (2005) states "digital carriers are generally more vulnerable to loss of information through damage than analogue carriers," advocating for multiple copies of digital files, advising "it is essential to keep at least two digital preservation copies and… use additional copies for access… preservation copies should be kept in different locations whenever possible (2005, pp. 4-5). IASA recommends migration as a digital preservation technique, as "content must be copied before the old… hardware become obsolete" (2005, p. 9).

Evens and Hauttukeete agree on digital carrier fragility, adding “it is assumed that digital carriers are fragile media… they have a restricted life span” (2011, p. 158).

Li, de Leon, and Fujinaga (2008) take a technical approach, examining an experimental optical audio reconstruction (OAR) technique for preserving fragile phonograph discs and wax cylinders using white-light interferometry profilers to trace and measure disc grooves, and extract an audio signal (p. 165). This approach to digital preservation is contactless, with no damage to any fragile items, and the technique is “the only way of restoring broken phonograph discs” (Li, de Leon, & Fujinaga, 2008 p. 166). Janukiewicz (2016) assessed the OAR technique further, but still only focuses on 78rpm discs, demonstrating challenges with the method (p. 16).

Seadle (2004) approaches audio digital preservation holistically, inspecting conversion technology from a technical point of view – recommending best practice for sampling rates, recording levels, and formats. Seadle emphasises sound preservation is a “large and complex social and organizational project” (2004, p. 98). Williamson (2005) sees digital preservation strategies of documentation, migration, refreshment, emulation, controlled storage, and backup process suitable for managing digital formats, to maintain a “golden digital heritage” (p. 512). He notes format and digital obsolescence as disturbing, as “pristine hardware cannot protect against data loss due to compromised media” (2005, p. 510). Finally, Orio, Snidaro, Canazza & Foresti (2009) assess methodologies and tools involved with analogue to digital sound recording transfer, although they pronounce preservation of carriers and maintenance of equipment “hopeless”, and content stored in these carriers “[at] risk of disappearing” (p. 202).

Digital preservation is also not the absolute endgame: the question remains on preserving original physical formats. Pellizzari (2015) examines the arguments for preserving original audio formats post digitisation, and admits two arguments exist within archival circles: “that digitization resolves most if not all the problems arising in connection with the preservation of documents,”

and therefore only digital storage is relevant; and “the high cost of preserving originals is a strong argument in favor of their destruction” (p. 8). However, Pellizzari notes that experts in the field of audio preservation, Wright, and Edmondson, also present important arguments for keeping original formats (p. 8). A compromise between either ‘keeping’ or ‘discarding’ original recordings, may not be as straightforward as Pellizzarri’s criteria for decision-making (format condition, availability of playback equipment) suggests (pp. 9-10).

These papers consider wider fields of AV preservation, and provide context for active and passive preservation methods. Case studies and interviews deliver exemplars of different approaches to preserving AV formats, identifying issues with preserving this material, and different audio and visual formats. Gaps within the literature exist, especially around video formats, likely because these standards are still being developed. Another thread lacking in this literature is material examining a New Zealand-specific approach to preserving AV formats. This would assist in identifying and documenting unique issues appearing in local institutions dealing with challenges relating to obsolescence, or adherence to best practices with preserving these materials.

4. Philosophical frameworks

Williamson (2013a) sees theoretical structures as assisting the researcher in ‘seeing’ different aspects of their research problem (p. 42). After considering conceptual and philosophical frameworks presented within included literature, this research uses Edmondson’s philosophies and practices of AV preservation as a framework, as they underpin preservation methodologies, and provide the framework for all discussion on preserving obsolete AV formats. Benjamin’s concept of the ‘aura’ is considered, as debates around authenticity of reproduced or digitally preserved works impact on heritage value, as “authenticity is… an objective and measurable attribute inherent in… material fabric, form and function of artifacts,” (Jones, 2010, p. 182). For

digitally re-formatted audiovisual carriers, future authentication may be required, as a digital copy only has what IASA (2005) terms the “primary information,” and will require secondary information, so “future users can be sure of the authenticity of the primary data” (p. 5). However, Benjamin, the aura, and authenticity are only cursory considerations, as digital preservation is out of scope for this research.

Edmondson’s *Audiovisual archiving: Philosophy and principles* (2016) sets out philosophies and principles of AV preservation, examining the values, rules and assumptions that exist in the field. Edmondson states that philosophies are powerful, because

> theories, worldviews and frames of reference they create are the basis of actions, decisions, structures and relationships. Audiovisual archivists… exercise a particular kind of power over the survival, accessibility and interpretation of the world’s cultural memory… theories, the principles, the assumptions and the realities influencing their work therefore becomes a matter of some importance… for society at large (p. 1)

For Edmondson, understanding and exploring “professional terrain” is achieved by theory, and he says that those working with AV materials “need to understand and reflect on their philosophical foundations, if they are to exercise their power responsibly” (2016, p. 1). These philosophies and theories lead to questions (“why do we do the things we do?” and “why do we do things the way we do them?”) considered important to “constantly ask” among developing practices, technologies and politics (2016, p. 1).

Theories and philosophies in this area were developed due to the increasing amount of AV materials in collections, and therefore, their increasing significance. The lack of what Edmondson calls “clear professional identity and recognition” and no fusion of values, ethics, principles, and perceptions made institutions vulnerable, with no clear methodologies (2016, p.2). The formation of associations such as IASA, FIAF (International Federation of Film Archives) and ARSC (Association of Recorded Sound Collections) among

others, and the subsequent publications from those associations and others (such as UNESCO) to advise of roles and legal situations, have assisted in providing structure and guidelines within the field. Major challenges within the field of AV preservation – including obsolete formats and digitisation – still require guidance, which Edmondson provides. Edmondson's philosophies and principles relate back to research questions and objectives of offering solutions to challenges around AV preservation by providing context for these collections, and giving detailed descriptions of actions around and reasons for AV preservation.

5. Research methodology

AV format obsolescence is a complex area, and requires interpretation of concepts and behaviours, as well as opportunities to understand current practices. Research in this area benefits from a qualitative approach – a holistic methodology looking at wider scenarios. Qualitative research, according to Leedy and Ormrod (2014) involves non-random data sources, selecting "individuals or objects that will yield the most information about the topic under investigation" (p. 154). A qualitative method was chosen over quantitative methods, as the quantity of appropriate institutions is small, and any sample or population would not produce wide-ranging results.

5.1 Qualitative research methods

Qualitative methods "demonstrate [a] different approach to scholarly inquiry" (Cresswell, 2014, p. 183), observing behaviours, and constructing worldviews through examining phenomena or concepts (Cresswell, 2014, pp. 19, 110). Qualitative research methods assist with revealing the

> multifaceted nature of certain situations… [and] enable a researcher to… gain new insights about a particular phenomenon… develop new concepts or theoretical perspectives about the phenomenon, or… discover problems that exist (Leedy & Ormrod, 2014, p. 142)

These methods may locate gaps within data, and provide further pathways for research. The inclusion of documentation such as paper records or AV materials in addition to interviews, demonstrate patterns or themes in the data (Cresswell, 2014, p.185-6). This is fundamental, as Prior (2016) indicates documents are “inert carriers of content,” and provide “rich textural data” (pp. 172, 174).

Content is essential in qualitative research, as “examination of content… [grounds] analysis in the words or concepts contained in the text” (Prior, 2016, p. 174). Data from content surfaced from these interviews through the coding process, which established emergent themes and patterns. These themes also relate back to the research questions posed early in this research.

Other qualitative research designs were considered, including grounded theory (where theory is derived from data collected in a natural setting), and content analysis (where specific characteristics of a body of material are identified) (Leedy and Ormrod, 2014, p. 152). These were not used due to the small number of sample institutions, and the lack of extensive publications produced by each institution.

5.1.1 Research design: Why case studies?

A small number of heritage libraries and archives in New Zealand have collections of physical AV materials that are either obsolete because the formats are no longer made, or because there is now no working equipment to play the formats back. This research was undertaken to find solutions to these preservation challenges prevalent with obsolete audiovisual formats in national institutions with these formats. Experiences with audiovisual formats have revealed issues with fragility, format deterioration due to chemical reactions, and significant problems with locating playback equipment for obsolete (or obsolescent) formats such as cylinders, cassettes, magnetic tape (audio and video), nitrate film, and lacquer discs. By undertaking qualitative case study research using interviews with expert AV preservationists, this research examines challenges and offers solutions to issues with obsolescent formats.

Why case studies? Case studies are a suitable research method, as they are flexible, and allow a “focus on the dynamics of a phenomena within a single setting” (Shanks & Beckmamedova, 2013 p. 173). This approach enables research to “predict similar outcomes across cases with similar contexts… and therefore strengthen generalization or produce contrasting findings” (Shanks & Beckmamedova, 2013 p. 180). Case studies enable comparative analyses of the institutions canvassed here. The number of institutions with these collections is small, so comparative case studies were deemed an appropriate research approach. Five out of six participants from all three institutions approached in the interview phase replied, and were subsequently interviewed, so case studies compare preservation methodologies, ideologies, and actions between the participants. The three New Zealand institutions with significant collections of these formats were selected due to my prior knowledge of their collections and the need to preserve them, and the expertise and knowledge base of the preservationists undertaking this work. The preservationists interviewed for this research are experts in their field, and provide information crucial to answering questions that arise relating to preservation of obsolete formats.

5.2 Data collection interviews

Information collection for this research was undertaken via face-to-face, semi-structured interviews with staff working directly with preserving obsolete AV formats. Semi-structured and open-ended interviews are considered authentic, and provide subjective experiences, although Miller & Glassner consider them to have the risk of answers repeating familiar situations (2016, p. 52). Semi-structured interviews are valuable to research results, as direct quotes from participant interviewees support findings (Williamson, 2013b p. 364). Interviews were arranged with institutional managers and participants, and then conducted at the participant’s natural setting (their respective institutions), and took between 40 minutes and 90 minutes, depending on the level of answers given. Institutions were selected due to prior knowledge of their AV collections, and participants chosen due to their area of format expertise. All institutions approached were based in the North Island, in

Wellington and Auckland, with a mostly even mix of men and women (three women and two men).

Participants were provided with an information sheet and a participant consent form before the interviews, which outlined the objectives of this research and advised all names and institutions would be kept confidential to not identify individuals. As recommended by Leedy and Ormrod (2010, p. 159) and Cresswell (2014, p. 194), these interviews were recorded on a small dictaphone[2] (after permission was obtained), and transcribed for data analysis soon after interviews were completed. Ten initial questions (see Appendix 3) were prepared in advance of the interviews, based on research questions identified earlier in this research, although different responses from interviewees elicited further targeted questions and clarifications.

All participants received a copy of their transcript, and all were satisfied that they were accurate, although two requested parts of their interview not be used, as they contained personal opinion. At one institution, the interview included both the retiring AV preservationist, and their replacement (their employment overlaps by some time), so the interview was longer as it covered two participant's answers. Written and published documents (including short preservation videos) produced by these institutions to advise on AV preservation were also gathered to provide secondary data, including documents published by Institution A's National Preservation Office on caring for audiovisual materials, taonga, and digitising collections, and an older document produced by Institution C introducing the collections, and recording types.

5.3 Data analysis

Qualitative research creates data from words and images, with researchers organising and categorising "a large body of information… [to] gradually boil it down to a small set of abstract underlying themes" (Leedy & Ormrod, 2014, p. 160). According to Creswell, data analysis for qualitative research "[proceeds]

[2] The first three interviews were recorded on an Olympus digital dictaphone, and the final interview on a Sony digital dictaphone

hand-in-hand with… data collection and the write-up of the findings," and assists with narrative and structural organisation (2014, p. 195). Much data was collected in this research, and then reduced into concepts by identifying emerging themes on preservation of obsolete AV formats.

Emergent themes were coded, with sub-themes teased out after further analysis, and used as comparison between institutions for similarities and differences, and to help identify gaps in the data. Data was coded using an Excel spreadsheet to identify themes, while noting why material was coded in a particular assisted with narrowing down coding fields (Rapley, 2016, p. 334). Williamson, Given, and Scifleet (2013) provide steps for qualitative data analysis: establishment of the research framework, selection of communication analysis type, listing of concepts or themes, selection of analysis practices (including reliability and validity), and presentation of findings (2013, pp. 428-429). They further suggest using discourse analysis to "inform the social context of… studies, as it "[enhances] the scope of the enquiry" and assists in data interpretation (Williamson, Given, & Scifleet, 2013, p. 431). Data analysis, Leedy and Ormrod state, is "complex and time consuming" with interpretations potentially open to researcher bias (2014, pp. 160-161). However, strategies such as using several types of data, and gaining multiple perspectives can assist with identification of more neutral findings (Leedy & Ormrod, 2014, p. 161).

An interpretive viewpoint is used when analysing this research, as it assumes "our knowledge of reality is gained only through social constructions," including language, documents, shared meanings, tools, and consciousness, as well as focusing on "the complexity of human sense making" (Klein and Myers, 1999, p.69). Interpretive case study research is "embedded in social contexts," and "aims to explain the meanings attributed to certain behaviours… through the use of… language to describe social events and situations, highlighting the subtleties of responses and behaviours" (Shanks & Beckmamedova, 2013 p. 177). The interpretive nature of these case studies is explored in the discussion section of this study.

6. Results

Case studies build up pictures of phenomena by using examples illustrating particular instances. Case studies, according to Leedy and Ormrod (2014) are suitable “for learning more about a little known or poorly understood situation” (p. 143). This applies to preservation of obsolete AV formats as little is understood about New Zealand issues and challenges in this area, and how information and experiences from local perspectives provide potential solutions. The following interviews were examined for data relating to this phenomenon, with themes identified to provide information on relevant issues. As previously stated, these interviews are confidential, and as there are only three institutions, identifying them could potentially identify interviewees. The institutions are referred to as Institution A, Institution B, and Institution C.

A number of themes relevant to all institutions appear within the data, although sub-themes often relate to one institution but not another depending on their circumstances. While results are presented as case studies, the discussion will speak more generally to themes and concepts relating to all three institutions, and how they inform research questions of this study.

6.1 Case Studies

6.1.1 Institution A

Institution A is a national institution based in Wellington, New Zealand, and houses many unique collections including some New Zealand-specific, and general collections of diverse information. Institution A was founded in 1965, after an amalgamation of three major collections. The library and collections are spread over three floors, with workroom functions and collection stacks separated from public areas. The ground floor houses a public area with a large café, and small shop.

AV preservationists are housed in a self-contained suite of small rooms on the lower ground floor. These rooms are isolated and soundproofed to stop external sound bleeding into any audio capture. Staff request mobile phones

are turned off, so no sound or mobile signals are captured while AV preservation occurs. Institution A has three staff undertaking AV preservation: two specialising in audio, and one specialising in video. Items for preservation are stored in crates or (in the case of mechanical discs formats) placed upright in racks. The computer set-up for audio capture is a PC with 2-3 monitors, with small mixing desks for audio preservationists. Racks of equipment for particular formats are connected to the computer set-ups. Most AV equipment is imported, being difficult to acquire in New Zealand.

Audiovisual collections at Institution A are wide in scope with an estimated 80,000 items (according to both participants). The collections cover many mechanical, magnetic and optical AV formats (see Appendix 4) and are dispersed over specific collecting areas. Although storage areas were not viewed during these interviews, from previous knowledge of them materials are kept in temperature and humidity controlled areas. Institution A is a significant 'department' of a larger government organisation, and has to present business cases and budgets for acquisition, equipment, software, or specialised materials/equipment.

6.1.1.1 Preservationist training and background

Two preservationists (referred to as participant A1 and A2) were interviewed at Institution A, one specialising in audio, and another in video. Both presented insights into how Institution A preserves obsolete AV formats, and challenges they encounter. Both participants have no formal training in AV preservation, but have different previous qualifications, training, and experience. Participant A1 has been at Institution A for 30 years, and was initially 'sound officer', becoming "part of the collection care team, but always doing the same work, building up a studio, and building up equipment". Participant A2 began working with AV materials while recording music, and started working in AV preservation in 2002, though admits "I had an honours degree in philosophy, which kind of helped with the archives and information management… side."

6.1.1.2 Physical preservation

6.1.1.2.1 Formats

Institution A has many different types of obsolete AV materials (see appendix 4). Participant A1 deals with primarily audio materials, mostly grooved disc formats including shellac and lacquer discs, LPs, 78rpm and 45rpm discs, and some cassettes. Participant A2 primarily works with video (magnetic) formats, including open reel videotape.

6.1.1.2.2. Storage

Institution A has controlled temperature storage for AV formats. Both participants discussed the importance of temperature controlled environments, and the different environments needed for different materials. Participant A1 describes one significant collection in Institution A as **"**temperature and relative humidity are controlled… the originals are in 13 degrees… and 40% [relative humidity]…the listening copies are like 15 and 45, so listening copies can be taken out." Participant A2 adds "the important thing is that it's steady climate… fluctuation in temperature is about the worst thing that can happen,." Participant A2 also notes that stabilised temperature means fewer media-related problems (for example, mould or 'vinegar syndrome') at Institution A.

6.1.1.2.3 Care and handling/preservation measures

In addition to storage, care and handling measures are key with Institution A housing materials in enclosures and environments that participant A1 says "mitigate the 10 agents of deterioration."[3] Care and handling includes conservation measures such as cleaning items, and preservation techniques problem formats like delaminating or mouldy discs, and tapes that are showing signs of vinegar syndrome, hydrolysis, or requiring splice repair. Discs are cleaned using distilled water, soft brushes, and a vacuum, and for future preservation, items are not labelled. In all cases, participant A1 advises, "you have to be careful what you choose for each thing." Participant A2 also

[3] The 10 agents of deterioration are physical force, theft and vandalism, fire, water, pests, pollutants, light, incorrect temperatures, incorrect relative humidity (RH), and custodial neglect (Kennedy, 2015).

discussed experience with baking open-reel tapes in a state of hydrolysis, and changes that have occurred since 2000 regarding times for this preservation method.

6.1.1.2.4. Standards

Participant A1 and A2 both refer to international institutions and publications that provide standards for these challenges and issues, especially IASA's technical documents, *TC03, TC04,* and *TC05*. Both participants consider international standards especially helpful in these cases, as they provide the standards for preserving obsolete AV formats although participant A2 admits to being frustrated with some of *TC04*, saying "when it first came out, I found standards for how to align equipment for what sort of signal should be coming out wasn't in there…"

The question of more localised standards was posed too, with both participants feeling that technical standards are covered in depth internationally, and do not require a local re-evaluation. However, participant A2 would like more standards based around use, as "one of the problems of standards talk is that it needs to understand the use-cases of the people" which do not happen locally. Ethical standards relating to New Zealand may be useful too, with participant A1 commenting, "it's more like a work practice or ethic… how we view an object, or collection… culturally… sits outside [technical standards]."

6.1.1.3 Cultural protocols

Both preservationists at Institution A comment that applying tikanga Māori is important to their work and practices, though participant A2 admits "as a matter of policy… I don't have a deep understanding of what that means." However, both participants refer to 'respect' when relating to cultural protocols, and extend respect to all items, not only materials of indigenous taonga. Participant A1 clearly states this "I apply tikanga to all of my work, not just specifically Māori or Pacific items," though acknowledges "there might be some things that need… different protocols, or a different kaupapa to deal with them."

6.1.1.4 Prioritisation

In terms of preservation prioritisation for material, this is decided on in conjunction with collection curators at Institution A. Prioritisation depends on format fragility, or content importance. In terms of format prioritisation, participant A1 says magnetic media is the focus.

6.1.1.5 Digital obsolescence

While wider issues surrounding digital preservation are out-of-scope here, the participants at Institution A note issues with digital format obsolescence, and participant A1 remarks that corrupted files are a problem as the file "might be newly created, and you can't get to it, and you can't preserve the content," and states "one copy is no copy." Participant A2 observes trying to recover digital files becomes digital preservation, and work a specific team rather than AV preservationists. Metadata is another important aspect of digital preservation and obsolescence, as "to know how that file was created is essential for the preservation of the file they've done" (participant A1).

6.1.1.6 Issues:

6.1.1.6.1 Institutional issues

As Institution A is part of a Government organisation, issues relating to financial constraints and organisational understanding of preservation are common. While no issues with staffing emerged, both participants acknowledged limited budgets within their institution, and any business cases required are "[pitched]…to people who don't know anything about your work at the higher level"(participant A1). Participant A2 finds communicating the more esoteric aspects of preservation difficult, for example "why it's important to buy obsolete equipment… why it needs to be maintained, and why it's worth looking for that quality." High quality equipment results in a higher quality AV capture, which participant A2 feels "[it's] important that the organisation understands that it's the good copy that should be it's focus… it can be quite hard to advocate for that." However, participant A1 feels that no justification is required about preservation, as "we're providing long-term access", although admits "sometimes it's difficult getting this across."

6.1.1.6.2 Equipment obsolescence

The challenge of locating and upkeep of AV equipment is a strong theme in all interviews, as working equipment is becoming harder to locate as more formats become obsolete, and technicians with experience to work on this equipment are retiring. Institution A is acquiring equipment, (notably Tascam 122 MK II) cassette players to set up capture studios, and participant A1 notes that acquisition of this equipment is from on-line auction sites such as e-Bay. Issues arise here, as participant A1 relates “you don’t know what state the equipment is in”, though says having professional relationships with international AV preservationists is useful, as they provide advice on information from online vendors. Participant A2 advises that equipment can be bought new, but “whether these have the kind of performance that a professional… preservation grade equipment would have is debatable.” Both note maintaining equipment is “really important” (participant A1), as “if you can’t fix your tape player anymore because there’s no parts… then that’s just as catastrophic” (participant A2).

6.1.1.6.3 Expectations of preservation

In considering AV preservation, and wider public expectations participant A1 agrees that there is a disconnect between the wider expectation that digitisation is a simple, easy task, and the reality that there are a lot of processes and infrastructures that surround preservation methods. Participant A1 explains it as “that thing between you … want to put a positive spin on it, but so that people realise how much work is involved, [and] the benefits they can get from it.”

6.1.1.7 Retention of formats

Both participants from Institution A agree obsolete AV formats are vital for preservation, and they should be retained after digital preservation, as the potential for loss of content is great and “you might have to go back to something” (participant A2). The item itself is important, as “people… want to see what the carrier was, and over time that will be even more important” (participant A1). Participant A1 adds that Institution A’s mandate to collect

means that “you want to maintain access to the format and content… in perpetuity… for the sake of our future as a country.”

6.1.2. Institution B

Institution B is a national institution, also based in Wellington, and is a recent (2014) amalgamation of three sound, film, and television archives. Institution B focuses specifically on AV materials, with related documentation (including posters and ephemera) also collected. Their collection items date back to 1895, and their holdings are in excess of 750,000 items. Institution B is an independent charitable trust dedicated to collecting, storing and preserving New Zealand’s AV heritage, and unlike Institutions A and C, has a public cinema for film screenings, and a public café area with the option to purchase materials. Film and (some) AV collections, as well as documentation collections, archivists and preservationists are housed on the 2-4th floors. Currently film and video preservationists are housed in the Wellington branch, as audio preservationists and collections were located in branches in other national centres. Since late 2016, Institution B has been undergoing restructuring, and branch collections moved to Wellington.
Film, AV, and documentation collections are held in temperature controlled vaults on metal shelving, which are freely accessible for ease of item retrieval, although do not appear to have earthquake bracing or protection. Films are also stored in two off-site areas in Plimmerton and Titahi Bay, with nitrate film stored in the latter store. Due to these interviews taking place during the restructure process, this research will only refer to film preservation at Institution B rather than the full gamut of audiovisual preservation.

Approximately 14 staff work with preserving films at Institution B. Film preservation and digitisation workspaces are in clear, clean workrooms: the physical preservation room has natural light, but the workrooms where digitisation of film takes place are dark. Equipment for preservation and conservation includes light tables, splicing desks, automatic and manual film wind through reels. Digitisation suites include scanners, which digitally scan films before preservationists then check, conserve, and prepare them for digital storage. While no stack visit occurred, some film was stored in

preservation workrooms, flat in tins. Information on how material is stored is gathered from preservation videos on Institution B's website.

6.1.2.1 Preservationist training and background

Unlike Institutions A and C, the participant from Institution B (referred to as participant B1) has been trained in the field of film preservation, training as a moving image archivist in the United States, after completing a PhD in film history. Participant B1 has extensive experience in film preservation, working in the US, Europe, Thailand and Australasia, working with "quite a bit with nitrate film."

6.1.2.2 Physical preservation

6.1.2.2.1 Formats

Institution B, like institution A, has a wide range of obsolete AV formats, including cylinders, video, cassette, DAT, open reel tape, and mechanical disc formats (see appendix 5). As a film preservationist, participant B1 works with different film formats, including nitrate film, diacetate and triacetate safety film, and polyester-based film.

6.1.2.2.2 Storage

Institution B also stores film at specific temperatures to preserve it for future use. Participant B1 advises that Institution B has "a super cold vault… a regular cold vault… [and] a nitrate vault… depending on what each medium needs." The coldest vault is two degrees centigrade, and 30% relative humidity (RH), while the 'regular' cold vault is eight degrees centigrade, and 30% RH. The vault for nitrate film is at a higher temperature than the Image Permanence Institute (I.P.I.) recommends - "the cooler the better, with RH no lower than 20% or higher than 50%" (Reilly, n.d., p. 15): Participant B1 explains this as "the nitrate is higher…we try for 12-14 [degrees]… any stickiness is drying out, and things are in surprisingly improving conditions." Institution B prepares for disaster by separating original and preservation materials, and having multiple digital copies of particular items. Storing material at least 5cms off the ground, marking items and containers to match them up, condition reporting material, and ensuring proper cleaning

equipment is available if disasters occur are further preservation measures used.

6.1.2.2.3 Care and handling/ preservation measures

Care and handling measures at Institution B revolve around not allowing food or drink in the working areas, and security measures: certain staff are not permitted within particular areas alone, or after a particular time, due to lack of training. While gloves are worn for paper, posters and stills preservation, they are not worn for film preservation participant B1 explaining that "wearing gloves… often causes more damage – so you're winding through something, it has a little nick in it… a glove will catch it, and tear it." Institution B allows only people who are trained properly with film formats to handle it, due to the complex nature of the format. Film reels are kept flat in metal and plastic tins in the vaults. To clean film, Institution B uses particle transfer rollers, or by hand using velvet cloths and isopropyl alcohol. An ultrasonic cleaner is no longer used, due to the toxic chemicals used with it.

6.1.2.2.4 Standards

Technical standards for film preservation are in a state of flux, according to participant B1, who says they are

> trying to figure out how we transfer our standards from… analogue to doing things digitally… we're… trying to be as conservative as possible in terms of we want… I think we're still trying to figure out what are the standards for modern day preservation.

Earlier methods and processes of digitisation are useful for reference copies, but participant B1 thinks that "we have a responsibility to the objects themselves" to preserve them at the highest quality, and respect the integrity and authenticity of the original item. Participant B1 also agrees that localised standards could be beneficial, especially in relation to cultural aspects, and "the different ideas about interacting with objects as artifacts, as treasures… thinking about a respect for an object."

6.1.2.3 Cultural protocols

The opinions of participant B1 towards standards relating to cultural aspects sit well with Institution B's procedures regarding cultural protocols. Like Institution A, Institution B has an awareness and respect for items, and applies to across the collections, participant B1 stating "these high standards that we hold our Māori and Pacific Islander's collection… [we] do it across the board." Institution B does hold ceremonies for taonga, and has awareness of materials they handle, though participant B admits "even if little bits and pieces get done wrong, just having that awareness in the spirit of it [helps]."

6.1.2.4 Prioritisation

Institution B prioritises preservation by condition, placing emphasis on caring for materials exhibiting obvious signs of decomposition or deterioration. After condition, the next priority is high-use material, or that which has been requested, with on-demand requests having a four-six week turnaround. Participant B1 also advises that all staff look out for little-known works, saying "we have people from all over the archive nominating things, just making cases for 'we should do this'. "

6.1.2.5.Digital obsolescence

Obsolescence of digital files is a recurring issue for Institution B, with participant B1 calling it "never ending… it comes up so frequently that even things we did five or six years ago are… on formats that we thought were sufficient, and they're not." Participant B1 reports a continuing concern that Institution B's preservationists are digitally preserving materials to correct file formats. Metadata is also an important inclusion at Institution B, and Participant B1 considers source (including location and creation of the item) paramount, as "without knowing the lineage of something, you don't know anything."

6.1.2.6.Issues

6.1.2.6.1 Institutional issues

Institution B has similar issues to other institutions: "time, money, staff – there's never enough" (participant B1). Institution B has several staff working

on preserving film, but still require more staff to use the equipment, with participant B1 explaining “just because we have the machinery, doesn’t mean we have the people, and the computing power… to run it.”

6.1.2.6.2 Equipment obsolescence

Finding equipment, and keeping it working order is a challenge too, especially for some video formats. However, participant B1 sees the upkeep as more significant for Institution B, saying “it’s more a matter of having people who have the knowledge to maintain… we have fewer and fewer people who have that experience.”

6.1.2.6.3 Expectations of preservation

Staff at Institution B also experience a disconnect between the realities of AV preservation, and the expectations of the wider public, with participant B1 saying “people expect that it’s like a Xerox machine – ‘oh, you’ve got it there, you throw it in, it’s done!’” However, Institution B addresses this by educating on the intricacies of preserving obsolete AV formats through videos on their website, a move that participant B1 is skeptical of, as “even within the organisation… it’s hard to get understanding into people’s brains… it’s just constant reiteration.”

6.1.2.7 Retention of formats

Retaining and preserving formats is important to participant B1 (and, by extension, Institution B), as AV materials are how 20th and 21st century history is seen. Obsolete formats should be preserved, participant B1 says, as they are “in danger of being lost in a moment… that is how we see the world, so we should have investment in taking care of that.” Keeping the original carrier is an important step, and participant B1 explains why it’s particularly important for film: “there’s a long history of preserving nitrate film to safety film and then destroying the nitrate film, because it’s dangerous… it’s actually proven to be far more resilient.” Also, participant B1 reports new processes and opportunities for content capture are developed regularly, and if these formats are discarded, then further (or better quality) content capture cannot happen.

6.1.3 Institution C

Institution C is part of an academic unit based in Auckland, with significant national collections of indigenous AV materials. Institution C was founded in 1970, with collection materials of value to local, and international communities and researchers. While managed by the library at the University of Auckland, the archive is housed in the centre of the Anthropology department, in a number of rooms, the room housing the majority of their materials (mostly open reel tapes) is climate-controlled for temperature and humidity. In terms of staffing, currently Institution C is growing, and advertising for more staffs underway. As the long-term AV preservationist at Institution C (participant C1) is due to retire, a new preservationist has started, although participant C1 is staying to oversee and assist the transition.

The environment at Institution C (archive, storage stacks and workspaces) is small, and to a degree, cramped, with equipment stacked along walls, and near desks, as there is no storage space, and workspaces have not been configured for further equipment as yet. A significant number of open-reel tapes were shelved on wooden shelving around the walls of one room, with some crates resting on the floor, with further magnetic materials. There appears to be no protection on these shelves, but they are static and attached to the walls, rather than mobile. Different formats are shelved together, rather than format specific separately. Boxes and equipment are placed on the floor, in front of shelving, making items difficult to retrieve easily. As the archive is housed in an academic department, there are no public facilities, such as tearoom/cafe, or listening area.

6.1.3.1 Preservationist training and background

As with Institution A, the participants from Institution C (referred to as C1 and C2) initially had no formal training in AV preservation when they began their careers. Participant C1 was initially appointed as an electronics technician for the department of Anthropology, with time commitments to the archive "notional," although this position included "repairing and calibrating and checking audiovisual equipment." Participant C1 later undertook study in the area of AV preservation. Participant C2 had no initial formal training either,

stating “I learnt everything on the job from… technicians and other archivists” in previous positions.

6.1.3.2 Physical preservation

6.1.3.2.1 Formats

Institution C has mostly magnetic tape formats of AV material, with participant C1 stating “most of our audio is cassette, and open-reel [tape].” Participant C1 also estimates that Institution C has “hundreds” of lacquer transcription discs (linguistic material), and a large amount of teaching resource videos, a small amount of DAT tapes and minidiscs (appendix 5 lists obsolete formats held by Institution B). A small amount of film (estimated at a dozen films) is held by Institution C, but participant C1 admits, “we don’t have the resources to handle film,” so some was passed onto the former Film Archive, as their climate conditions were ideal. Participant C2 estimates there are over 7,500 items in the core cassette and open-reel tape collections.

6.1.3.2.2 Storage

AV formats at Institution C are housed in a storeroom, and participant C1 states “we fought tooth and nail to get proper climate control… the target is 45% humidity, and the temperature in 19 degrees. It’s very stable, but it took a huge battle.” When Institution C initially moved into the building, there were issues with temperature-controlled storage, as air conditioning was turned off at 5pm each night, and kept off all weekend. Materials are kept in original packaging where relevant.

6.1.3.2.3 Care and handling/preservation measures

Care and handling measures are undertaken where appropriate, but wearing gloves is often avoided, as they hinder some preservation work – participant C2 says “I… can’t fix a splice with gloves… there are certain things you just can’t do wearing gloves.” However, both participants stress the need for good hygiene practices, such as hand washing. As with Institution A and Institution B, no food or drink is allowed at Institution C. Because Institution C has a substantial number of magnetic tape formats in different conditions, participant C1 has used several methods to preserve content and carrier

including baking open-reel tape, treating cassettes for mould and soft binder syndrome, and also transplanting tape from one faulty or damaged cassette shell into another.

6.1.3.2.4 Standards

Like Institution A, Institution C follows IASA (2009) standards. Neither participant C1 or C2 thought there should be New Zealand standards, with participant C1 stating ”I don’t think there’s any need to reinvent the wheel.”

6.1.3.3 Cultural protocols

Institution C approaches cultural protocols from the perspective of respecting restrictions on materials, including any access restrictions. No food or drink is allowed near AV material.

6.1.3.4 Prioritisation

Prioritisation of items has been tried in the past at institution C, but participant C1 admits “with preservation projects, it really didn’t work, ‘cause they weren’t up to scratch.” This has led to a focus on more significant popular collections, although recently participant C1 says they have “been trying to work systematically through the collection.”

6.1.3.5 Digital obsolescence

Institution C refers to digital obsolescence in terms of digital media, and participant C1 thinks it “quite important to… digitise that as soon as possible.” These formats include DAT tape, Minidiscs, and CD-Rs, which are a priority, as they need to be preserved “while you’ve got the players, before… material deteriorates” (Participant C1). Neither participants mention any obsolete digital formats. Participant C1 considers metadata vital in locating preserved formats, with information fields such as song type, performer, date, location (including village and island), and Iwi affiliation of the composer considered important fields for discoverability. Participant C2 thinks that researchers can help with metadata too, commenting ”they know what they want… they can… assist in making those descriptions better.”

6.1.3.6 Issues:

6.1.3.6.1 Institutional issues

When Institution C was part of an academic department, there were resourcing limitations, which manifested in Participant C1's original role in the archive being part time, with a full-time role being a "relatively recent" development, since being management was taken over by the University of Auckland library. Other issues also stem from Institution C being part of an academic unit, with a lack of archival experience and understanding on the part of the department meaning the archive "didn't progress," and they "struggled to get funding for equipment… we struggled to get funding for staff." Participant C1 concurs that library management are "more forward thinking" in terms of the archive's needs. Participant C1 is also adamant that Institution C was not "researched properly" at the start, as no policy documents were created, and this led to the archive having "a real battle on our hands getting real climate control." A continuing issue for Institution C is location, as the archive is difficult to locate. Participant C1 concurs, admitting "to find us physically is really hard, and yet we're supposedly functioning as a public archive."

6.1.3.6.2 Staffing

Quality control of work at Institution C has also been problematic in the past, with participant C1 stating "if you employ someone to do the task, confirming that they've done a good job… that would take just as long as the person doing the job." Participant C2 has also had experience with this in previous institutions, and advised of "weekly checks, peer checking… we did a spot check, listened to the audio, looked at the metadata" to make sure preserved content was of a high quality.

6.1.3.6.3 Equipment obsolescence

Challenges with equipment acquisition and obsolescence are felt by Institution C too, and participant C1 says "we're going to run out of equipment" before all obsolete formats are preserved digitally. Acquiring equipment is not a current issue for Institution C, as participant C1 advises "we did get four Tascam's some years ago", but also admits "I hope they'll last." Studer open-reel tape

machines were purchased at the same time. Participant C1 thinks that this will cover audio equipment requirements, and adds that the archive also purchased “quite a bit” of video equipment, as well as calibration equipment. Institution C also agrees that having equipment is one thing, and maintaining it another, as “you actually need the expertise to service it… to make it safe, and then on top of that you need a supply of parts.”

6.1.3.6.4 Expectations of preservation

As with Institution A and institution B, participants at Institution C also deal with differences between realities of format preservation, and public expectation. Participant C2 admits “most people don’t have that awareness that you can have all these little problems along the way.” Participant C1 also considers access another aspect of this disconnection, saying “we have this expectation… that once it’s digitised, the content is accessible. [It’s] only accessible if the metadata is there.”

6.1.3.7 Retention of formats

Preserving and retaining obsolete AV formats is just as important to participants at Institution C as it is to participants at Institution A and Institution B. Participant C2 states that “if you don’t, you won’t be able to find it… it won’t exist”, while participant C1 thinks preservation matters “because you’ve got the potential for the loss of digital material.” Participant C1 does think that institutions have to be realistic about format and equipment obsolescence, however, as “why would you go to all the trouble of preserving magnetic tape… if you have no player?”

7. Discussion

An examination of AV preservation is essentially a catalogue of challenges (at least on the surface). However, institutions such as those canvassed here continually work towards managing these challenges, providing access to material on formats that are unplayable due obsolescence of format, or playback equipment.

The results section of this study presented some main themes relating to how participants approached preservation of obsolete AV formats. Main themes include: staff expertise and experience, physical preservation methods for physical formats, prioritisation of formats, obsolescence of formats and playback equipment, standards used, digital obsolescence, and issues relating to institutions' expectations around digitisation. Analysis of interviews shows that themes of format retention, and the importance of preserving content on these formats are hugely important, and underpin *why* institutions preserve this material – which is a good place to start the discussion.

7.1 Why preserve?

7.1.1. Content loss

So why preserve obsolete AV formats at all? Edmondson (2016) considers Lindgren's idea of the loss principle, where "if there is any reason… why the loss of a particular item would be regretted in the future, there is a *case* for preservation", and calls it a "cautionary statement against thoughtless destruction" rather than a hard-and-fast rule for preservation (p.64). Loss of content and/or carrier is a primary reason for AV preservation, with all participants acknowledging this: Participant C2 admits "if you don't… it won't exist," participant B1 says that if these formats aren't preserved, they are "in danger of being lost in a moment", and participant A1 considers "we'll lose them otherwise" This consensus between institutions for why these materials need preserving illustrates their shared concern for obsolete AV formats.

7.1.2 Access

Providing access to content on obsolete formats is another reason for preserving them. Two participants in particular emphasise this when describing why AV preservation matters. Access to AV materials is mandatory: Edmondson cites UNESCO's Memory of the World programme, which aims to protect world's documented and collected memories, and make them "accessible to all" (2016, p. vii). This includes obsolete formats, which hold unique AV content that may not exist in any other form, such as this

preserved by participant B1:

> We've just finished working on a film… it was a duplicate negative of a film made in 1912… [we] have found it's a pretty fabulous little film in Gisborne, of the sinking of the Star of Canada. It's got… [a] trolley line view of downtown Gisborne in 1912.

Access is often cited as a vital reason for digitisation when preservationists are required to justify processes to their institutions. Participant A1 explains to funding bodies "we're providing long-term access by doing this work," which is part of Institution A's legislative mandate for their New Zealand collections[4].

7.1.3 Metadata

Further discussion on access revolves around metadata, and Edmondson advises that principles surrounding metadata focus "less on management of the individual carrier than on the management of the entire environment that allows the work to be accessed" (2016, p. 46). Participant C1 has considered this frequently, musing, "we have this expectation… once [the item is] digitised, the content is accessible. The content is only accessible if the metadata is there." Participants A1 and B1, too, believe metadata is important, but not only for access: Participant B1 "[thinks] about this quite a lot", and considers data about the source of the item important, as "without knowing the lineage… you don't know anything." Participant A1 sees preservation metadata of paramount significance, because without it "you… can't preserve it."

Participants indicated important metadata fields, with different fields required for different institutions. Institution A prefers preservation metadata relating to content and carrier: who preserved the item, who created it, the original carrier format, and how content was preserved. Institution B also favours metadata relating to preservation methods, and also data on the source of the carrier, and storage location. Institution C has a different approach, with

[4] The legislative mandate says New Zealand collections at Institution A will be preserved, protected, developed and made accessible to all New Zealanders (National Library of New Zealand, 2015, para 15)

metadata fields reflecting content preferred, such as title, performer, location, Iwi affiliation and song type. It is unclear why participants from Institution A and Institution B did not mention these metadata fields as important, and, conversely, why Institution C did not mention preservation metadata as an principal field. However, as each institution has a different focus, fields chosen likely reflect institutional mandates and functions.

7.2 Staff expertise

Participants at all three institutions reported different levels of experience and expertise when they began their careers. Only one participant (participant B1) had formal training as a moving image archivist, and subsequently worked with international collections - considering preservation “way more fun, actually doing the hands-on aspect of it.” All other participants received training on the job, from “old technicians” (participant C2), or organisational or collegial support from other AV preservationists. Participant C1 says “one of the beautiful things about working in audiovisual archiving is the mutual support… there’s been opportunities to visit other archives, pick each others’ brains,” although support is usually from international parties, as “opportunities for training in New Zealand are very limited (participant C1). Participants from Institution A have musical backgrounds, with experience in home recording (participant A2), or electro-acoustic music (participant A1), so had some skills in the field when they began. While knowledge can be gained on the job, participant C1 also emphasised the importance of prior experience admitting, “in terms of capturing what’s there… you actually need people who are knowledgeable.”

7.3 Preservation

Physical preservation of obsolete AV formats in heritage libraries and archives takes on many guises: storage, temperature and humidity, care and handling, techniques for cleaning, repairing, or halting deterioration, and the acquisition and upkeep of equipment. All participants adhere to similar standards, and take care for their collections very seriously. All institutions have large collections of obsolete formats numbering in the thousands: Mechanical,

magnetic, optical, and film formats are among the collections, and participant A1 opines Institution A "[has] just about all obsolete formats now." Participant B1, when considering Institution B's audio collections has a similar response: "we have pretty much everything, and the vast majority of it is on… what would be considered obsolete formats." Institution C's collection is mostly on magnetic formats of open reel tape or cassettes, with the oldest material on transcription disc from 1949.

7.4 Storage, temperature and humidity

Collections of obsolete AV formats in all institutions are sizeable, with fragile, large, and (in many cases) chemically deteriorating carriers. Storage is fundamental to the survival of obsolete formats, a protective measure against environmental factors that assist with deterioration. Edmondson agrees, advising, "practices and techniques that slow down deterioration… are far better and cheaper than any recovery process. Not the least of these is the observance of good storage" (2016, p. 66). A stable temperature controlled environment with a low-mid RH is recommended by IASA, who advise "to keep humidity and temperatures low (to retard chemical deterioration), and to avoid climatic changes (to… minimize chemical stress)" (2014, p. 33). All institutions take storage seriously, and participant B1 states, "we have purpose built vaults for all the different materials… depending on what each medium needs." Participant A2 also discussed Institution A's controlled atmosphere rooms, impressing the importance of steady temperature as "fluctuation in temperature is about the worst thing that can happen." Participant C1 emphasises the need for a stable climate with AV storage, calling it the "the most crucial action we can take for preserving audiovisual material." Participant A1 has an interesting viewpoint on physical storage:

> I often describe it as a nested doll, the storage of the original item… you've got the item, you've got the box, that case that it's in…. it might be in another enclosure, and you've got the shelf, you've got the room, you've got the building… you've got all these buffers to the external environment

For Institution C, packaging is not as high a priority as other preservation measures, with participant C1 revealing “we don’t have sophisticated packaging … it’s the original package in most cases.” However, Participant B1 does not mention any original packaging or boxing, although videos produced by Institution B indicate film and video are housed on metal shelves in metal, or plastic cases. The lack of discussion on packaging is noteworthy, as this is a protective (although often chemically reactive) part of the original carrier and provides information on the item. Further questioning of participants would focus on packaging for safe (and accessible) storage, and how items are stored in the vaults.

Correct temperature and humidity of storage conditions is crucial to reducing, or at least halting, chemical and physical deterioration of obsolete physical AV formats. While participants adhere to ISO or IASA standards, participant B1 admits a departure from standards for nitrate film formats, reporting their nitrate film vault is higher than the recommended temperature and humidity. “We try for 12-14… interestingly, we’ve found that our collection condition has improved significantly, even though it’s not technically the IPI standards for optimal storage conditions.” Participant B1 reports other vaults are far lower in temperature for other media. Institution A and Institution C’s storage vaults for collection items are stable at higher temperatures, and all institutions’ temperatures comply with IASA’s standards in *TC05,* which states that temperatures should be between 8-35 degrees centigrade, and RH between 25-60% (IASA, 2015, p. 33), depending on format and use.

7.5 Care and handling

Another part in the preservation process of physical items is care and handling, which differs depending on carrier, as “each [format] requires its own kind of vigilance” (Edmondson, 2016, p. 67). Participants A1 and A2 do not reveal if they use gloves when handling items, but participant B1 and C2 consider gloves potentially detrimental to their practices: participant B1 says gloves “often causes more damage,” as they can catch on small nicks in film and tear it. Participant C1 too refrains from using gloves, explaining, “I… can’t fix a splice with gloves.” For institution C, if magnetic tape is being handled

without gloves, then clean hands are required, while Institution B has “people who are trained to handle [film] properly without gloves.” No institutions discussed further handling measures such as best practice to remove and carry items between stack and work areas, and how to safely remove items from packaging, and treat them while preservation methods are occurring – potentially damaging steps of the preservation process. However, both Institution B and Institution C both discuss not allowing food and drink near the items, (also a cultural protocol for Institution C), and while not mentioned by Institution A, prior knowledge of their preservation methods reveals neither participants have food or drink near their work spaces.

Cleaning items also comes under care and handling processes, with Institution A and B having methods in place to clean AV formats. Cleaning methods are particular according to format, and participant A1 reports, “you have to be careful for what you choose for each [format],” as they have different characteristics and compounds. Institution C did not discuss any cleaning techniques for cleaning their magnetic and mechanical formats.

7.6 Format decay and preservation methods

Preservation methodologies for obsolete AV formats in all collections are time-consuming. Different tasks are frequently undertaken to ‘save’ formats and the content contained on them: Removing mould, baking tapes, and cleaning discs (where feasible) are only some available methods for preserving content for as long as possible.

All three institutions use particular methods to combat format decay (mould) and chemical degradation (delamination of discs, hydrolysis, or sticky shed syndrome), with baking tapes (in a special oven) one of the most well known methods for drying out some magnetic tape types with these problems. Participant A2 in particular has worked with closely with magnetic formats, conducting baking experiments on personal tapes suffering from hydrolysis, and has found changes in baking times. “The baking times that are needed to restore the tapes to playability are increasing… the rule of thumb was eight hours… now people are reporting 24 hours” (Participant A2). Institution B

confirms this increase: An online video discussing magnetic tape preservation reveals the baking method has extended to up to two weeks (Nga Taonga Sound and Vision, n.d.)

Cassettes, too, are affected by mould, but cannot be baked due to the mix of plastics that comprise the cassette shell. These (and acetate-based open reel tapes, which are also not baked as they will be damaged) have been treated by participant C1, who preserved them by “keeping them in vacuum [bags] with silica gel for a few weeks. This dries out the mould and makes it dormant. It can then be cleaned off more effectively.” remaining institutions did not discuss additional methods for preserving tape suffering from mould, sticky shed syndrome, or soft-binder syndrome, instead focusing on baking tape for format preservation. Participants from Institution C note that issues with cassette playback often lead to tape ‘transplantation’ from one cassette shell to another, and participant C1 has “made a gadget to facilitate the transfer” between the cassette shells. This level of ingenuity and skill in AV preservation methods is not widely publicised in Institutions A and B, but may be due to institutional constraints around unstable and fragile formats and their treatment.

In contrast, preservation methods for mechanical disc formats revolve around storage, cleaning, and content transfer. Cracked or broken Discs are difficult to capture content from, while discs suffering from mould (and dirt) require cleaning before preservation methods occur. Delamination of lacquer discs is concerning to participant A1, who advises “the best way to preserve delaminating discs is as quickly as possible,” and points to IASA to provide the further advice on their preservation (2015, p. 11). While participants discussed their own methods and preservation expertise, further detail and advice at a technical and practical level would benefit those requiring hands-on (and best practice) advice on preserving deteriorating formats.

7.7 Standards

Specific preservation standards are used by Institution A and Institution C, while Institution B uses different standards. Participant B1 implies that

Institution B uses IPI (Image Permanence Institute) standards as a guide for temperature and humidity controls, saying that the warmer temperatures in the nitrate film vaults are “not technically the IPI standards for optimal storage conditions.”

Institution A and Institution C both use IASA standards for AV preservation, although participant A2 considers “the quest for standards… the situation’s more complex.” Participant A2 reported that feedback from training sessions showed surprise that no ISO (International Standards Organisation) standards were given, but also added “standards take a long time to come about… a lot of expertise and… discussion around different scenarios.” Both participants A1 and A2 use IASA standards, though participant A2 sees them as “guides” rather than standards. Both participants refer to *TCO3* (2005) as a key document, with participant A1 explaining “we base our workflows as best we can on *TC03*. Participant A2 also uses *TC04* (2009) as a standard for digital capture resolution. Institution C is brief in their affirmation – partipant C1 says they “follow *TC04*, yeah”, while participant C2 affirms “yes, IASA standards” when asked what standards are followed.

7.7.1 Local standards

There is less consensus between institutions about adopting New Zealand specific standards, although different institutions approached this question from different angles. Participants from Institution A have considered this from an ethical point of view, rather than a technical one, as IASA standards are adopted internationally[5], and participant A1 is unsure how “technically there would be anything to add to that.” If local ethical standards did emerge, participant A1 sees them as relating to cultural applications, while participant A2 considered the question about local standards from a philosophical angle, saying “one of the problems with standards talk is that it needs to understand the use-cases of the people.” Participant A2 also considered the need for more use of an ‘open-source’ approach: “I think that the level required to

[5] The National Film and Sound Archive of Australia used IASA standards in their *Preservation Strategy 2010-2012* (National Film and Sound Archive, 2010).

digitise New Zealand's AV heritage on one sort-of centre of excellence preservation factory kind-of thing is completely lacking." Participant B1 also articulated a possible need for local ethical standards, opining "I think… New Zealand could take a lead… perhaps [emphaisisng] the cultural aspects of it." Interestingly, Participant B1 also considers that New Zealand could take a part in the development of technical standards too, saying "from the technical standpoints… there's no reason why New Zealand shouldn't be contributing equally." Conversely, Institution C does not see a need for change in this area, although participant C1 observes there are some questions over sampling rates, and New Zealand "could choose to be stingy and keep sample rates down."

While all institutions mostly agree the establishment of local standards is unnecessary as *TC03* (2005) and *TC04* (2009) cover all technical standards that are required for preservation and digital capture activities, investigating a more local standard of ethics relating to AV taonga is an option participants at Institution A and Institution B have considered. Participant B1 thinks New Zealand is positioned to do this work as the country "is uniquely positioned… with such focus on biculturalism." This focus on ethical, cultural standards does appear frequently, especially in relation to cultural protocols around Māori and Pacific collection items.

7.8 Prioritisation

Prioritising formats for preservation is different between institutions, as they all have different goals and collection responsibilities. Participants from Institution A work with collection curators to prioritise materials, creating "a program that's based on format" (participant A1) – something that Edmondson (2016) believes important. Participant A2 uses a ranking system, explaining "the rarer the playback equipment, and the more at risk the media are of disintegrating or degenerating… the higher the priority should be," and for Institution A, the focus is on preserving magnetic formats, as the format is degrading quickly.

Institution B agrees that condition is always the first priority, identifying any vinegar syndrome on acetate film stock by A-D testing[6]. Institution C prioritises their "popular, significant collections" (participant C1), and Participant C1 says new deposits are prioritised, as "part of the incentive to get [depositors] to deposit material has been a commitment to digitise it reasonably soon."

7.9 Cultural protocols

The treatment of indigenous Māori and Pacific materials within AV collections is an aspect of collection care requiring focus, especially as "ethical issues regarding access, display, cultural rights and ownership, custodial practices, and consultation, poses a critical challenge for individuals and organizations" (Whaanga, Bainbridge, Anderson, Scrivener, Cader, Roa & Keegan 2015, p. 521). All institutions approach these materials with varying degrees of tikanga (cultural protocols), and Institution B has strong protocols in place. Participant B1 explains this further: "We have a set of procedures in place for bringing things into the archive… in terms of preserving things… we make a point of involving the right people, having… an awareness of respect for the item, then what we try to do is apply it across the collection."

Respect and application of tikanga for all collections (not only Māori and Pacific materials) is a common theme between all institutions. Participant A1 describes why they do this, explaining "I apply tikanga to all my work… it's all about having respect for the item." Participant A2 agrees that applying tikanga "means common sense and respect," and revealed their manager "mentioned that common sense, and respect, and tikanga will overlap quite an amount," though admits "it would be arrogant of me to assume it means nothing more than that." Participants at Institution C admit to not following protocols in terms of tikanga, but participant C2 says that "we do follow cultural protocols in terms of access. We have material that has heavy restrictions." Cultural protocols undoubtedly hold an important place at all institutions canvassed, but there appears to be confusion about what it means to apply tikanga to

[6] A-D testing: strips of dye-coated paper are used to detect the severity of deterioration on acetate film due to vinegar syndrome.

Māori and Pacific materials, and Institution C seems to not have any clear cultural protocols within their policies. Regardless, recognition that common sense and respect are essential aspects of tikanga is a starting point for deeper cultural understanding.

7.10 Obsolescence of digital formats

Digital preservation is out-of-scope for this study, but questions around obsolescence of digital formats were posed to each participant. Responses were interesting, as participants appeared to perceive digital obsolescence in different ways. Participants from Institution C consider digital formats in terms of physical digital media, for example, CD-Rs, DAT tape, or minidiscs, and participant C1 says “you need to get those [digtised] while you’ve got the players, before the material deteriorates.” When asked about obsolescence of digital files, participant C1 reported no major problems so far, but participant C2 discussed issues with corrupt file formats in previous preservation roles. Institution A and Institution B find that obsolescence of digital formats recurs often – participant B1 revealing it is “constantly coming up… it’s just never-ending.” Participants from Institution A also find it problematic: Participant A1 considers “one copy is no copy,” and warns against the temptation to think “’it’s digital, it’ll last for a long time.” Participant A2 believes that a primary problem with digital obsolescence lies in the codecs used, warning “if everyone invents their own codec, they all look like AVI files, but a player will play one and not the other.” Issues with digital preservation, and obsolescence of digital files require further in-depth research.

7.11 Issues

All participants note issues with the different aspects of AV preservation. While there are a number of wide-ranging challenges, common themes emerge from these interviews including finances and lack of institutional understanding, obsolescence and upkeep of equipment, and the disconnect between the expectation and realities of physical and digital preservation.

7.11.1 Institutional challenges

AV preservation issues relating to institutions are captured by participant B1, who says challenges "come down to… time, money, staff – there's never enough." Participants from Institution A agree limited funds are a constraint, as "no-one wants to pay too much for anything, but you want to pay the amount that it costs to get it done" (participant A2). Participants from Institution C have experienced challenges with their wider institutions, as the archive was originally part of an academic department, and acquiring funding was problematic. The different wider structures of all institutions canvassed here mean funding comes from different channels, and this can impact on what the institution can achieve.

Institutional challenges include a lack of understanding by colleagues, which manifests in different ways. Institution A notes it occurring when people making funding decisions "don't know anything about your work at the higher level" (participant A1), while others have trouble understanding "the more esoteric aspect of this work… why it's important to buy obsolete equipment… the difference between a good copy and a bad copy… it can be quite hard to advocate" (participant A2). Institution C has experienced challenges with this too, with participant C1 noting when the archive was part of an academic department, there was a "lack of commitment" from the wider institution. Management was also an issue, as Institution C "was managed… by academics who had no archival knowledge" (participant C1). As participant C2 is new to the role at Institution C, they do not have experience with institutional challenges there, but note in previous roles a concern with "an absolute lack of communication with management."

7.11.2 Expectations surrounding preservation

When discussing institutional challenges with Institutions A and C, there was a level of frustration expressed about the perceived lack of understanding around AV preservation, and how it is considered a simple task by some. Participants at all institutions report experiencing a 'disconnect' between the perception that preservation (including digital preservation) of AV formats is

straightforward, and quick, when in reality, it is a laborious task. Participants from Institution A and Institution B have much to say about this: participant A1 says “it‘s not always easy to communicate – I’ve had comments like…’why is metadata so important… you can just digitise it, can’t you?” Participant B1 has had similar comments, reporting there is “a tendency to say ‘people don’t care as long as they can see it, they don’t care what the quality is like’… they only don’t care because we haven’t told them they should care.” Both participants note processes that occur for preservation are time-consuming, and think that education and outreach about collections may change perception: Participant A1 states “you can’t do enough to talk about the benefits of preserving – they are the be-all and end-all of your collection, they are the access into the future.” Participant B1 says Institution B has tried to address why preservation is important through a series of online videos about the collections and preservation matters, but often comes across obstacles, as “even if [people] get it, they go home… and it slips away.” It is, participant B1 reiterates, a case of “constant education.”

Participants from Institution C agree preservation is complex, and participant C2 notes “it’s only when you work with it that you understand the intricacies that it involves.” For institutions with collections of obsolete AV formats requiring both physical and digital preservation, education for the public, and wider institutional colleagues may provide opportunities to further about the importance of these processes, and why they happen.

7.11.3 Equipment obsolescence and maintenance

A constantly recurring theme within this research is the continual challenge with obtaining and maintaining playback equipment for obsolete AV formats. Edmondson (2016) calls issues with obsolete technologies and equipment “an essential element in re-creating context” as institutions are “faced with profound dilemmas” when it is no longer obtainable (p. 57). Playback equipment obsolescence and the subsequent difficulty in maintaining and finding parts creates frustration and concern that content on obsolete formats will not be a captured or accessed. All institutions have experienced these frustrations to varying degrees. When these interviews were occurring at

Institution A, I noted that 'new' second-hand Tascam 122 MK II cassette decks had recently arrived for a second cassette capture studio, and was awaiting technical checks before being installed for use. For Institution A, good quality equipment is essential, but locating it can be difficult. Participant A1 explains "you don't just want any old equipment," while participant A2 expands, describing challenges with locating equipment as "if you decide you want to digitise reel-to-reel tape, you can't go down to your local AV shop and ask what is a good brand of recorder." Participants purchase equipment on auction sites such as e-Bay, although participant A2 does admit "you can purchase some models of playback equipment new… but whether these have the kind of performance that… preservation grade equipment would have is pretty debatable."

Institution B also has difficulties obtaining video playback machines, calling acquisition of this equipment "difficult at this point," but sees the greater is around equipment maintenance. "The people who have the knowledge to maintain… it's coming to a point where we have fewer and fewer people who have that experience" (Participant B1). Participants from Institution C consider themselves in a good place in terms of equipment acquisition, as they have a number of Tascam cassette decks and Studer open-reel tape machines[7]. However, they agree upkeep and maintenance is the main concern, and participant C1 agrees "it's not just the equipment itself, you actually need the expertise to service it." Participant C1 also recognises issues with ageing magnetic tape formats, and impresses "tape gets older… they get geriatric – as they get older, you need better quality playback equipment that will not damage them, [and] is gentle and considerate towards these geriatric tapes."

The requirement for equipment to be available and readily maintained is key to preservation content capture – without working equipment, no content can be preserved digitally. Edmondson (2016) takes the position that institutions with these formats could be strategic by "[nurturing] such skills in-house and… network with skilled individuals in its wider constituency" to form a knowledge base of equipment maintenance. This could be particularly important with

[7] These machines were viewed at Institution C during the interview held there.

older second-hand equipment, especially Tascam 122 cassette decks, which participant A1 notes may have mechanical issues[8]. All participants observe the importance of equipment, and are concerned about equipment obsolescence, with stockpiling professional-grade equipment currently the only way to combat equipment obsolescence.

7.11.4 Retaining obsolete formats

The importance of preserving obsolete AV formats lies in their content and historical value – they are a primary record of the world from the late 19th century onwards. All participants agree that content preservation from obsolete formats is important, but their reasons are diverse: Participant A2 thinks that decisions to preserve the content are easy, as "if it's in the library, presumably it's because it has some cultural and historical significance." Participant A1 agrees, saying that Institution A's mandate to collect (based on collection policies) means "every item is important," especially for future access to content. Participant B1 concurs that AV formats are historically important as "audiovisual is how the 20th century… interacts with the world… we should have investment in taking care of that." The participants from Institution C also see the importance for preserving this material, but their reasons are practical, with participant C1 stating "you've got the potential for loss of… material," and participant C2 adding "if you don't… it won't exist." Noting the importance of preserving obsolete formats is only the first step in their preservation, retaining them is the second. Discarding obsolete AV formats after digital preservation can lead what Edmondson (2016) sees as a potential "loss of vital provenance and other information" (p. 57), and he considers that "discarding an original, no matter how many copies have been made, should never be undertaken lightly" (p. 67). All participants believe keeping these formats is important, as they may be returned to for more thorough information capture – participant A2 considers says "you might have to go back to something, there might be further details," and participant B1 agrees, saying "five years later, a new process has developed where… they

[8] According to participant A1, there is a mechanical issue with the C-gear on the capstan – a small plastic part that cannot be replaced once it stops working.

can get deep into the cracks, and get all the sound." Future examination of artifacts is a further reason for retaining original formats – participant A1 opines that people "just want to see what the carrier was," while participant A2 reckons "even as objects that can no longer be accessed, they still have value." It is this value that heritage institutions strive to save.

8. Findings and Implications

8.1 Findings

All participants in this study have valuable information to impart about preserving obsolete AV formats. While all approach it from a practical perspective, there are other perceptions, notably participant A2's philosophical approach, discussing why things are done to gain understanding of carriers and the importance of the content. An additional finding impacts on all AV preservation measures: the decreasing timeframe for preserving AV formats. Findings from this research correlate to the original research questions, which were posed to detail the objective of this research: to identify, and find potential solutions to issues, relating to the preservation of obsolete AV formats.

Preservation of obsolete AV formats is important to the institutions included here, as they have either staff dedicated to preserving these items, or are institutions devoted to collecting AV materials. Processes for preserving their collections are broadly similar, but differences in Institutional mandates require diverse approaches.

8.1.1 Protective Measures

Protective measures are taken by all institutions to preserve obsolete AV formats using best practices presented by IASA's technical committee in their publications *TC03*, *TC04,* and *TC05*. Storage and environment controls are in place, with formats kept in temperature and humidity controlled areas where format degradation due to chemical reaction can be managed, and items stored safely, carefully housed in either original, or replacement, packaging. Preservation methods such as cleaning items, nitrate film wind-through, or

baking tapes to combat hydrolysis are some of the more widely used processes to ensure survival of formats for future use. Careful handling processes, such as using gloves where required, or ensuring hands are clean when gloves are not used is necessary to ensure items are not damaged. While not covered here, digital preservation ensures content survival, and all participants reported metadata as essential for locating items for future use.

8.1.2 Obsolete formats

Obsolete physical AV formats are plentiful in all three institutions canvassed, with all participants listing obsolete formats. Obsolete formats are those no longer produced, or no longer have playback equipment manufactured, while obsolescent formats are those becoming obsolete. Obsolescence occurs when formats are no longer produced, or can be played back.

Obsolete formats include:

- Mechanical formats: Cylinders, coarse-groove 78rpm discs, lacquer discs, transcription discs,
- Magnetic formats: Videotape (except VHS and Betacam tape)
- Film formats (especially nitrate film)
- Optical formats: Minidisc

Obsolescent formats include:

- Magnetic formats: Open-reel (or reel-to-reel) tape, cassette tape; VHS and Betacam videotape

Recordable CDs (CD-Rs) are also considered obsolescent due to their unstable chemical composition.

8.1.3 Preservation Issues

All institutions reported challenges with obsolete AV format preservation. These issues are broad – funding for staff, equipment, and correct storage environments, as well as a lack of institutional comprehension on what is required to carry out this work (and why) are common challenges reported. Another key challenge is the acquisition and maintenance of playback equipment – this is becoming increasingly hard to source, and there are little to no providers in New Zealand for this equipment as it becomes unavailable. A third challenge emerges around the reality of preserving AV formats, and

expectations of the wider public (and, in some cases, institutional colleagues). AV preservation is detailed and time-consuming, and participants are committed to providing highest quality preservation, using best-practice standards. This does not often correlate with the wider idea that preservation (especially digital preservation) is a straightforward and fast process. Participants agree that education for both colleagues in the field, and the wider public on the intricacies of AV preservation, and reasons why it is required, would be beneficial for recognising the importance of this work.

8.1.4 Retaining AV formats

Reasons to keep obsolete AV formats, regardless of their playback abilities lie in their contained information. There is the possibility that content could be re-digitised to higher standards, or played back in the future, if equipment can be restored, or new equipment sourced. This is important, as digital copies are never authentic, exact copies because information is lost in the digitisation process, and any re-digitisation to a higher quality can potentially re-capture data. As these obsolete formats are often historical documents, they are an irreplaceable record, and if not retained, they likely do not exist anywhere else, and their information will be potentially lost. If AV content has been already captured, discarding the original format removes any opportunity for re-capture, which could reveal further (information from the original format.

8.1.5 Decreasing preservation timeframe

While not a finding from interview data but from surrounding literature, the decreasing timeframe left to preserve obsolete AV formats is critical, according to Casey (2015), IASA (2014), NFSA (2015), and Library of Congress (2012). This creates urgency around preserving items so content can be captured digitally while carriers are still playable, and playback equipment still working, and able to be maintained. This places pressure on institutions to consider preservation workflows to prioritise these formats, and as well as potentially straining budges of institutions that have little money to spend on AV preservation.

8.2 Implications

A number of implications have been identified from this research, which may impact on other institutions with collections of obsolete AV formats.

- Staff undertaking preservation require experience and skills in care and handling, and preservation techniques. Best practice is key for preserving these materials.
- AV preservation is expensive, and smaller institutions may not be able to afford equipment, or temperature controlled areas to store this equipment. It may be more cost-effective to out-source digital preservation, or re-locate collections to other institutions with best-practice preservation standards.
- All obsolete formats require different care and handling, and preservation measures. There is no one-size-fits all for AV materials – each format has different chemical composition and reactions to environment.
- Storage environments (temperature and humidity) are key to slowing down any format degradation.
- Working, professional-grade equipment is ideally required to capture content to a high-quality level, and the knowledge to maintain it is paramount. Lack of equipment means that content cannot be captured.
- Retaining AV formats is important to the survival of content, and if correct environments and preservation methods are not available, then these items may be damaged or destroyed.
- There is little time left to preserve (both physically and digitally) obsolete (or obsolescent) AV formats, so decisions need to be made on how to preserve items, or if they can be preserved al all in their current institutions.

9. Further topics for research

This study focuses on the particular challenges associated with preserving physical obsolete AV formats in New Zealand heritage libraries and archives.

While this research aims to answer questions that smaller (and some larger) local institutions may have surrounding these formats, and their specific preservation challenges, it does not cover all facets. Additional research in this area is recommended to add further discussion to the wider field of AV preservation. Some topics include:

- Further study on digital preservation of all AV formats in New Zealand institutions, and the challenges of digital obsolescence.

- How local broadcasting archives and libraries approach their diverse and large AV collections, and the difference between digitisation for access, and for preservation.

- How smaller New Zealand institutions see particular challenges with AV preservation of obsolete (and digital) formats, and how they approach these challenges.

- A survey on how many obsolete formats exist in New Zealand heritage libraries and archives, and which institutions can preserve different formats to a high quality. This could potentially lead to discussions on establishing national centres of AV preservation.

These topics would provide a broader examination of preservation issues, and open the field to not only heritage collections, but broadcast collections which have their own idiosyncratic challenges. Approaching smaller institutions with AV collections to gather information on their own approaches and limitations can only provide more options for support.

10. Conclusion

Preserving obsolete AV formats in institutional collections involves a complex set of processes and methodologies. Working with AV formats is what participant B1 terms “a constant grappling with obsolescence,” and many challenges appear – Peoples and Maguire (2015) put it succinctly: “the

availability of proper storage space, functioning playback equipment, and expertise in working with obsolete formats diminishes with each passing year (p. 3). This research was undertaken to identify challenges in New Zealand heritage libraries and archives with collections of obsolete AV materials to potentially provide advice or solutions to smaller institutions with these collections that have no recourse to preserve them. Wider literature examined reveals how widespread and detailed challenges relating to AV preservation are, and confirm what all participants agree on: preservation of obsolete AV materials needs to happen sooner rather than later.

As the number of institutions working with these materials is limited, three national institutions with large collections of obsolete AV formats were approached. Participants working directly with these materials from all three institutions were interviewed, with results presented as interpretive case studies. Their responses show similarities in both approach, and in challenges faced with deteriorating and obsolete formats, and equipment obsolescence. The need to preserve obsolete AV formats was considered key, as their content is likely unique, and important to New Zealand history and culture, and to lose it would impact greatly on the national historical record. One crucial finding is how important preserving this material in the short-term is: increasing obsolescence of formats and equipment, and estimates of how much time is left to preserve content by IASA, NFSA, UNESCO and other commentators suggests a limited time-frame to capture content. This impacts heavily on all local institutions that do not have equipment, experience, or funding to undertake this work, as their collections of obsolete AV media may never be preserved, and their (potentially important) content lost.

This research clarified many already-held beliefs about preserving obsolete AV formats, especially the necessity for best-practice standards and processes, and the frequent need to advocate for collection protection and preservation. Important information was gleaned, including uncertainty around equipment acquisition and maintenance, and the ever-decreasing amount of time that remains to preserve this obsolete and obsolescent AV formats.

Content on obsolete AV formats is unique, and without it, an irreplaceable perspective on our history is lost. It’s in all our best interests to save it.

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12. Appendix 1: Participant consent form

Participation consent form

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF INFORMATION MANAGEMENT
TE KURA TIAKI, WHAKAWHITI KŌRERO
LEVEL 5, RUTHERFORD HOUSE, PIPITEA CAMPUS, 23 LAMBTON QUAY, WELLINGTON
PO Box 600, Wellington 6140, New Zealand
Phone + 64-4-463 5103 Fax +64-4-463 5446 Email sim@vuw.ac.nz Website www.victoria.ac.nz/sim

Participant Consent Form

Research Project Title: "Waking the dead': Preserving obsolete audiovisual formats in New Zealand heritage libraries and archives."

Researcher: Amanda Mills, School of Information Management, Victoria University of Wellington

I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions and have them answered to my satisfaction.

I understand that I may withdraw myself (or any information I have provided) from this project, without having to give reasons, by e-mailing millsaman@myvuw.ac.nz by the 31st March, 2017.

I understand that any information I provide will be kept confidential to the researcher and their supervisor, the published results will not use my name, and that no opinions will be attributed to me in any way that will identify me or the organisation I am employed by.

I understand that the data I provide will not be used for any other purpose or released to others.

I understand that, if this interview is audio recorded, the recording and transcripts of the interviews will be erased within 2 years after the conclusion of the project. Furthermore, I will have an opportunity to check the transcripts of the interview.

Please indicate (by ticking the boxes below) which of the following apply:

- ☐ I would like to receive a summary of the results of this research when it is completed.
- ☐ I agree to this interview being audio recorded.

Signed:

Name of participant:

Date:

13. Appendix 2: Information participation Sheet

Participation information sheet.

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF INFORMATION MANAGEMENT
TE KURA TIAKI, WHAKAWHITI KŌRERO
LEVEL 5, RUTHERFORD HOUSE, PIPITEA CAMPUS, 23 LAMBTON QUAY, WELLINGTON
PO Box 600, Wellington 6140, New Zealand
Phone + 64-4-463 5103 **Fax** +64-4-463 5446 **Email** sim@vuw.ac.nz **Website** www.victoria.ac.nz/sim

Participant Information Sheet

Research Project Title: "Waking the dead': Preserving obsolete audiovisual formats in New Zealand heritage libraries and archives."

Researcher: Amanda Mills, School of Information Management, Victoria University of Wellington

As part of the completion of my Masters of Information Studies, this study is designed to examine preservation methodologies of obsolete audiovisual (AV) formats and their content in New Zealand heritage libraries and archives. Existing research has examined this topic from an international perspective, but little research has investigated local issues and practices. As local heritage libraries and archives house many obsolete carriers with valuable content requiring preservation for future access, this research aims to examine local solutions to questions or challenges surrounding the preservation of these formats. Victoria University requires, and has granted, approval from the School's Human Ethics Committee.

I am inviting conservators of AV materials in heritage libraries and archives to participate in this research. Participants will be asked to take part in a 30-45 minute interview at a location convenient to you. Permission will be asked to record the interview, and a transcript of the interview will be sent to participants for checking.

Participation is voluntary, and you will not be identified personally, or as an employee of a specific institution in any written report produced as a result of this research, including possible publication in academic conferences and journals. All material collected will be kept confidential, and will be viewed only by myself, and my supervisor, Belinda Battley. The research report will be submitted for marking to the School of Information Management, and subsequently deposited in the University Library. Should any participant wish to withdraw from the project, they may do so until March 31st 2017, and the data collected up to that point will be destroyed. All data collected from participants will be destroyed within two years after the completion of the project.

If you have any questions or would like to receive further information about the project, please contact me at millsaman@myvuw.ac.nz or telephone , or you may contact my supervisor Belinda Battley at Belinda.Battley@vuw.ac.nz or telephone . If you have further queries about the ethics process for this research, please contact the SIM HEC chair, Dr. Philip Calvert at Philip.calvert@vuw.ac.nz, or telephone 04 4636629.

Amanda Mills

14. Appendix 3: Questions for participants.

Interview questions

Establish: interviewee name, place, dates.

- How long have you been doing this work? How did you start?

- What obsolete AV formats do you have in your collections? How many do you have?
    - Probe: conservation staff numbers

- What issues or challenges have you found in preserving these formats?
    - Probe: finding equipment. Limits/constraints?

- How are these formats preserved physically?
    - Probe: care and handling measures

- How do you prioritise your obsolete AV materials? Do you give priority to particular items?

- What preservation methods do you use?
    - Probes: standards used? Should there be NZ standards?

- What cultural protocols do you follow when preserving Māori or Pacific materials? How do you apply tikanga to these items?

- What issues do you face with obsolescence of digital carriers?

- Do you think there should be a wider acknowledgement that preservation of audiovisual material demands further attention or consideration? If so, how? If not, why not?
    - Probe: institutional collaboration
    - Probe 2: expectations of digital preservation and reality of difficulties

- Why do you think it's important to preserve content on obsolete formats?
    - Probe: keeping original formats?

Thank you for taking the time to talk to me today, I appreciate that this is taking time away from your work.

15. Appendix 4. Obsolete formats held at Institution A

Format	Media	Carrier
Mechanical	Cylinder	
	Shellac discs	78rpm discs
	Lacquer discs	16” transcription discs
	Vinyl discs	12” discs, 10” discs, 7” discs (33⅓rpm, 78rpm, 45rpm)
Magnetic (audio)	Cassette	⅛ inch audiocassette
	Open-reel tape	¼ inch tape
		½ inch tape
		1” tape
		2” tape
		Multi-track tape
Magnetic (video)	Video	VHS
		Betacam
		U-Matic
		½“ Open-reel video
		1” Open-reel video
		2” Open-reel video
Magnetic (optical)	Minidisc	
Optical	CD	
	CD-R	
	DVD	
Digital	DAT tape	Digital compact cassette

16. Appendix 5. Obsolete formats held at Institution B

Format	Media	Carrier
Mechanical	Cylinder	
	Shellac discs	78rpm discs
	Lacquer discs	16” transcription discs
	Vinyl discs	12” discs, 10” discs, 7” discs (33⅓rpm, 78rpm, 45rpm)
Magnetic (audio)	Open reel tape	Paper tape
		10.5” reels
		7” reels
		5” reels
		3” reels
Magnetic (video)	Video	VHS
		Betacam
		U-Matic
		1/2" video
		1” video
		½” cartridge
		S-VHS
Optical	DVD	
Film	Nitrate film	35mm
	Safety film	Acetate base
		Diacetate base
	Polyester film	8mm
		Super-8
		9.5mm
		17.5mm
		22mm
		28mm
		70mm
Digital	DAT tape	

17. Appendix 6. Obsolete formats held at Institution C

Format	Media	Carrier
Mechanical	Lacquer discs	16” transcription discs
Magnetic (audio)	Cassette Open-reel tape	⅛ inch audiocassette (format types not given)
Magnetic (video)	Video	VHS Betacam Large Betacam U-Matic ½“ video 1” video ½” cartridge video Hi8
Magnetic (optical)	Minidisc	
Optical	CD CD-R	
Digital	DAT tape	Digital compact cassette

300185267

Name: Amanda Mills

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