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RADICAL CONTACT PRINTS / REVISED TEXT

Radio-autograph of a tropical puffer fish. Source: Operation Crossroads the Official Pictorial Record, 1946.

A small fish is carefully sliced along the length of its body, splayed open and arranged so that its exposed tissue presses against a photographic plate. After several hours the fish is removed and the film developed. This whole process is carried out in complete darkness without the aid of an enlarger or light to generate the negative imprint of the object as might be expected when producing a contact print. Instead the ghostly apparition that emerges out of the developing solution is a direct capture of the gradient levels of radioactivity present within the soft tissue of a tropical puffer fish caught in the aftermath of the atomic testing in the Bikini Atoll in 1946. Its contaminated flesh the energetic source of its own radiological recording. Inside the fish's stomach sits a deposit of radioactive algae or "hot" supper, which has yet to be digested and redistributed to the regions around the gills, liver, intestines, and reproductive organs where toxicity settles in greater concentrations.[1] The variance in light and shadow produced by the nuclear signature of tropical fish was used during the post-war period as a kind of bio-calculus for measuring the degree to which radiation exposure could accumulate within living tissue. Designated radio-autographs, nuclear scientists used such natural species to make atomic test prints because their planar morphology and relatively consistent tissue depth made them ideal living analogues to the photographic plate. Not only could their irradiated tissue render the nuclear visible, but it was also

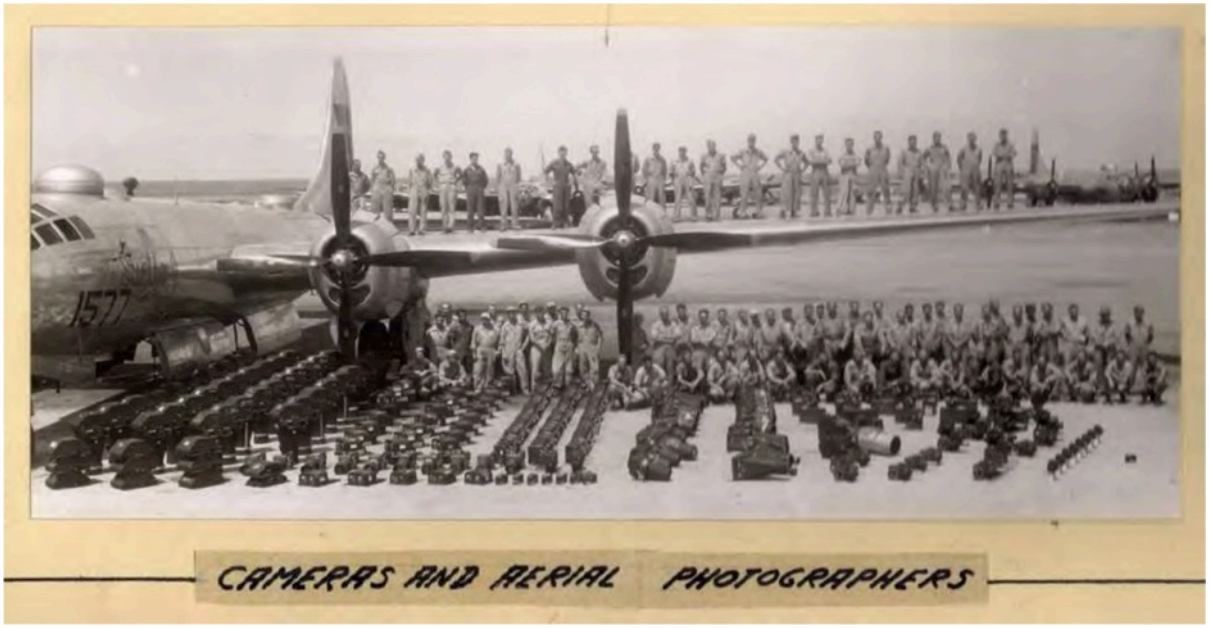
[1] United States. Joint Task Force One. Office of the Historian, *Operation Crossroads: The Official Pictorial Record* (New York: W. H. Wise, 1946). P. 216. See also David Bradley, *No Place to Hide* (Boston: Brown Little, 1948). P. 125.

the source of its spontaneous illumination as radioactive decay and the emission of energetic particles lit the object from within.

Contacts prints are typically made by placing objects directly onto photo-sensitive paper and exposing them. The resulting image registers the relative material imperviousness of each object to projected light as a one-to-one reversal. Photographic contact sheets are produced in a similar manner by exposing film negatives sandwiched between glass and paper. Radio-autographs, which are technically contact prints, did not require the intercession of an external agent to bring the dynamics of mutating matter into the field of vision as their unique radiological properties literally exposed themselves. Chief amongst early users of radio-autography was U.S. army medical doctor David Bradley, who worked as a radiological monitor or "Geiger man" during Operation Crossroads, the first post-war atomic weapons' test. As a visual event the radio-autographs of contaminated fish are seemingly incommensurable with the retinal drama of an atomic blast, but what photography accomplishes in its capture of these nuclear activities is to remediate their scalar difference. The radiological wound revealed within the defective tissue of a fish is no less momentous than that of the mushroom cloud and arguably even more disturbing as the compromised interiority of living matter was immediately rendered visible despite the radical a-visuality of nuclear contaminates.[2] Efforts to visualise the unseen forces of radiation have organised our scientific as well nuclear imaginaries for more than one hundred years.

Designed to assess the effects of aerial as well as underwater nuclear explosions on naval assets and biological specimens, Operation Crossroads was conducted in the remotely populated area of the Marshall Islands known as the Bikini Atoll in what the army then referred to as the Pacific Proving Grounds. On the afternoon of July 1, 1946 more than half of the world's supply of motion picture film was exposed as eighteen tons of cinematography and camera equipment were loaded aboard U.S. Army Air Forces planes and dispatched to the Bikini Atoll. Included amongst the photographic cargo was the world's largest still camera with a 48-inch focal length telephoto lens, as well as ultra high-speed cameras capable of taking 10,000 frames per second and motion picture cameras set to capture events at an equally astonishing frame-rate of 2000 fps. Boeing F-13 planes had also been retrofitted as "photographic ships" with the installation of motion picture cameras into their gun turrets—machine guns converted into massive point and shoot cameras. In total the day generated over 50,000 still images and several million feet of moving image matter as the radioactivity from atomic bomb detonations registered their lethal fallout on film.

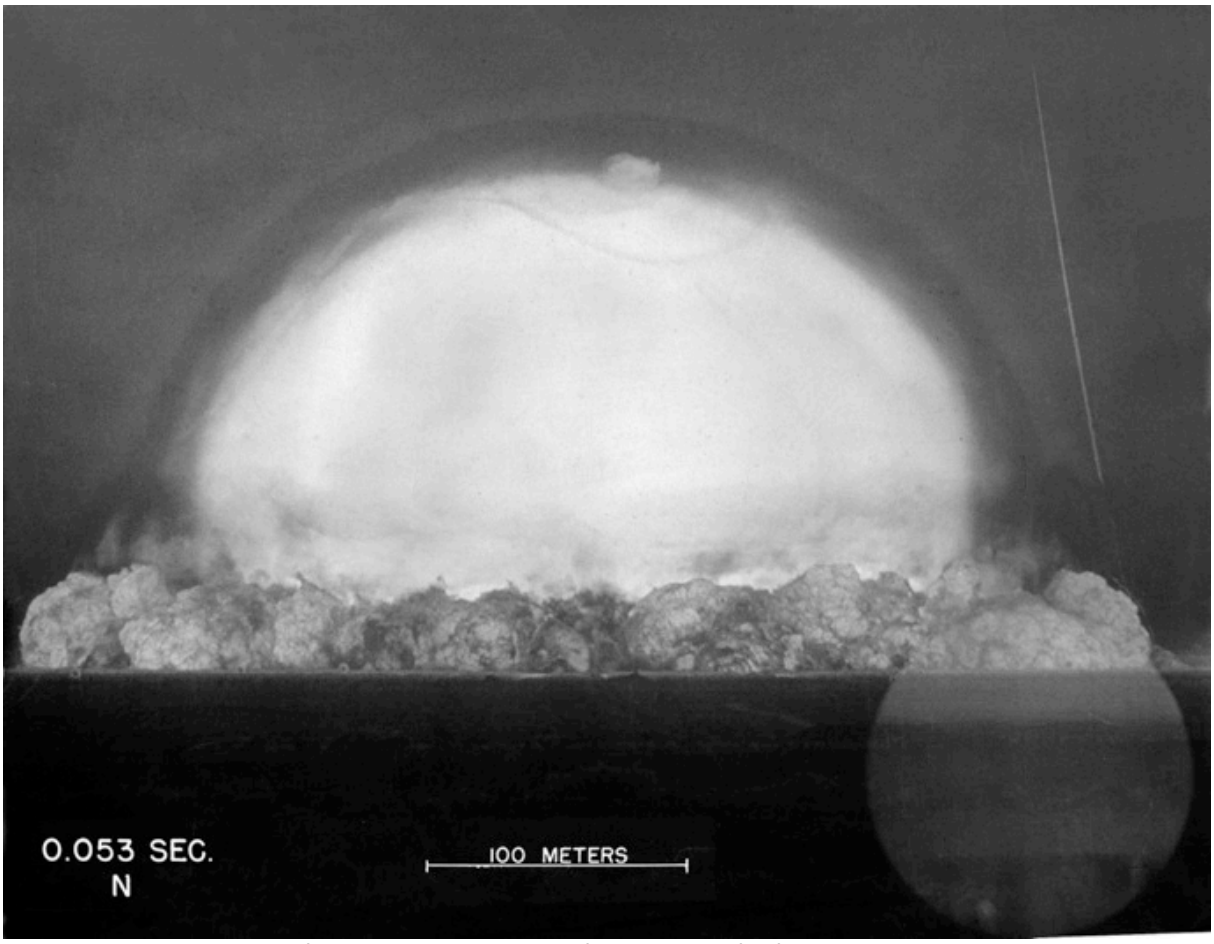
[2] Film theorist Akira Mizuta Lippit advances the concept of a-visuality when he reflects upon a comment made by the late abstract-expressionist painter Willem de Kooning with respect to the "radical visuality" produced by the atomic bomb. "The advent of atomic light signalled, for de Kooning, the absolute transformation of visual representation" inaugurating a new kind of seeing freed by the nuclear foreclosure of figuration's traditional symbolic economy. In the apocalyptic forces unleashed by the bomb de Kooning located a 'transcendent' sublime as everyone was momentarily reduced to colourless transparency and dispersed into the radioactive dust of angels. Lippit argues that de Kooning's "sadistic metaphysics" confuses the radical a-visuality of atomic light with a kind of religious fervour that maps a "redemptive" narrative onto the conversion of the physical body into ghostly spirit-matter by the sheer visceral and spectral force of atomic energy. Akira Mizuta Lippit, *Atomic Light: Shadow Optics* (London: University of Minnesota Press, 2005). P. 81.



Photographic Engineering Section of Operations Crossroads, 1946. Source: The Perry M. Thomas Collection, Michigan State University Archives and Historical Collections.

The massive mobilisation of an imagine-regime as a first-responder to a crime-scene marks this date in history as the day the world turned unequivocally into a picture. When Martin Heidegger famously stated in 1938 that: "the fundamental event of the modern age is the conquest of the world as picture" he signalled an impending future in which the two atomic bombs exploded over Japan would register in the West first and foremost as media-events. The battle over the control of the image and with it the narrative around the ethics of producing and detonating a nuclear device begins here in Japan.[3] These events, followed one year later by further nuclear experimentation in the Pacific stand at the "crossroads" that Heidegger so presciently invoked: namely the transformation of all material—human or otherwise—into media-matter hybrids.[4] Indeed, the thermonuclear weapons testing of the hydrogen bomb and the approaching nuclear accidents at Three Mile Island, Chernobyl, and Fukushima were already lurking within the first image of the atomic age produced in the desert of New Mexico on July 16, 1945.

[3] "After months of criticism by veterans groups and members of Congress, the Smithsonian Institution has agreed to make major changes in its planned exhibit of the airplane that dropped an atomic bomb on Hiroshima. The exhibit featuring the B-29 bomber, the Enola Gay, will no longer include a long section on the postwar nuclear race that veterans groups and members of Congress had criticized. The critics said that the discussion did not belong in the exhibit and was part of a politically loaded message that the dropping of the atomic bomb on Japan began a dark chapter in human history. The exhibit, which is scheduled to open in May, will also omit items that the critics said dwelt to excess on the horrible effects of the atomic bombs that were dropped on Hiroshima and Nagasaki in 1945, attacks that ended World War II." Neil A. Lewis, "Smithsonian Substantially Alters Enola Gay Exhibit After Criticism," *New York Times*, October 1 1994.
[4] Martin Heidegger, *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York: Harper Torchbooks, 1977). P. 134.



Trinity Test, New Mexico, July 16 1945. Source: Los Alamos National Laboratory.

The particular significance of Operation Crossroads lies in the army and navy's recognition that pictures or recorded image-data would provide *the* most comprehensive scientific account of its aerial and underwater tests. Cameras were placed at the centre of tactical operations with aerial documentation complimented by fixed-shore film installations: all in the service of capturing the effects of radiation on matter. Media with its technical capacity to capture, arrest, magnify, and narrate the dynamic properties and behaviours of matter, especially under conditions of stress, would become crucial to the ways in which nuclear phenomena would come to be analysed and studied. For example, the examination of welds in reactor rods or the search for signs of malignancy in flesh is a practice of visual literacy determined by the ability to decode the incandescent micro-features of matter revealed by X-ray technology. The radioactive fish flesh, exposed through Bradley's technique of contacting printing, was an early forerunner in the development of such processes of visualisation.

> We can make radio-autographs of the distribution of radioactivity in the bodies of little fish, and by means of fish population surveys attempt to discover whether or not the Bomb had any effect of the life-cycles of the lagoon inhabitants. . . Such studies may influence the lives of people living in the Tibetan plateau. We don't know to what distances from Bikini the radiation disease may be carried. We can't predict to what degree the balance of nature will be thrown off by atomic bombs. . . Bikini is not some faraway little atoll pinpointed on an out-of-the-way chart. Bikini is San Francisco Bay, Puget Sound, East River. It is the Thames, the Adriatic, Hellespont, and misty Baikal.[5]

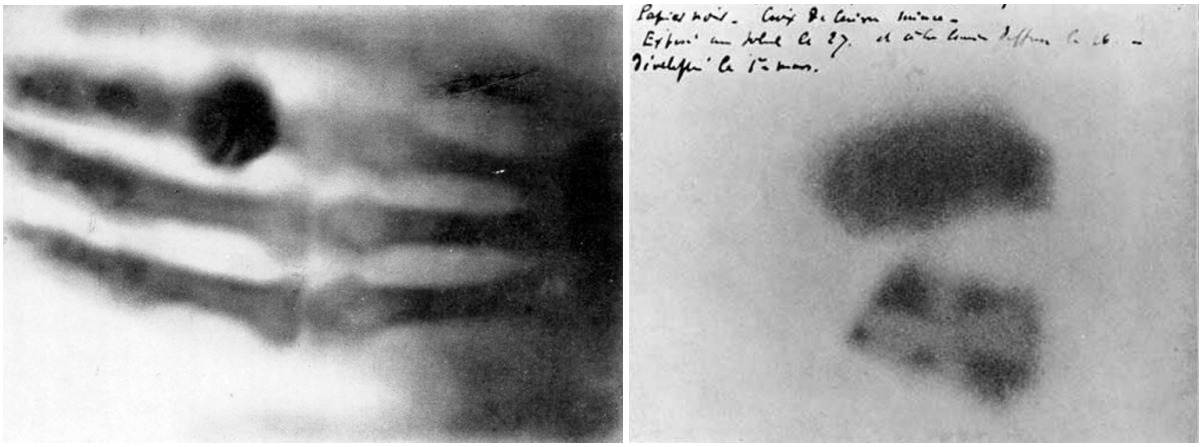
[5] Bradley, *No Place to Hide*. P. 149.

While the image-rapture induced by the lethal combustion of atomic energy has tended to occlude the morality that subtends the unleashing of such large-scale bio-chemicals weapons, the mushroom cloud finds its ultimate counter-archive within the radiological contact print of the tropical puffer fish. Unlike the transcendent image of atmospheric chaos, which separates the visual field from its material effects on the ground, the radiological contact print is immanent to and continuous with the event. That is to say, that the violence out of which the image emerges as scientific document or record is also the very means by which the image comes into the world; its constitutive and enabling force. Likewise in Hiroshima and Nagasaki when the searing heat rays of the atomic blasts transformed the material surfaces of these cities into photographic contact prints as ghostly photograms of damaged bodies and buildings were etched directly into concrete and stone. Exposed by the radical intensity of the blast, and without the mediation of a filmic negative, these "atomic shadows" document life at the very moment of death. They too are a kind of radio-autograph—a spontaneous recording of an external event in which the image is transformed into an actual "material witness".[6]

Atomic shadow of a walking body scorched into the steps of Sumitomo Hiroshima Bank, Kamiya-Cho, 260 metres from the hypocentre of the blast. Source: United States Strategic Bombing Survey.

[6] See Susan Schuppli, *Material Witness: Forensic Media and the Production of Evidence* (London: MIT Press, Forthcoming).

However, before the airborne particle became the delivery system by which lethal toxins were to be carried into the terrifying narratives of modernity, the nuclear capacities of the twentieth century were preceded by two key developments in photo-imaging technology: the discovery of the X-ray in 1895 followed by that of spontaneous radioactivity in 1896. Both of these experimental technologies transformed solid matter into a spectral image trace without the arbitration of the sun, a necessary pre-condition of all early photographic practices. On November 22, 1895 German physicist Wilhelm Konrad Röntgen exposed his wife's hand to a series of unusual rays as it rested immobile on a photographic plate. These emissions, which we now call Röntgen rays, could pass through the atmosphere and pierce the body to generate shadowy photographic renderings from at a distance. A radiant energy that comes from elsewhere is a form of divine light that suggestively links the radiological science of the X-ray to the transcendental metaphysics of spirit. "Like a dream, this form of light moved through objects, erased boundaries between solid objects, crossing their internal and external borders."[7] Referred to as "ghost pictures" because of the mysterious agency that could transform solid forms into ethereal image-matter, the resulting ghostly view of Anna Bertha's elongated skeletal digits conjured the coming of a new world in which the potential for dematerialising the corporeal substance of the body by technological means was first realised.



The first X-ray ever taken depicting Anna Bertha Röntgen's hand, November 22, 1895. (left)
Ghostly image of a metal object (Maltese Cross) generated by spontaneous radioactivity, Becquerel, May 1896. (right)

The photographic potential of radioactivity quickly followed on the heels of Röntgen's work and was pioneered by French physicist Henri Becquerel who was experimenting with uranium salts and phosphorescence. [8] Becquerel did not immediately recognize the role that spontaneous

[7] Lippit, *Atomic Light: Shadow Optics*. P. 44.
[8] Becquerel described his research methodology as follows: "One wraps a Lumière photographic plate with a bromide emulsion in two sheets of very thick black paper, such that the plate does not become clouded upon being exposed to the sun for a day. One places on the sheet of paper, on the outside, a slab of the phosphorescent substance, and one exposes the whole to the sun for several hours. When one then develops the photographic plate, one recognizes that the silhouette of the phosphorescent substance appears in black on the negative. If one places between the phosphorescent substance and the paper a piece of money or a metal screen pierced with a cut-out design, one sees the image of these objects appear on the negative ... One must conclude from these experiments that the phosphorescent substance in question emits rays which pass through the opaque paper and reduce silver salts." Henri Becquerel, "Sur les Radiations Emises par Phosphorescence," in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, ed. Académie des sciences (Paris: Gauthier-Villars, 1896). Pp. 420-21.

radioactivity had played in producing his mysterious images and believed instead that they were generated by exposing objects placed onto uranium-salt coated papers to sunlight. When a series of cloud-covered days disrupted his experiments in May of 1896, Becquerel put his materials away in a drawer. Upon resumption of his work, Becquerel decided for some inexplicable reason to develop these sequestered plates and found to his surprise that an incredibly bright and detailed image had etched itself into the uranium-salted paper while hidden away from sunlight. Uranium salts, it turned out, emitted radiation even when sheltered from an external source of energetic stimulation. Film theorist André Bazin would make a similar claim for photography some years later, when he declared that: "For the first time, between the originating object and its reproduction there intervenes only the instrumentality of a nonliving agent."[9] It is Becquerel's breakthrough photographic plate fogged by its exposure to radiation, which also bears an uncanny resemblance to Bradley's irradiated puffer fish that first achieves this remarkable feat.

Forty years after Hiroshima and Operation Crossroads another radiological witness appeared, but this time not spawned by the weapons testing conducted at the Los Alamos National Laboratory in the United States. Instead it was created by the civilian nuclear energy programme in the former Soviet Union during the 1970s, a period that saw fifteen reactors built across the Ukraine, making it the second-largest custodian of nuclear materials outside of Russia, with the Chernobyl reactor complex supplying the Ukraine with the majority of its energy requirements.[10] Three days after the explosion and meltdown of Chernobyl's Nuclear Reactor Unit 4 on April 26, 1986, Ukrainian filmmaker Vladimir Shevchenko was granted permission to fly over the site in order to document decontamination efforts. When Shevchenko's 35-mm film footage was later developed, he noticed that a portion of the film was heavily pockmarked and carried extraneous static interference and noise. Thinking initially that the film stock used had been defective, Shevchenko finally realised that what he had captured on film was the image and sound of radioactivity itself.

Film stills from *Chernobyl: Chronicle of Difficult Weeks*, director Vladimir Shevchenko, 1986, 54 mins.

[9] André Bazin, "The Ontology of the Photographic Image," *Film Quarterly* 13, no. 4 (1960). P. 7.
[10] The Soviet Union successfully detonated a nuclear bomb in 1949, and Russia inherited a vast nuclear weapons production complex after the dissolution of the Soviet Union. It still maintains holdings of enriched uranium and its related weapons arsenal. www.nti.org/country-profiles/russia/ Accessed 29 09 13.

> Radiation is a fatal invisible foe. One that even penetrates steel plating. It has no odor, nor color. But is has a voice. Here it is. We thought this film was defective. But we were mistaken. This is how radiation looks. This shot was taken when we were allowed a 30-second glimpse from the armoured troop-carrier. On that April night the first men passed here—without protection or stop-watches, aware of the danger, as soldiers performing a great feat. Our camera was loaded with black-and-white film. This is why the events of the first weeks will be black and white, the colors of disaster.[11]

Not only had the disaster inscribed itself directly into the emulsive layer of the film as decaying radioactive particles transgressed the exterior casing of the movie camera, sadly they also unleashed their mutating virulence upon Shevchenko's own body.[12] An act of radiological recording had converted silver halide particles into carriers of a lethal disease, transmuting the film quite literally into the most dangerous reel of footage in the world.[13] Although Shevchenko's documentary provides us with an intimate view into the space of disaster, its pictorial mediation allows us to remain at a safe and objective distance to it. However, the sudden distortion of the film's sound and image flows by the Geiger-like interference of radiation displaces our initial confidence in its representational status as a fixed historical index and installs in its place a sense of dread that what we are witnessing on film is in fact the unholy representation of the real: an amorphous contagion that continues to discharge its lethal contaminates into the present. Shevchenko's damaged film is perhaps the most radical of all contact prints, because it is still "dangerously alive".

Conceptualising this unexpected filmic rupture as a capture of the real rather than an act of cinematic inscription forces a rethinking of the ontological nature of mediatic matter itself. Contrary to André Bazin's well-known theorisations of film as "time-embalmed" or "change mummified", this particular sequence of irradiated film cannot be fixed at 24-fps.[14] Instead its ontological status as a record and index of past events is transformed into a dynamic ontology of becoming as radiation exerts its modulating influences over time. The radical recoding of the film by way of the nuclear accident insists that an analytic pursuit of Shevchenko's film as merely a representation of the real must be set aside in favour of an engagement with the film as an actual toxic event. Because of the energetic nature of nuclear materials, their radioactive contaminants consistently break free of the technogenic housings that, in principle, are meant to contain them.[15] Escaping to migrate across sovereign borders, radiological dust clouds discharge their particles at

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[11] Transcription of film voice-over from Vladimir Shevchenko, "Chernobyl: Chronicle of Difficult Weeks," in *The Glasnost Film Festival* (USSR: The Video Project, 1986).
[12] Vladimir Shevchenko died in 1999. To-date only thirty-one confirmed deaths are officially attributed to the accident at Chernobyl.
[13] I am indebted to Peter C. Van Wyck whose citation of this incident/accident provoked my search for the actual film footage. Peter C. Van Wyck, *Signs of Danger: Waste, Trauma, and Nuclear Threat*, vol. 26, Theory Out of Bounds (Minneapolis: University of Minnesota Press, 2004). P. 97.
[14] "If the plastic arts were put under psychoanalysis, the practice of embalming the dead might turn out to be a fundamental factor in their creation. The process might reveal that at the origin of painting and sculpture there lies a mummy complex. The religion of ancient Egypt, aimed against death, saw survival as depending on the continued existence of the corporeal body. Thus, by providing a defense against the passage of time it satisfied a basic psychological need in man, for death is but the victory of time. To preserve, artificially, his bodily appearance is to snatch it from the flow of time, to stow it away neatly, so to speak, in the hold of life. It was natural, therefore, to keep up appearances in the face of the reality of death by preserving flesh and bone." See Bazin, "The Ontology of the Photographic Image." Pp. 4-5.
[15] "Nuclear materials" writes Peter C. Van Wyck "stand in relation to their containment only very imperfectly—there is always leakage." Van Wyck, *Signs of Danger: Waste, Trauma, and Nuclear Threat*, P. 19.

varying rates of decay, irradiating environments and warping biological systems as they pass.[16] In distributing their effects, the nuclear expands the original contact zone of the event—its photographic registration marks if you will—making it difficult to apprehend the slow leaking of its violence across territories and over epochs, quite unlike the targeted immediacy of the atomic blast. While most of the more than one hundred radioactive elements that were produced by the atmospheric release have long since decayed, Strontium-90 and Caesium-137 isotopes directly attributed to Chernobyl are still present in areas of the world today.[17] In this sense, the contained image of the nuclear archived by the radio-autograph of the puffer fish is somewhat misleading, as Bradley himself realised when he described a strange milky diffusion emanating from the coral reef as offering the first signs that radioactive contaminates were dramatically altering the physical ecosystems of the Atoll. "With the discovery, by divers, that areas of coral were bleaching out into chalky white from some unexplainable and lethal agent has come an increasing concern over the fish."[18] It was this phenomena that led Bradley's team to photograph the marine tissue of fish, whose toxicity would in short order begin to make its ways up through the food chain.[19] Throughout this essay, radioactivity has been the force that radicalises matter, transforming all that it comes into contact with, producing a kind of insurgent photography that operates in excess of vision. The provocation of such radical contact prints is ultimately that of bearing witness to processes, in which images do not merely represent events but are themselves continuous *with* and materialised *as* events.

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[16] Caesium, one of the most enduring radioactive isotopes, is easily absorbed by natural materials because of high degree of solubility of its salts, which are some of the most common chemical compounds found within it.

[17] Large amounts of Strontium-90 (Sr-90) were also dispersed worldwide during atmospheric nuclear weapons tests conducted during the 1950s and 1960s, so Chernobyl is not the only source of Sr-90. See International Atomic Energy Agency. www.iaea.org/newscenter/features/chernobyl-15/cherno-faq.shtml. See also US Environmental Protection Agency briefings. www.epa.gov/radiation. Accessed 22.09.13 and 29.09.13 respectively.

[18] Bradley, *No Place to Hide*. P. 124-25.

[19] "Almost all seagoing fish recently caught around the atoll of Bikini have been radioactive. Thus the disease is passed on from species to species like an epizootic. The only factors which tend to limit the disease, as distinguished from infectious diseases are the half- lives of the material involved, and the degree of dilution and dissemination of the fission products." Ibid. P. 126.