STATE OF IOWA
COUNTY OF LINN

Now Comes Before me, Notary Public, Christopher Caldbeck, a person of the age of majority, know to me, who, under oath, does depose and say:

I am a retired Navy Commander having served in many assignments both afloat and shore. This includes a position to of Executive Officer or second in command of a Guided Missile frigate. I am a graduate of the Division Officer, Department Head and prospective Executive Officer course at the Navy's Surface Warfare Officer School. I have also completed the United States Army Command and General Staff College. I am qualified as a Surface Warfare Officer, Officer of the Deck, Engineering Officer of the Watch and navigator. I am also qualified for command at sea. I am familiar with both the steam operated evaporator distillation system and the reverse osmosis distillation system.

I have reviewed the report by the National Research Centre for Environmental Toxicology and the Queensland Health Services (hereinafter NRCET) entitled the *Examination of The Potential Exposure of Royal Australian Navy (RAN) Personnel to Polychlorinated Dibenzodioxins And Polychlorinated Dibenzofurans Via Drinking Water*, (NRCET study) which was published in 2002. I have also reviewed the report of the Institute of Medicine's (IOM) Board on the Health of Special Populations in relation to the project "Blue Water Navy Vietnam Veterans and Agent Orange Exposure," which replicated and validated the NRCET study.

As a threshold matter, the vessels of both Australian and American origin operated side by side in the waters adjacent to Vietnam. The missions were driven by the ship capabilities and not by nationality. There was no tactical differences between the operations conducted by ships of the United States and Royal Australian Navy. Several Australian ships, especially those of the *Charles F. Adams* DDG-2 class, were built in the United States. All United States Navy ships used a steam evaporator distillation system such as the one pictured and described in the NRCET study. A new system known as reverse osmosis is currently in use on U. S. Navy ships, however the conversion from the steam operated evaporators did not begin until the mid 1990's, long after the Vietnam War. The system pictured and described in the NRCET report was not a reverse osmosis system.

The NRCET study noted that ships in the near shore marine waters collected waters that were contaminated with the runoff from areas sprayed with Agent Orange. NRCET Study at 10. The authors later reported to this office that estuary containing the dioxins extended more than three nautical miles from shore. This means that the contamination would have extended well past the gun line which was normally located 2000 to 5000 yards from shore. The distilling plants aboard the ship, which converted the salt water into potable drinking water, actually enhanced the effect of the Agent Orange. NRCET Study at 42.

The steam operated evaporators all work on similar principles to produce water (feed water) for the boilers and potable water for the ship's crew. Water is introduced from the sea and is passed through the distilling condenser and air ejector condenser where it acts as a coolant

for the condensers. It is then sent through the vapor feed heater into the first effect chamber and into the second effect chamber where it is changed to water vapor. Vapor then is passed through a drain regulator into a flash chamber and passes through baffles and separators into the distilling condenser where it is condensed into water and pumped to the ship's water distribution system. Sea water not vaporized is pumped over the side by the brine pump. *Id*. This is the same process discussed in the NRCET Study. There was no filter on the suction side of the system and any sediment drifting in the water would have been taken into the distillation system. . There was no process on board ships to test for the Agent Orange dioxin.

Applying Henry's law, the NRCET report as confirmed by the IOM report, found that the Agent Orange dioxin would have co-distilled with the water vapor. The scrubbers at the top of the evaporators would not have removed the dioxin. Instead it would have carried over with the vapor and would have adhered to the water molecules once the vapor condensed. The same piping and distillation system was used for feed water and potable water down to the final distribution manifold. Even if the evaporators were distilling water to feed rather than potable, the entire system would have bene contaminated.

Potable water was manufactured continuously along with "feed" water for the ship's boilers. It was a constant headache, especially true in southern latitudes such as Vietnam since the higher ambient sea water temperatures reduced the efficiency of the distilling process. The Navy procedures in effect at the time discouraged the distillation of potable water near river discharges or in port however allowed it to be done at the discretion of the Commanding Officer. Most Commanding Officers delegated this authority to their Chief Engineers. However ships were allowed to make feed water for the boilers in any location. The distilling system was the same for both potable and feed water. Even if potable water was not being distilled in an area contaminated by Agent Orange, the suction piping, flash chambers, scrubbers and discharge piping up to the distribution manifold would still become contaminated. The dioxin would then contaminate the distilled water on the way to the potable water tanks. This was not only necessary to ensure an adequate potable water reserve but to help maintain ship's stability. T was often necessary to adjust the levels in both fuel and water tanks to keep the ship from listing and maintaining an even keel.

A destroyer sized ship in the tropics ships would completely replenish their potable water supply almost daily. These ships did not have the capacity to carry potable water throughout the voyage without replenishment via their distillation system. These ships patrolled the entire coast of Vietnam and often anchored in harbors to provide gunfire support. To infer that these ships never steamed through contaminated waters is naive. Additionally, there was no means to transport large quantities of water outside of the reserve potable water tanks.

The range of the Navy guns varied based on the ship type. With the exception of the Battleship *USS New Jersey*, any time a Navy ship was firing its guns ashore, it would have had to have been within the territorial seas of Vietnam. The distance to shore directly corresponds to the maximum range of the support of forces ashore. Consequently, most naval units operated close to shore. Often anchorages occurred within the ten fathom (60 feet) curve. Gunfire missions were often shot from two to three thousand yards of the shore, well within the twelve

or even the old three nautical mile limit. Many were anchored in Da Nang Harbor. The computers at the time were analog rather than digital and anchoring allowed for a more stable fire control solution.

The maximum safe anchorage for a destroyer size ship as well as the major auxiliaries was 30 fathoms or 180 feet. The draft on Destroyer size ships were approximately 15-20 feet depending upon the loadout (fuel, water and ammunition). The anchoring process called for the ship to drop the anchor in shallow water. The anchor was designed to dig into the sea bottom. The ship would then drop an additional length of anchor chain three times the depth of the water to help hold the anchor. The ship would then reverse engines to set the anchor in place. The cavitation effect of the propellers operating in reverse would disturb the seabed causing silt, dirt and sediment to rise to the surface and resuspend. Prior to weighing anchor the ship would haul in the chain which further disturbed the bottom and when the anchor itself cleared the bottom it would cause a further disturbance. Without question every anchoring evolution disturbed the sea bed causing a resuspension of the silt, dirt and sediment.

Additionally, ships operating at high speed along the shallow estuarine waters would settle by the stern in a phenomena known as "squat." This would cause a more direct impingement by the propellor wash on the sea bed and further disturb the bottom. Again the silt, dirt and sediment would rise to the surface.

After reviewing both the NRCET study and the IOM report I am convinced that any Agent Orange sprayed on the river banks or washed into the rivers and streams would have eventually made it to the near shore waters where ships of the Royal Australian and United States navys were operating. Any dioxin entering the ships distillation equipment would have co-distilled and would have it made its way into the shipboard potable water system. The water would have been used for drinking, cooking, laundry, showering and cleaning. Additionally personnel in the main engineering spaces would have been exposed due to drainage from the steam drains into the bilges or while performing maintenance on the various main propulsion and auxiliary equipment. The internal cleaning of the boiler tubes, which was required every 1800 hours of operation, would have been especially unsafe. Anchoring and high speed runs within the shallow estuarine waters would have caused the bottom sediment, along with any attached Agent Orange dioxin to resuspend, allowing additional opportunities for ships to take in contaminated salt water into their distillation plant.

Christopher W. Caldbeck

Christopher Caldbeck

SUBSCRIBED AND SWORN TO Before Me, Notary Public this 2nd day of January 2014.

Erica Smith

Notary Public

My Commission Expires: July 31, 2016

ERICA SMITH
Notarial Seal, Iowa
Commission Number 711754
My Commission Expires 7-31-2016