EXECUTIVE SUMMARY

The Independent Scientific Panel (ISP) was established under the "Goodwill Agreement" entered into by the Government of Indonesia and PT Newmont Minahasa Raya, to monitor and assess the marine environment adjacent to mine tailings placed in Buyat Bay, North Sulawesi. The tailings placement occurred between 1996 and 2004 as part of the operation of the Mesel gold mine. Monitoring of the marine environment in the area of Buyat Bay has taken place continuously from before the mine began operation, throughout operation, and for 3 years after closure. The ISP was established to continue environmental monitoring for a further 10 years.

The ISP compiled a complete "ISP Environmental Monitoring Plan, 2007", covering seawater quality and sediment/tailings quality sampling, benthic marine invertebrate communities identification, metal content analyses of fish tissue, coral reef communities survey, water column stratification survey, seabed bathymetry mapping, seafood consumption study, a market basket fish metals content study and a desktop human biomarker review study in relation to human health. Together with the ISP Secretariat, contractors were selected to carry out the environmental monitoring program as set forth in the "ISP Environmental Monitoring Plan, 2007", through a tender/bidding process. The selection process imposed two main evaluation criteria, namely scientific/technical criteria and administrational criteria. Monitoring items in the "ISP Environmental Monitoring Plan, 2007" were grouped into Human Health, Environmental Geochemistry, and Marine Biology. Successful candidates to carry out each individual group monitoring were Universitas Sam Ratulangi/SEAMEO Universitas Indonesia, BPPT-Engineering, and Institut Pertanian Bogor, respectively. The first survey of the ISP program took place in late September 2007, the results from which are provided in this report.

Seawater samples were collected from several locations and water depths in Buyat Bay and reference locations which are far away from the deposited tailings. Seawater quality parameters that were measured were dissolved arsenic, dissolved mercury and total suspended solids. Arsenic and mercury concentrations in all seawater samples were below the Indonesian Seawater Quality Standard for Marine Biota. Total suspended solids data showed no significant difference between samples from Buyat Bay and the reference sites. Seawater data from this survey indicate that arsenic, mercury and total suspended solids concentrations in seawater overlying the tailings were the same as the reference stations away from the tailings and are present at concentrations typical of unimpacted coastal marine waters. Therefore it can be concluded that tailings in Buyat Bay were not impacting the arsenic, mercury and suspended solids content of seawater during the September 2007 survey.

In order to determine the physical structure of the marine water column in Buyat Bay as well as coastal areas in the vicinity of the bay, water column profiling using a Conductivity_Temperature_Depth (CTD) probe was conducted during the September 2007 survey. The data show that seawater temperature decreases and density increases with depth, with a zone of maximum change in temperature called the thermocline. The observed thermocline in Buyat Bay during September 2007 varied between a water depth of 20 to 60 meters, with an average depth of the thermocline at approximately 40 meters.

Sediment samples were collected from several locations in Buyat Bay and reference locations which are far away from the deposited tailings. Sediment samples were analyzed for total arsenic and mercury as well as aluminum, iron, manganese, silicon, total organic carbon and grain size. As expected, total arsenic and mercury concentrations in the sediments in the tailings footprint area are higher than the background range. This is due to the presence of various solid minerals that contain arsenic and mercury. Because there is a lack of a correlation between the concentration of metals bound in minerals and their biological availability, there are no marine sediment standards for arsenic and mercury set by Indonesian regulatory authorities. These data indicate that tailings are present in Buyat Bay, but cannot be used to draw conclusions about transfer of metals to the water column or to marine organisms.

Marine benthic invertebrates are organisms that live in or on the seafloor. These organisms include: worms such as polychaetes, crustaceans such as shrimp and similar organisms, and mollusks such as clams, as well as many other organisms that live in the mud and sand on the seafloor. Marine benthic invertebrate samples were collected from several locations in Buyat Bay and reference locations which are far away from the deposited tailings. The survey results indicate that the number of different organisms and the abundance of organisms at each station did not differ greatly among the stations. The tailings footprint area had moderate abundance of organisms compared to the other stations, indicating that marine benthic invertebrates are able to colonize the tailings mound in approximately the same numbers as at other locations with little or no tailings present. Collectively, these data show that at this time marine benthic invertebrates are able to inhabit the tailings mound and adjacent areas.

A bathymetric survey of Buyat Bay, extending 1.5 km offshore, was conducted during the September 2007 survey. This survey provided information on the location of tailings footprint in Buyat Bay. The survey results show that the present dimensions of the tailings mound is approximately 750 m in length (N-S axis), 500 m in width (E-W axis) and 12 meters high. The results indicate that the tailings placed in Buyat Bay are physically stable and have up to this time not been redistributed to a wider area.

Fish were caught from Buyat Bay and a reference site away from the tailings for the purpose of sampling arsenic and mercury in muscle tissue. Twenty five specimens were analyzed from each location. The concentration of arsenic and mercury were generally similar in Buyat Bay and the reference site. Fish from the reference site had slightly higher concentrations of mercury than those caught in Buyat Bay, which is most likely due to the different types and sizes of fish caught in the two locations. The concentrations of arsenic and mercury in fish from both Buyat Bay and the reference site were below international standards for the protection of human health. Based on concentrations of arsenic and mercury in the fish sampled from both locations during this survey, it can be concluded that in reference to these metals, fish from this area do not pose a risk to human health if consumed.

Coral reefs are among the most productive biological systems in the world, supporting a wide variety of life forms, including fish. Monitoring of coral reef communities was conducted during the September 2007 survey to assess whether tailings deposition has had an effect on the local corals and fish. Coral reef and fish sampling was conducted at six locations in Buyat Bay, Ratatotok Peninsula and at reference locations. The coral reef

results show that there is no correlation between the types of coral observed and proximity to the area of tailings deposition. These observations therefore show that variations in coral communities in various stations are due to natural variability and not related to tailings deposition in Buyat Bay. Fish are used as indicators of reef health as reef fish population dynamics are closely affected by reef habitat, which they depend on for food and shelter. All monitored stations showed relatively similar numbers of total fish and fish species observed. These results demonstrate that there are no significant differences in the abundance of fish from stations close to the area of tailings deposition than those further away, which in turn indicates that the tailings in Buyat Bay have not affected the abundance of coral fish in the vicinity of Buyat Bay up to this time.

The primary objective of the fish consumption study was to use a standard pre-trialed and quality assured questionnaire to determine the levels of consumption of freshwater and marine fish and other seafood in the Buyat Bay, Buyat, Basaan and Ratatotok communities. The first round survey of the village-specific food consumption frequency patterns and quantification of the amounts consumed was conducted in October 2007, representing the dry season consumption patterns. These data will ultimately be used to undertake a human health food pathway risk assessment for the Buyat area communities.

Monitoring of total arsenic and total mercury in fish flesh composite samples sourced from the fishermen living at Buyat Bay, from the local fish markets at Buyat and Ratatotok villages and from the fish market at Manado City was undertaken in October 2007. The sample collection, pre-preparation and analysis program were conducted to best international practice, including the procedures recommended by the World Health Organisation (WHO) for the preparation of “as consumed” fish. All mean total mercury levels for the present monitoring were below the FAO/WHO Codex standard values for mercury. Inorganic arsenic levels in fish were also below international food standards (Thailand, Australia & New Zealand). The total arsenic and mercury results from the Buyat-Ratatotok area are very similar to those reported for the Manado City and Jakarta fish markets as well as being within the mean values reported by national total diet surveys in Australia, New Zealand the United Kingdom and the United States. In conclusion, the results for total arsenic and total mercury from the October 2007 survey indicate that the levels of these metals in local fish are similar to the results of numerous national total diet studies and do not pose a health concern to humans if consumed.

There has been a number of human biomarker studies for mercury in blood, urine and scalp hair conducted in North Sulawesi. Many of these studies have been undertaken between 1996 and 2005 in the Buyat area including Buyat Bay, Buyat Village and Ratatotok Village. Biomarker sampling has also been conducted in the Buyat area for arsenic in blood, hair, urine and fingernails. All of the Buyat-area monitoring studies have demonstrated that local residents have levels of mercury and arsenic comparable with those observed in other parts of Indonesia, and more broadly in non-impacted populations internationally. Taking into account all of the Buyat area human biomarker data, it can be readily concluded that the Buyat Bay and Buyat area communities have levels for which there is no possibility of mercury- or arsenic-related illnesses to have occurred either in 2005 or in the PT Newmont Minahasa Raya’s mining period between 1996 – 2004.