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| **TO:** | David Harpley, CZN | **Date:** | July 7, 2011 |
| **C.C.:** | Alan Taylor | | |
| **FROM:** | Byard MacLean | | |
| **Subject:** | EA0809-002 Undertaking No. 1 - Response to John Brodie's Review | | |

**Introduction**

I refer to John Brodie's comments contained on pages 323 to 329 of the June 23/24 Public Hearing transcripts. Mr. Brodie makes unsubstantiated assumptions that are incorrect when compared to actual testing data that was created as part of the paste backfill design criteria. The result is that Mr. Brodie incorrectly concludes that there is insufficient void space underground to store the flotation tailings.

**Specific Comments**

Mr Brodie's estimate of 11% of the mined ore reporting to the final sphalerite (ZnS) and galena (PbS) concentrates is incorrect. Tonnage of concentrate is calculated by multiplying the tonnes processed by the mill feed grade by the metal recovery, and dividing by the metal concentrate grade. CZN has completed five separate metallurgical testing campaigns at SGS Lakefield, one of the premier testing laboratories in Canada. These testing campaigns provided the metal recovery and concentrate grade values used in the previously described calculation. This test data consistently indicates that the life of mine concentrate proportion represents 26% of the mined ore. Mr. Brodie has not provided a reliable basis for his 11% assumption.

Mr Brodie's estimate of 17% of the mined ore reporting to the DMS reject fraction is incorrect. The SGS Lakefield metallurgical testing also measured the percent of DMS rock rejected. The average value projected over the life of the mine is 24% of the mined ore. Again, Mr. Brodie has not provided a reliable basis for his 17% estimate.

Using the correct values of % concentrate and % DMS rock which were developed from actual testing, a value of 50% results for the amount of mined ore reporting as flotation tailings.

**Backfill Sequencing and Storage Capacity**

The table attached is a summary of the backfill sequencing model which is an integral part of the mine plan. It was prepared by the backfill design engineer (Frank Palkovits) in conjunction with the mine engineer responsible for the overall mine plan (Barrie Hancock). The sections of the model that are of potential interest to the Review Board have been highlighted in yellow and are described as follows, starting at the top of the page:

1. The top highlighted area shows the tonnes of the final sphalerite (ZnS) and galena (PbS) concentrates produced each year and the associated percentage of mined ore (26% vs. Mr. Brodie's 11%)
2. The second highlighted area shows the tonnes of DMS rock produced each year and the associated percentage of mined ore (24% vs. Mr. Brodie's 17%)
3. The third highlighted area shows the tonnes of flotation tailings produced each year and the associated percentage of mined ore (50% vs. Mr. Brodie's 72%)
4. The bottom highlighted area shows the Void Balance, which is the available space underground at any point in time to accept backfill from the plant. The most important line in the Void Balance is the "Closing voids balance" which indicates that, at any point

in time, there are sufficient voids to store all of the following years' backfill capacity. To demonstrate the safety factor in the table, at the end of operating year 3 (highlighted in purple) there are 160,417 cubic metres available for paste backfill, yet only 130,600 cubic metres are required.

Additional tailings storage capacity is anticipated from two other sources:

1. Approximately 20% (roughly 1 million tones) of the total 5 million tonnes of ore in the mine plan is from mineralization termed 'stratabound'. The stratabound mineralization is flat-lying, and is wider in lateral extent but of a much lower height compared to the vein-type mineralization from which the rest of the ore is derived. While the specific mining method for the stratabound resource has not yet been finalized, the greater width of the mineralization enables methods other than cut and fill to be considered. A possible mining method is commonly known as sub-level stoping. In sub-level stoping, only a small part of the backfill used requires strength, allowing for deposition of paste with much less DMS rock as compared to the cut and fill operation used in mining the vein. The dry density of tailings-only paste is about 70% higher than the cap paste containing DMS rock (that will be used in cut and fill). The sub-level stoping method backfill schedule can be modified in numerous ways to keep tailings placement constant and with low cement requirements. As a conservative measure, the current plan assumes paste cap requirements during mining of the stratabound to be equal to requirements when mining the vein, when in practice, cap requirements will be significantly lower when mining the stratabound.

2. At cessation of mining of the lower levels, the main access ramp will be available for filling. The void space available will be approximately 32,000 $m^3$. There will be an additional space (void) of approximately 53,000 $m^3$ available by filling access drifts, ventilation raises and ore passes.

Mr. Brodie's claim that 225,000 $m^3$ of tailings will need to be stored in the WSP is incorrect. Mr. Brodie does not appear to have properly accounted for the design concept for mine start up. Up to 50,000 tonnes wil initially be sent to the WSP to allow for sufficient void space to accumulate underground prior to backfilling. The 50,000 tonnes of tailings represents the maximum amount of tailings generated prior to the initiation of backfilling operations. On-going optimization of the mine plan will potentially reduce this somewhat. Because these tailings will not be used as backfill feed until the mine ceases operations, the optimal place to store these tailings is under water (sub-aqueous) in the WSP.

The Paste plant has been designed so that thickened and filtered flotation tailings can be directed to the paste mixing section or stored temporarily if the paste plant is down or a mined void is not available for paste. Stored tailings would be reclaimed back to the tailings thickener when operations resume. If there is an issue that would require the storage of additional filtered tailings, this could be done just north of the paste plant on a suitably lined pad draining into crushing building sumps. Temporary tailings storage using this approach is preferred to pumping to the pond and later reclaim with a dredge. Reclaiming tailings from the pond will require a reduction in WSP pond level, which might only occur after mill shutdown on mine closure. Therefore, in conclusion, no more than 50,000 tonnes of tailings will need to be stored in the WSP because of temporary storage availability near the Mill and the availability of voids underground (see table)..

Mr. Brodie has assumed, again without any substantive evidence, that CZN will compromise its ability to store 100% of the flotation tailings underground by employing the following operating strategies:

1. Cost saving measures may lead to increased use of DMS material in paste to reduce cement requirements over the life of the mine
2. Cost saving measures may lead to placement of development waste in stopes (as backfill in lieu of much more paste backfill).

The bulk fill paste is expected to have a low cement content of only 1-2%. A reduction in cement content of this mix would not be practical. The cap layer paste is expected to have 3-4% cement content and a float tails to DMS rock ratio of 1:1. Testing indicates that, to maintain trafficability, the proposed proportions of both cement and DMS rock will be necessary. Given this, and an understanding that void space needs to be reserved for float tails, we do not expect use of DMS rock in the paste greater than planned, unless this is required as the mine moves to closure to fill all voids. Similarly, the mine plan will insist on bringing all development waste to surface to provide maximum void for float tails, although this may be relaxed as the mine moves to closure when excess void is likely to be identified.

In conclusion, we have confirmed that sufficient void will exist for all float tails to be placed underground at mine closure, and with a contingency void remaining. Further, operational changes could be made to create more void space should this be required, although we do not expect this to be the case. Operating policies will ensure the maximum void is made available for paste (keeping DMS rock use to a minimum and removing all development rock). We have also confirmed that no more than 50,000 tonnes of float tails will need to be temporarily stored in the WSP. Additional short-term float tails storage may be required during normal operations, but this will be provided either in or immediately adjacent to the Mill. We can only assume that Mr. Brodie's assumptions are based on either experience or speculation. As noted above, the backfill design and mine plan were developed by specialist engineers, each with in excess of 30 years of experience. They used real and reliable data, and standard industry methods in their work. We see no reasons to dispute their professional opinions.

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|---|---|---|
| **Project No.** | 01-2011-01 | **PRELIMINARY ORE PRODUCTION AND BACKFILL MATERIALS BALANCE** |
| **Date:** | 06/06/2011 | **SNC LAVALIN INC - CANADIAN ZINC CORP- PRAIRIE CREEK MINE** |
| **Rev. No:** | 0 | **FEASIBILITY STUDY FOR UNDERGROUND PASTE BACKFILL** |

MINE PASTE ENGINEERING LTD **MPE**

| | | | | | 6-in | 7-in | 9-in | 10-in | | 6-in | 7-in | 9-in | 10-in | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vein SG = | 3.19 | | | | | | | | | | | | | |
| Stratabound SG = | 3.38 | Dev Rock SG = | 2.80 | (80:20) Pulp Density = | 83.4% | 83.0% | 82.0% | 81.7% | 100% Tailings Paste = | 81.3% | 80.5% | 80.0% | 79.6% | **SNC** |
| Tailings SG = | 2.85 | Placed W/R R.D. (uncompacted) = | 1.92 | 80:20 R.D= | 2.18 | 2.16 | 2.13 | 2.12 | R.D. = | 2.12 | 2.09 | 2.08 | 2.07 | **MPE** |
| Zn Flotation Reject (DMS) | 2.80 | 50:50 Blend Insitu B/F = | 2.24 | | | | | | | | | | | **CZN** |
| Avg SG MDMS + Tailings (80:20) | 2.84 | CHF= | | (60:40) Pulp Density = | | | | | Tailings and DMS (50:50) = | 88.0% | 87.0% | 86.2% | 85.5% | |
| Avg SG MDMS + Tailings (50:50) | 2.83 | | | 60:40 R.D= | | | | | 50:50 R.D = | 2.32 | 2.28 | 2.26 | 2.23 | |

| | *units* | *factor* | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRODUCTION** | | | | | | | | | | | | | | | | | | |
| Vein U/G Production | tonnes | | - | 240,000 | 345,000 | 350,000 | 390,000 | 370,000 | 360,000 | 355,000 | 350,000 | 330,000 | 280,000 | 190,000 | 175,000 | 155,000 | 70,000 | 3,960,000 |
| Stratabound Production | tonnes | | 0 | 0 | 0 | 0 | 20,000 | 60,000 | 60,000 | 60,000 | 60,000 | 100,000 | 120,000 | 135,000 | 140,000 | 140,000 | 140,000 | 1,035,000 |
| **ROM Diluted Total** | **tonnes** | | **0** | **240,000** | **345,000** | **350,000** | **410,000** | **430,000** | **420,000** | **415,000** | **410,000** | **430,000** | **400,000** | **325,000** | **315,000** | **295,000** | **210,000** | **4,995,000** |
| ROM Concentrate | tonnes | 25.7% | 0 | 62,784 | 91,423 | 92,779 | 108,199 | 110,731 | 108,019 | 109,407 | 107,639 | 112,535 | 102,908 | 82,901 | 78,733 | 71,117 | 45,853 | 1,285,028 |
| | | | | 26% | 26% | 27% | 26% | 26% | 26% | 26% | 26% | 26% | 26% | 26% | 25% | 24% | 22% | **26%** |
| **Mill Tailings and DMS** | | | | | | | | | | | | | | | | | | |
| **Total Flotation Tails and DMS** | **tonnes** | | **-** | **177,216** | **253,577** | **257,221** | **301,801** | **319,269** | **311,981** | **305,593** | **302,361** | **317,465** | **297,092** | **242,099** | **236,267** | **223,883** | **164,147** | **3,709,972** |
| DMS Rock | tonnes | 32.4% | | 64,800 | 93,150 | 94,500 | 107,900 | 107,700 | 105,000 | 103,650 | 102,300 | 102,100 | 91,200 | 68,850 | 65,450 | 60,050 | 37,100 | 1,203,750 |
| | | | | 27% | 27% | 27% | 26% | 25% | 25% | 25% | 25% | 24% | 23% | 21% | 21% | 20% | 18% | **24%** |
| **Flotation Tailings** | **tonnes** | 67.6% | | **112,416** | **160,427** | **162,721** | **193,901** | **211,569** | **206,981** | **201,943** | **200,061** | **215,365** | **205,892** | **173,249** | **170,817** | **163,833** | **127,047** | **2,506,222** |
| Flotation Tailings / ROM Total | % | | 0% | 47% | 47% | 46% | 47% | 49% | 49% | 49% | 49% | 50% | 51% | 53% | 54% | 56% | 60% | **50%** |
| **VOIDS FROM NEW MINING** | | | | | | | | | | | | | | | | | | |
| U/G Stope Voids Created Annually | $m^3$ | | - | 75,235 | 108,150 | 109,718 | 128,174 | 133,739 | 130,604 | 129,037 | 127,469 | 133,034 | 123,277 | 99,502 | 96,279 | 90,009 | 63,364 | 1,547,592 |
| U/G Dev Voids Created Annually | $m^3$ | | - | 7,525 | 10,118 | 10,295 | 13,715 | 13,005 | 12,650 | 12,650 | 10,295 | 9,230 | 7,455 | 5,148 | 4,083 | 3,373 | 355 | 119,895 |
| Total NEW U/G Voids | $m^3$ | | - | 82,760 | 118,268 | 120,013 | 141,889 | 146,744 | 143,254 | 141,687 | 137,764 | 142,264 | 130,732 | 104,649 | 100,362 | 93,382 | 63,719 | 1,667,487 |
| **Cumulative NEW U/G Voids** | | | **-** | **82,760** | **201,028** | **321,041** | **462,930** | **609,674** | **752,928** | **894,615** | **1,032,379** | **1,174,643** | **1,305,376** | **1,410,025** | **1,510,387** | **1,603,769** | **1,667,487** | |
| **SUMMARY** | | | | | | | | | | | | | | | | | | |
| **Total Cement** | **tonnes** | | **-** | **2,573** | **4,275** | **4,335** | **5,067** | **5,344** | **5,146** | **5,146** | **5,027** | **5,265** | **4,869** | **3,958** | **3,800** | **3,681** | **2,652** | **61,139** |
| **Voids Balance** | | | | | | | | | | | | | | | | | | |
| Opening voids balance | $m^3$ | | 132,233 | 132,233 | 140,203 | 150,211 | 160,417 | 171,706 | 176,400 | 180,914 | 186,901 | 190,425 | 188,549 | 181,907 | 171,306 | 158,298 | 142,830 | 142,830 |
| New voids from mining | $m^3$ | | - | 82,760 | 118,268 | 120,013 | 141,889 | 146,744 | 143,254 | 141,687 | 137,764 | 142,264 | 130,732 | 104,649 | 100,362 | 93,382 | 63,719 | 1,667,487 |
| Old voids Disposal | $m^3$ | | - | 9,790 | 260 | 307 | 2,600 | 4,550 | 8,740 | 5,700 | 2,240 | - | - | 5,250 | 7,370 | 9,350 | 5,300 | 61,457 |
| New voids Backfilled | $m^3$ | | - | 65,000 | 108,000 | 109,500 | 128,000 | 137,500 | 130,000 | 130,000 | 132,000 | 144,140 | 137,375 | 110,000 | 106,000 | 99,500 | 77,000 | 1,614,015 |
| Closing voids balance | $m^3$ | | 132,233 | 140,203 | 150,211 | 160,417 | 171,706 | 176,400 | 180,914 | 186,901 | 190,425 | 188,549 | 181,907 | 171,306 | 158,298 | 142,830 | 124,248 | 124,248 |