Material Transfer Report

Submitted by

Ideal Source Quality Assurance, LLC

License number 24-32675-03E

William B. Yelon, Ph.D.

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This report itemizes topaz gemstones, morganite and diamonds transferred for use under 10 CFR §30.14.for the calendar year 2022.

a) Type and quantity of material transferred:

The current NRC license issued to Ideal Source Quality Assurance (ISQA) has been modified from its predecessors to change the statistical basis under which irradiated gemstones are approved for release in the U.S. by focusing on the risks to human health as well as explicitly including topaz, diamonds and morganite in the list of gemstones covered by the license (as well as implicitly other gemstones with similar impurity profiles). During 2020 we started to develop a new data base (fully implemented in 2021) that allows for a more comprehensive tracking of tested stones from testing all the way through manufacture to delivery to wholesale distributor of finished gemstone jewelry. This data base was described in last year's report, but we include it here with additional commentary at the end of this report. We believe the issue it raised merits reiteration .

In 2022 ISQA conducted 222 test sessions on behalf of 31 unique customers These included tests performed for Ostro Minerals on old inventory previously released from the Maria reactor and approved using the criteria in the earlier license. While most customers submitted only one type of stone for testing, a few sent shipments with stones of more than one type (in separate packages). Names and addresses of customers are considered confidential business information.

Topaz: 319,236 cts.
Approximately 90 percent of the topaz (TOP-1) released was treated by and in the possession of Ostro Minerals (aka Topaz Minerals). Many of these stones had previously been released under the old license as part of the statistical procedures and stored in Bangkok Thailand. All stones in storage in Bangkok including those not released earlier had been subject to Ge testing by which their U.S. release dates had been calculated. However, many of these stones had been re-cut and/or polished and consequently we decided to retest all of the goods with the Bangkok testing station prior to release. Although Dr. Yelon was unable to perform an on-site inspection due to Covid-19, he performed QA on the Bangkok system through the exchange of stones of varying activity

between Bangkok and Missouri and through video conferencing during which he was able to observe the processes of background determination and sample testing. Tests included starting with a large batch and comparing the results as the batch was divided and re-divided into smaller parcels. The results confirmed the reliability (and very low background) needed. It is anticipated that additional QA procedures will be carried out in 2023 to confirm the continued reliability of the Bangkok testing station.

Of the remaining 10%, approximately half were sky blue (TOP-2) and had not been subject to neutron irradiation. As expected these stones showed no measurable activity. The remaining darker blue stones (TOP-3) were the product of treatment at sites of unknown provenance and were subject to increased care in the testing both in Missouri and in Bangkok. In all cases activity well below the NRC exempt limits was observed.

Diamond 4,085 cts
Diamonds were supplied for testing by a number of customers. These included some stones were identified as treated in the U.S. and the remainder from irradiation at sites unknown to ISQA. Both natural and "lab-grown" diamonds were submitted for testing. As expected, no measurable activity was seen in any stones of any type or origin, indicating that only electrons had been used for the color treatment.

Morganite 55,242 cts
Cut and polished morganite were submitted for testing by a large number of customers. Interestingly, all morganite samples arrived packaged one piece per bag, which significantly complicated the testing process, since only a small number of bags could fit into the testing stations at one time. The only measured activity above background was in the form of 134-Cs which was occasionally reported in the analysis but never exceeded 1 Bq/g. All of these stones were approved for release.

ISQA maintains records of all tested parcels, reflecting the type of stone and at a minimum the total mass of each shipment. These computerized records are generated by the testing programs. More detailed records of the breakdown of the individual shipments are contained in test request forms (TRF) as spreadsheets provided to ISQA administrative offices prior to testing. These TRFs are ultimately input data for the data base previously described and are permanently stored. Paper certificates are no longer issued. Rather, the certification is tracked through the data base with SKU and P.O.. information following every parcel through its ultimate processing.

b) At the time of introduction of the byproduct material, the topaz gemstones in category (TOP-1) were the property of:

Ostro Minerals (UK) Ltd

77-79 Charlotte Street,

London, W1T 4PW

And of distributors acting on behalf of Ostro.

Ostro Minerals is the successor company to Topaz Minerals AG, previously located in Zurich Switzerland. It remains under the Ostro family control after the death of its owner and founder Max Ostro, in May 2010.

The remainder of the tested stones were submitted by 30 distinct customers. No effort was made to establish the origins or treatment histories of these stones. For diamond and morganite the near absence of activity implies that such information is of no particular value in assuring the safety of the stones upon release of the stones in the U.S. As mentioned above, dark blue Topaz of unknown origin (TOP-3) was subject to extra scrutiny typified by the use of samples smaller than those usually employed for testing of stones treated and released by the Maria Reactor (NCBJ) in Poland.

c) Because of the geological nature of the topaz gemstones, the initial concentrations of byproduct material varied both with respect to the origin of the gemstones and within gemstones from a single origin. After an initial decay period, during which the short-lived byproduct materials were not characterized, the principal isotopes were ^{54}Mn, ^{182}Ta, ^{46}Sc, and ^{58}Co. Traces of ^{134}Cs and ^{65}Zn were also detected in a small minority of stones. Activities of the main isotopes varied from zero to a few hundred Bq/g. A few outliers, easily detected in the sorting procedure, may even have ^{182}Ta concentrations exceeding 1000 Bq/g. Decay time for each individual parcel was determined by the initial concentration of these isotopes.

As. was the case in 2020, the change in license procedures and the interruption of testing created a state in which many stones were “old” with nearly undetectable activity. No new “shipments” from Maria (typically consisting of 1 million or more carats) were released. At the time of transfer of topaz from TOP-1, the average activity of these gemstones was (typically), ^{54}Mn ≤ 2 Bq/g and ^{182}Ta ≤ 1 Bq/g. The activity of the other isotopes was less than 1 Bq/g. In general, the average sum-of-ratios for each parcel was less than 0.1, i.e. 10% of the levels allowed by NRC regulation. More recently irradiated stones were also tested and in all cases the sum-of-ratios was found to be less than 1, and in most cases was less than 0.5. Records maintained by ISQA (as well as at the irradiation facility) provide the average activities for each individual parcel of stones, as determined by high resolution Ge counting on he testing date, from which later activities can be calculated. The ISQA tests of selected parcels, using NaI(Tl) detection, are in excellent agreement with the Ge testing in Poland. Detailed records of the testing results are maintained by ISQA and in the “cloud”. No new shipments, released on the basis of statistical sampling from a large number of parcels, occurred in 2022. A limited number of small parcels were released to Bangkok from Poland on the basis of Ge testing. Any such stones were retested using the Bangkok station at the time of sale.

Reports of material transfers will be maintained permanently at ISQA headquarters. Reports of the average activities for all parcels shipped from Poland under the ISQA

license will also be maintained (on computer and on hard copy or data storage device) in the ISQA office or the cloud. Reports of all parcels tested will be preserved in similar form.

At the time of transfer, activities of diamond and Morganite were negligible. Trace amounts of 134-Cs were occasionally observed in morganite, with quantities never approaching 1 Bq/g. Activities of sky-blue topaz (TOP-2) were also negligible. For darker blue topaz (TOP-3) the activity of submitted stones was found to be low, indicating that these stones had likely been circulating for some time between their release from the treatment center and their cutting and polishing prior to submission for testing by ISQA. We suspect that many, if not most of the stones in category TOP-3 were treated as rough stones and only cut after an order had been placed for color-matched special cuts. The average SOR for these stones, while not as low as those in TOP-1 were typically less than 0.5.

Addendum: Comments on stone tracking data-base

We previously described the functionality of our stone tracking data-base (included below for completeness). It has been in use for nearly 2 years and is currently being accessed by a major jewelry wholesalers, well known for supplying "high-end" retail jewelry chain stores. Its use enables them to buy multiples of any item from multiple manufacturers while assuring that all irradiated stones contained in those pieces have passed testing. We are aware of blue topaz jewelry for sale in other outlets, in quantities that appear to far exceed the number of carats "approved for release" by other NRC licensees and for which no proof of testing is available. I am personally aware of one customer who maintains separate inventories of morganite; those that have passed ISQA testing and those for use for less demanding customers. The testing process we employ adds to our and the customer's costs but protects the public from unscrupulous or ignorant distributors and sellers. We strongly advocate that the NRC require a similarly robust tracking system for all exempt gemstone licensees.

A More Robust Tracking System

In the past we have employed a tracking system based on certificates printed on "security" paper that cannot be photocopied without producing background text of "void" or similar. These certificates specified one single "parcel" consisting of stones of single size, shape and color. Sales of multiple such parcels would require the production of multiple certificates; one for each distinct item. All certificates were labeled with a bar code and certificate number which could be checked against the data base maintained by ISQA. This was already quite advanced compared to our competitors who frequently delivered certificates that specified only the total quantity of stones released and did not separate the stones into parcels of distinct character. The certificate numbers could be used by any vendor for any stone as there was no way to associate any item with a particular test. Not surprisingly these certificate numbers have been used for the sale of stones in greater quantity than have actually been tested. Even our certificates have been misused. We have seen examples of photocopies of our certificates with "void"

prominently visible, presented to a buyer as proof of compliance, and we have seen examples of out certificates in which the quantity or other characteristics have been altered in pen and ink.

We have alerted the licensing section of the NRC about this problem several time, but they have, thus far, taken no action. However, the problem is sufficiently acute that high end merchants have demanded a more serious certification process. We have worked with them to develop a new system that makes it close to impossible to sell untested goods under cover of bogus or misused certificates.

Starting in late 2020 we have been working with some of the major wholesalers of finished jewelry whose customer include some of the most well know retail jewelry chains. Their customers demand better assurances that any irradiated colored stones carry proof of certification. Jointly we have created a new tracking system based on a sophisticated data base that allows a stone (or stones in a parcel) to be followed at each stage from testing through the various production stages (such as setting and fabrication of finished pieces) to the wholesaler that provides the inventory to retail stores and chains. The customer with loose stones requests testing via a "Test Request Form" (TRF). The TRF is based on a spreadsheet in which the stone type, quantity, size, shape and color are all tabulated along with an SKU and P.O. number issued by the final wholesaler. When the testing is completed the spreadsheet is uploaded to the data base into the field reserved for that customer. Each customer has his/her own field, which he/she can access, but which is inaccessible to anyone except those who have issued the P.O.s for that item. When the treated stones are delivered to the next stage in the processing, the quantity delivered is deducted from the customer's tables and added to the tables of the recipient, with the Sku and P.O. numbers attached. It is forbidden to transfer more stones than are represented in the table as cleared. This process repeats at each stage until the goods reach the wholesaler who has issued the P.O. While it is possible to replace a tested stone by an untested one, there is no incentive to do so since the total quantity available cannot exceed the tested quantity. Development of this system has been costly and, in its early form, required considerable manpower to upload the data and move through the tables, as well as to organize the process to the satisfaction of the final wholesalers. Over time we are reducing the labor by allowing the customers to track and command the transfers stage by stage. Paper certificates are no longer issued, the relevant information is permanently stored in our database. In the course of the last year, more and more customers have signed onto our program as they can see the advantage of traceability.